ISO TC184/SC4/WG3 N745

Date: 1998-11-24

Supersedes ISO TC 184/SC4/WG3 N537

ISO/CD 10303-231
Product data representation and exchange: Application protocol: Process engineering data: Process design and process specifications of major equipment

COPYRIGHT NOTICE: This ISO document is a committee draft and is copyright protected by ISO. While the reproduction of committee drafts in any form for use by participants in the ISO standards development process is permitted without prior permission from ISO, neither this document nor any extract from it may be reproduced, stored, or transmitted in any form for any other purpose without prior written permission from ISO.

Requests for permission to reproduce this document for the purposes of selling it should be addressed as shown below (via the ISO TC 184/SC4 Secretariat's member body) or to ISO's member body in the country of the requester.

Copyright Manager
ANSI
11 West 42nd Street
New York, New York 10036 USA
phone: +1-212-642-4900
fax: +1-212-398-0023

Reproduction for sales purposes may be subject to royalty payments or a licensing agreement.

ABSTRACT: This part of ISO 10303 documents the Application Protocol for the exchange of process engineering data. It specifies the process engineering and conceptual design information of process plants, including process designs, unit operations, process simulations, stream characteristics, and design requirements for major process equipment. The primary life cycle perspective is that of conceptual process engineering done prior to the detailed design and construction of new process plants or the modification of existing plants.

KEYWORDS: application protocol, process design, process engineering, process equipment, process plant, process simulation, unit operations

COMMENTS TO READER: This document has been reviewed and noted by the ISO TC 184/SC4 Secretariat and has been determined to be ready for this ballot cycle.

Project Leader: Mitch Gilbert
Address: P.D.I.T., Inc.
4130 Faber Place Drive
Suite 303
Charleston, SC 29405 USA
Telephone: +1 803-747-1420
Telefacsimile: +1 803-747-2438
Electronic mail: mgilbert@pdit-sc.com

Project Editor: Mark E. Palmer
Address: National Institute of Standards and Technology
100 Bureau Drive, Stop 8630
Gaithersburg, MD 20899
USA
Telephone: +1 301-975-5858
Telefacsimile: +1 301-975-5433
Electronic mail: mark.palmer@nist.gov

Contents

Page

1 Scope 1

2 Normative references 5

3 Definitions and abbreviations 6
3.1 Terms defined in ISO 10303-1 6
3.2 Terms defined in ISO 10303-31 7
3.3 Other definitions 7
3.4 Abbreviations 14

4 Information requirements 16
4.1 Units of functionality 16
4.1.1 chemical_reaction_data 21
4.1.2 control_strategy 21
4.1.3 heat_transfer_equipment_data 22
4.1.4 major_process_equipment_data 24
4.1.5 mass_transfer_equipment_data 25
4.1.6 material_data 28
4.1.7 material_transfer_equipment_data 29
4.1.8 plant_context 30
4.1.9 plant_item_data 32
4.1.10 plant_system_definition 34
4.1.11 process_description 35
4.1.12 process_flow_diagram 35
4.1.13 process_simulation_data 36
4.1.14 process_vessel_equipment_data 38
4.1.15 stream_data 39
4.1.16 substance_experimental_data 40
4.1.17 substance_model_data 40
4.1.18 unit_operation 42
4.2 Application objects 45
4.2.1 Process plant UoFs 45
4.2.1.1 plant_context 45
4.2.1.2 plant_system_definition 59
4.2.2 Process substance and material UoFs 61
4.2.2.1 substance_experimental_data 61
4.2.2.2 substance_model_data 66
4.2.2.3 chemical_reaction_data 79
4.2.2.4 material_data 82
4.2.3 Process design UoFs 97
4.2.3.1 process_description 97
4.2.3.2 unit_operation 102
4.2.3.3 stream_data 166
4.2.3.4 process_simulation_data 174
4.2.3.5 process_flow_diagram 196
4.2.3.6 control_strategy 199
4.2.4 Process equipment UoFs 210

4.2.4.1 plant_item_data 210
4.2.4.2 major_process_equipment_data 254
4.2.4.3 heat_transfer_equipment_data 264
4.2.4.4 mass_transfer_equipment_data 354
4.2.4.5 material_transfer_equipment_data 388
4.2.4.6 process_vessel_equipment_data 411
4.3 Application assertions 427

5 Application interpreted model 494
5.1 Mapping table 494
5.2 AIM EXPRESS short listing 2130

6 Conformance requirements 2235
6.1 Class 1 - Stream property information 2236
6.2 Class 2 - Stream and substance model information 2236
6.3 Class 3 - Experimental VLE and property information 2237
6.4 Class 4 - Chemical reaction and substance model information 2237
6.5 Class 5 - Unit operations information 2237
6.6 Class 6 - Process simulation information 2238
6.7 Class 7 - Plant test information 2238
6.8 Class 8 - Plant item information 2239
6.9 Class 9 - Heat exchanger unit operation information 2239
6.10 Class 10 - Heat exchanger equipment design information 2240
6.11 Class 11 - Pump unit operation information 2240
6.12 Class 12 - Pump equipment design information 2241
6.13 Class 13 - Compressor unit operation information 2241
6.14 Class 14 - Compressor equipment design information 2242
6.15 Class 15 - Separation tower unit operation information 2243
6.16 Class 16 - Separation tower internals tray design information 2243
6.17 Class 17 - Separation tower internals packing design information 2244
6.18 Class 18 - Process vessel unit operations information 2244
6.19 Class 19 - Process vessel equipment design information 2245
6.20 Class 20 - Basic process control strategies information 2245
6.21 Class 21 - Process simulation quantities flowsheet information 2246
6.22 Class 22 - Process flow diagram information 2246
6.23 Class 23 - Process engineering information 2247

Annex A (normative) AIM EXPRESS expanded listing 2285

Annex B (normative) AIM short names 2374

Annex C (normative) Implementation method specific requirements 2387

Annex D (normative) Protocol Information Conformance Statement (PICS) proforma 2388

Annex E (normative) Information object registration 2390

Annex F (informative) Application activity model 2391
F.1 Application activity model 2391
F.1.1 Application activity model definitions and abbreviations 2391
F.1.2 Application activity model diagrams 2409
F.2 PIEBASE activity model 2422
F.2.1 Activity model definitions and abbreviations 2422
F.2.2 Activity model diagrams 2430

Annex G (informative) Application reference model wallpaper version 2436

Annex H (informative) AIM EXPRESS-G 2494

Annex J (informative) AIM EXPRESS listing 2550

Annex K (informative) Bibliography 2551

Index 2552

Figures

Figure 1 - Planning model xv
Figure 2 - Life cycle activity coverage 2
Figure 3 - Process plant AP coverage and overlaps 2
Figure 4 - Data planning model 20
Figure 5 - Nozzle entrance type 259
Figure 6 - Baffle window 266
Figure 7 - Baffle type 269
Figure 8 - TEMA shell type 289
Figure 9 - Tube pattern 344
Figure 10 - Tube to tubesheet joint types 345
Figure 11 - Tubesheet types 346
Figure 12 - Vapour belt 353
Figure F.1 - IDEF0 basic notation 2410
Figure F.2 - Manage, do, provide resources template 2410
Figure F.3 - AAM indented node list 2411
Figure F.4 - A-0: Provide physical assets 2412
Figure F.5 - A2: Design and engineer process plant 2413
Figure F.6 - A22: Design and engineer process plant in concept 2414
Figure F.7 - A223: Define processes 2415
Figure F.8 - A2233: Perform process design 2416
Figure F.9 - A22332: Select models and obtain performance data 2417
Figure F.10 - A223323: Obtain physical property data and models 2418
Figure F.11 - A22334: Design and rate process equipment 2419
Figure F.12 - A223343: Design and rate major processing equipment 2420
Figure F.13 - A22335: Perform design analysis and cost optimization 2421
Figure F.14 - PIEBASE activity model indented node list 2431
Figure F.15 - A-0: Enterprise activities 2432
Figure F.16 - A0: Conduct core business 2433

Figure F.17 - A5: Provide supporting resources 2434
Figure F.18 - A55: Provide physical assets 2435
Figure G.1 - ARM Chemical_reaction_data UoF diagram 1 of 1 2439
Figure G.2 - ARM Control_strategy UoF diagram 1 of 2 2440
Figure G.3 - ARM Control_strategy UoF diagram 2 of 2 2441
Figure G.4 - ARM Heat_transfer_equipment_data UoF diagram 1 of 4 2442
Figure G.5 - ARM Heat_transfer_equipment_data UoF diagram 2 of 4 2443
Figure G.6 - ARM Heat_transfer_equipment_data UoF diagram 3 of 4 2444
Figure G.7 - ARM Heat_transfer_equipment_data UoF diagram 4 of 4 2445
Figure G.8 - ARM Major_process_equipment_data UoF diagram 1 of 2 2446
Figure G.9 - ARM Major_process_equipment_data UoF diagram 2 of 2 2447
Figure G.10 - ARM Mass_transfer_equipment_data UoF diagram 1 of 6 2448
Figure G.11 - ARM Mass_transfer_equipment_data UoF diagram 2 of 6 2449
Figure G.12 - ARM Mass_transfer_equipment_data UoF diagram 3 of 6 2450
Figure G.13 - ARM Mass_transfer_equipment_data UoF diagram 4 of 6 2451
Figure G.14 - ARM Mass_transfer_equipment_data UoF diagram 5 of 6 2452
Figure G.15 - ARM Mass_transfer_equipment_data UoF diagram 6 of 6 2453
Figure G.16 - ARM Material_data UoF diagram 1 of 4 2454
Figure G.17 - ARM Material_data UoF diagram 2 of 4 2455
Figure G.18 - ARM Material_data UoF diagram 3 of 4 2456
Figure G.19 - ARM Material_data UoF diagram 4 of 4 2457
Figure G.20 - ARM Material_transfer_equipment_data UoF diagram 1 of 4 2458
Figure G.21 - ARM Material_transfer_equipment_data UoF diagram 2 of 4 2459
Figure G.22 - ARM Material_transfer_equipment_data UoF diagram 3 of 4 2460
Figure G.23 - ARM Material_transfer_equipment_data UoF diagram 4 of 4 2461
Figure G.24 - ARM Plant_context UoF diagram 1 of 4 2462
Figure G.25 - ARM Plant_context UoF diagram 2 of 4 2463
Figure G.26 - ARM Plant_context UoF diagram 3 of 4 2464
Figure G.27 - ARM Plant_context UoF diagram 4 of 4 2465
Figure G.28 - ARM Plant_item_data UoF diagram 1 of 6 2466
Figure G.29 - ARM Plant_item_data UoF diagram 2 of 6 2467
Figure G.30 - ARM Plant_item_data UoF diagram 3 of 6 2468
Figure G.31 - ARM Plant_item_data UoF diagram 4 of 6 2469
Figure G.32 - ARM Plant_item_data UoF diagram 5 of 6 2470
Figure G.33 - ARM Plant_item_data UoF diagram 6 of 6 2471
Figure G.34 - ARM Plant_system_definition UoF diagram 1 of 1 2472
Figure G.35 - ARM Process_description UoF diagram 1 of 1 2473
Figure G.36 - ARM Process_flow_diagram UoF diagram 1 of 1 2474
Figure G.37 - ARM Process_simulation_data UoF diagram 1 of 2 2475
Figure G.38 - ARM Process_simulation_data UoF diagram 2 of 2 2476
Figure G.39 - ARM Process_vessel_equipment_data UoF diagram 1 of 4 2477
Figure G.40 - ARM Process_vessel_equipment_data UoF diagram 2 of 4 2478
Figure G.41 - ARM Process_vessel_equipment_data UoF diagram 3 of 4 2479
Figure G.42 - ARM Process_vessel_equipment_data UoF diagram 4 of 4 2480
Figure G.43 - ARM Stream_data UoF diagram 1 of 3 2481
Figure G.44 - ARM Stream_data UoF diagram 2 of 3 2482
Figure G.45 - ARM Stream_data UoF diagram 3 of 3 2483
Figure G.46 - ARM Substance_experimental_data UoF diagram 1 of 1 2484
Figure G.47 - ARM Substance_model_data UoF diagram 1 of 3 2485

Figure G.48 - ARM Substance_model_data UoF diagram 2 of 3 2486
Figure G.49 - ARM Substance_model_data UoF diagram 3 of 3 2487
Figure G.50 - ARM Unit_operation UoF diagram 1 of 6 2488
Figure G.51 - ARM Unit_operation UoF diagram 2 of 6 2489
Figure G.52 - ARM Unit_operation UoF diagram 3 of 6 2490
Figure G.53 - ARM Unit_operation UoF diagram 4 of 6 2491
Figure G.54 - ARM Unit_operation UoF diagram 5 of 6 2492
Figure G.55 - ARM Unit_operation UoF diagram 6 of 6 2493
Figure H.1 - AIM EXPRESS-G diagram 1 of 55 2495
Figure H.2 - AIM EXPRESS-G diagram 2 of 55 2496
Figure H.3 - AIM EXPRESS-G diagram 3 of 55 2497
Figure H.4 - AIM EXPRESS-G diagram 4 of 55 2498
Figure H.5 - AIM EXPRESS-G diagram 5 of 55 2499
Figure H.6 - AIM EXPRESS-G diagram 6 of 55 2500
Figure H.7 - AIM EXPRESS-G diagram 7 of 55 2501
Figure H.8 - AIM EXPRESS-G diagram 8 of 55 2502
Figure H.9 - AIM EXPRESS-G diagram 9 of 55 2503
Figure H.10 - AIM EXPRESS-G diagram 10 of 55 2504
Figure H.11 - AIM EXPRESS-G diagram 11 of 55 2505
Figure H.12 - AIM EXPRESS-G diagram 12 of 55 2506
Figure H.13 - AIM EXPRESS-G diagram 13 of 55 2507
Figure H.14 - AIM EXPRESS-G diagram 14 of 55 2508
Figure H.15 - AIM EXPRESS-G diagram 15 of 55 2509
Figure H.16 - AIM EXPRESS-G diagram 16 of 55 2510
Figure H.17 - AIM EXPRESS-G diagram 17 of 55 2511
Figure H.18 - AIM EXPRESS-G diagram 18 of 55 2512
Figure H.19 - AIM EXPRESS-G diagram 19 of 55 2513
Figure H.20 - AIM EXPRESS-G diagram 20 of 55 2514
Figure H.21 - AIM EXPRESS-G diagram 21 of 55 2515
Figure H.22 - AIM EXPRESS-G diagram 22 of 55 2516
Figure H.23 - AIM EXPRESS-G diagram 23 of 55 2517
Figure H.24 - AIM EXPRESS-G diagram 24 of 55 2518
Figure H.25 - AIM EXPRESS-G diagram 25 of 55 2519
Figure H.26 - AIM EXPRESS-G diagram 26 of 55 2520
Figure H.27 - AIM EXPRESS-G diagram 27 of 55 2521
Figure H.28 - AIM EXPRESS-G diagram 28 of 55 2522
Figure H.29 - AIM EXPRESS-G diagram 29 of 55 2523
Figure H.30 - AIM EXPRESS-G diagram 30 of 55 2524
Figure H.31 - AIM EXPRESS-G diagram 31 of 55 2525
Figure H.32 - AIM EXPRESS-G diagram 32 of 55 2526
Figure H.33 - AIM EXPRESS-G diagram 33 of 55 2527
Figure H.34 - AIM EXPRESS-G diagram 34 of 55 2528
Figure H.35 - AIM EXPRESS-G diagram 35 of 55 2529
Figure H.36 - AIM EXPRESS-G diagram 36 of 55 2530
Figure H.37 - AIM EXPRESS-G diagram 37 of 55 2531
Figure H.38 - AIM EXPRESS-G diagram 38 of 55 2532
Figure H.39 - AIM EXPRESS-G diagram 39 of 55 2533
Figure H.40 - AIM EXPRESS-G diagram 40 of 55 2534
Figure H.41 - AIM EXPRESS-G diagram 41 of 55 2535

Figure H.42 - AIM EXPRESS-G diagram 42 of 55 2536
Figure H.43 - AIM EXPRESS-G diagram 43 of 55 2537
Figure H.44 - AIM EXPRESS-G diagram 44 of 55 2538
Figure H.45 - AIM EXPRESS-G diagram 45 of 55 2539
Figure H.46 - AIM EXPRESS-G diagram 46 of 55 2540
Figure H.47 - AIM EXPRESS-G diagram 47 of 55 2541
Figure H.48 - AIM EXPRESS-G diagram 48 of 55 2542
Figure H.49 - AIM EXPRESS-G diagram 49 of 55 2543
Figure H.50 - AIM EXPRESS-G diagram 50 of 55 2544
Figure H.51 - AIM EXPRESS-G diagram 51 of 55 2545
Figure H.52 - AIM EXPRESS-G diagram 52 of 55 2546
Figure H.53 - AIM EXPRESS-G diagram 53 of 55 2547
Figure H.54 - AIM EXPRESS-G diagram 54 of 55 2548
Figure H.55 - AIM EXPRESS-G diagram 55 of 55 2549

Tables

Table 1 - Mapping table for chemical_reaction_data UoF 496
Table 2 - Mapping table for control_strategy UoF 507
Table 3 - Mapping table for heat_transfer_equipment_data UoF 516
Table 4 - Mapping table for major_process_equipment_data UoF 946
Table 5 - Mapping table for mass_transfer_equipment_data UoF 986
Table 6 - Mapping table for material_data UoF 1223
Table 7 - Mapping table for material_transfer_equipment_data UoF 1282
Table 8 - Mapping table for plant_context UoF 1399
Table 9 - Mapping table for plant_item_data UoF 1448
Table 10 - Mapping table for plant_system_definition UoF 1593
Table 11 - Mapping table for process_description UoF 1598
Table 12 - Mapping table for process_flow_diagram UoF 1605
Table 13 - Mapping table for process_simulation_data UoF 1622
Table 14 - Mapping table for process_vessel_equipment_data UoF 1688
Table 15 - Mapping table for stream_data UoF 1774
Table 16 - Mapping table for substance_experimental_data UoF 1811
Table 17 - Mapping table for substance_model_data UoF 1821
Table 18 - Mapping table for unit_operation UoF 1868
Table 19 - Conformance classes 2248
Table 20 - Conformance class elements - part 1 2249
Table 21 - Conformance class elements - part 2 2267
Table B.1 - Short names of entities 2374
Table G.1 - ARM UoF templates 2436

Foreword

The International Organization for Standardization (ISO) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

International Standard ISO 10303-231 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data*.

ISO 10303 consists of the following parts under the general title *Industrial automation systems and integration - Product data representation and exchange*:

— Part 1, Overview and fundamental principles;

— Part 11, Description method: EXPRESS language reference manual;

— Part 12, Description method: EXPRESS-I language reference manual;

— Part 21, Implementation method: Clear text encoding of the exchange structure;

— Part 22, Implementation method: Standard data access interface specification;

— Part 23, Implementation method: C++ language binding to the standard data access interface;

— Part 24, Implementation method: C language binding to the standard data access interface;

— Part 26, Implementation method: Interface definition language binding to the standard data access;

— Part 31, Conformance testing methodology and framework: General concepts;

— Part 32, Conformance testing methodology and framework: Requirements on testing laboratories and clients;

— Part 34, Conformance testing methodology and framework: Abstract test methods;

— Part 35, Conformance testing methodology and framework: Abstract test methods for SDAI implementations;

— Part 41, Integrated generic resource: Fundamentals of product description and support;

— Part 42, Integrated generic resource: Geometric and topological representation;

— Part 43, Integrated generic resource: Representation structures;

— Part 44, Integrated generic resource: Product structure configuration;

— Part 45, Integrated generic resource: Materials;

— Part 46, Integrated generic resource: Visual presentation;

— Part 47, Integrated generic resource: Shape variation tolerances;

— Part 49, Integrated generic resource: Process structure and properties;

— Part 101, Integrated application resource: Draughting;

— Part 104, Integrated application resource: Finite element analysis;

— Part 105, Integrated application resource: Kinematics;

— Part 106, Integrated application resource: Building construction core model;

— Part 201, Application protocol: Explicit draughting;

— Part 202, Application protocol: Associative draughting;

— Part 203, Application protocol: Configuration controlled design;

— Part 204, Application protocol: Mechanical design using boundary representation;

— Part 205, Application protocol: Mechanical design using surface representation;

— Part 207, Application protocol: Sheet metal die planning and design;

— Part 208, Application protocol: Life cycle management - Change process;

— Part 209, Application protocol: Composite and metallic structural analysis and related design;

— Part 210, Application protocol: Electronic assembly, interconnect, and packaging design;

— Part 212, Application protocol: Electrotechnical design and installation;

— Part 213, Application protocol: Numerical control process plans for machined parts;

— Part 214, Application protocol: Core data for automotive mechanical design processes;

— Part 215, Application protocol: Ship arrangement;

— Part 216, Application protocol: Ship moulded forms;

— Part 217, Application protocol: Ship piping;

— Part 218, Application protocol: Ship structures;

— Part 221, Application protocol: Functional data and their schematic representation for process plant;

— Part 222, Application protocol: Exchange of product data for composite structures;

— Part 223, Application protocol: Exchange of design and manufacturing product information for casting parts;

— Part 224, Application protocol: Mechanical product definition for process plans using machining features;

— Part 225, Application protocol: Building elements using explicit shape representation;

— Part 226, Application protocol: Ship mechanical systems;

— Part 227, Application protocol: Plant spatial configuration;

— Part 229, Application protocol: Exchange of design and manufacturing product information for forged parts;

— Part 230, Application protocol: Building structural frame: Steelwork;

— Part 231, Application protocol: Process engineering data: Process design and process specification of major equipment;

— Part 232, Application protocol: Technical data packaging core information and exchange;

— Part 301, Abstract test suite: Explicit draughting;

— Part 302, Abstract test suite: Associative draughting;

— Part 303, Abstract test suite: Configuration controlled design;

— Part 304, Abstract test suite: Mechanical design using boundary representation;

— Part 305, Abstract test suite: Mechanical design using surface representation;

— Part 307, Abstract test suite: Sheet metal die planning and design;

— Part 308, Abstract test suite: Life cycle management - Change process;

— Part 309, Abstract test suite: Composite and metallic structural analysis and related design;

— Part 310, Abstract test suite: Electronic assembly, interconnect, and packaging design;

— Part 312, Abstract test suite: Electrotechnical design and installation;

— Part 313, Abstract test suite: Numerical control process plans for machined parts;

— Part 314, Abstract test suite: Core data for automotive mechanical design processes;

— Part 315, Abstract test suite: Ship arrangement;

— Part 316, Abstract test suite: Ship moulded forms;

— Part 317, Abstract test suite: Ship piping;

— Part 318, Abstract test suite: Ship structures;

— Part 321, Abstract test suite: Functional data and their schematic representation for process plant;

— Part 322, Abstract test suite: Exchange of product data for composite structures;

— Part 323, Abstract test suite: Exchange of design and manufacturing product information for casting parts;

— Part 324, Abstract test suite: Mechanical product definition for process plans using machining features;

— Part 325, Abstract test suite: Building elements using explicit shape representation;

— Part 326, Abstract test suite: Ship mechanical systems;

— Part 327, Abstract test suite: Plant spatial configuration;

— Part 329, Abstract test suite: Exchange of design and manufacturing product information for forged parts;

— Part 330, Abstract test suite: Building structural frame: Steelwork;

— Part 331, Abstract test suite: Process engineering data: Process design and process specification of major equipment;

— Part 332, Abstract test suite: Technical data packaging core information and exchange;

— Part 501, Application interpreted construct: Edge-based wireframe;

— Part 502, Application interpreted construct: Shell-based wireframe;

— Part 503, Application interpreted construct: Geometrically bounded 2D wireframe;

— Part 504, Application interpreted construct: Draughting annotation;

— Part 505, Application interpreted construct: Drawing structure and administration;

— Part 506, Application interpreted construct: Draughting elements;

— Part 507, Application interpreted construct: Geometrically bounded surface;

— Part 508, Application interpreted construct: Non-manifold surface;

— Part 509, Application interpreted construct: Manifold surface;

— Part 510, Application interpreted construct: Geometrically bounded wireframe;

— Part 511, Application interpreted construct: Topologically bounded surface;

— Part 512, Application interpreted construct: Faceted boundary representation;

— Part 513, Application interpreted construct: Elementary boundary representation;

— Part 514, Application interpreted construct: Advanced boundary representation;

— Part 515, Application interpreted construct: Constructive solid geometry;

— Part 517, Application interpreted construct: Mechanical design geometric presentation;

— Part 518, Application interpreted construct: Mechanical design shaded representation.

The structure of this International Standard is described in ISO 10303-1. The numbering of the parts of this International Standard reflects its structure:

— Parts 11 to 12 specify the description methods,

— Parts 21 to 26 specify the implementation methods,

— Parts 31 to 35 specify the conformance testing methodology and framework,

— Parts 41 to 49 specify the integrated generic resources,

— Parts 101 to 106 specify the integrated application resources,

— Parts 201 to 232 specify the application protocols,

— Parts 301 to 332 specify the abstract test suites, and

— Parts 501 to 518 specify the application interpreted constructs.

Should further parts of ISO 10303 be published, they will follow the same numbering pattern.

Annexes A, B, C, D, and E form an integral part of this part of ISO 10303. Annexes F, G, H, J, and K are for information only.

Introduction

ISO 10303 is an International Standard for the computer-interpretable representation and exchange of product data. The objective is to provide a neutral mechanism capable of describing product data throughout the life cycle of a product independent from any particular system. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and archiving.

This International Standard is organized as a series of parts, each published separately. The parts of ISO 10303 fall into one of the following series: description methods, integrated resources, application interpreted constructs, application protocols, abstract test suites, implementation methods, and conformance testing. The series are described in ISO 10303-1. This part of ISO 10303 is a member of the application protocol series.

This part of ISO 10303 specifies an application protocol (AP) for exchanging process engineering and conceptual design information for process plants. Process engineering information is used throughout the process plant life cycle. Process engineering information is initially generated during the process design activities, including conceptual and final process design and a portion of the detailed engineering design specifications of process equipment. Process engineering information is used to produce process flow diagrams (PFDs), piping and instrumentation diagrams (P&IDs), equipment and instrument lists, and process specifications on equipment datasheets. It is also used to populate databases with process information needed later in the life cycle, e.g., process stream data. This information forms the conceptual basis for specifying, selecting, and operating process plant equipment over the plant life cycle. Finally, this AP supports or partially supports continuous and batch processes, process simulations, stream data, unit operations, conceptual design requirements for major process equipment, and process control.

Figure 1 contains a planning model that provides a high-level description of the requirements for this application protocol, as well as indicating the relationships between the basic data components. Figure 4 in clause 4 provides a data model that shows a more detailed view of the data component requirements and relationships.

This application protocol defines the context, scope, and information requirements for the exchange of process engineering data as detailed in the exchange scenarios described below and specifies the integrated resources necessary to satisfy these requirements. The AP's purposes are as follows:

— Exchange of process engineering information from initial and revised process design packages between an operating company and an engineering company;

— Exchange of process engineering information within an organization among various software packages that support the process engineering work activity, including internally owned software and software licensed from different software providers;

— Exchange of process engineering information among various software packages involved in various stages of the plant life cycle, which may involve disciplines other than process engineering, and which need to use process engineering information;

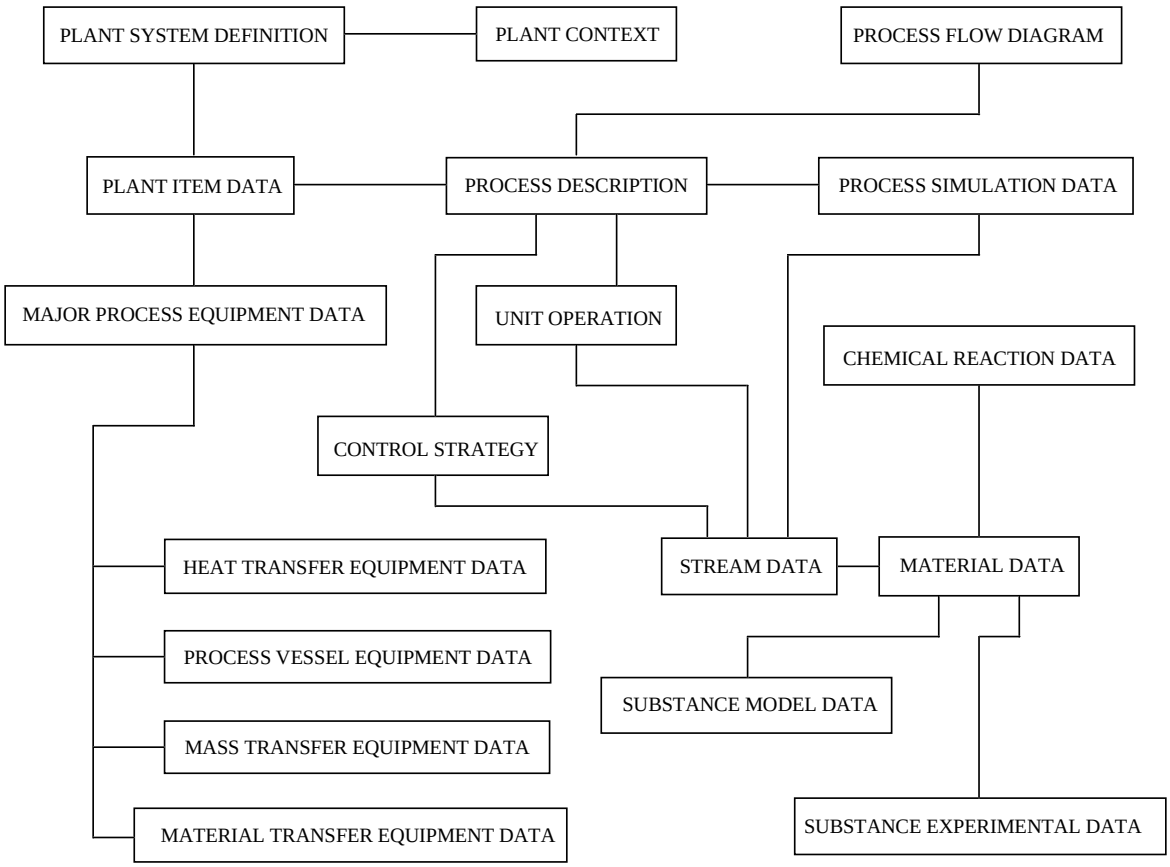


Figure 1 - Planning model

— Exchange of process engineering information from a licensed technology package from the company that is licensing the information to an engineering company or an operating company;

— Exchange of process engineering information from a process design package within a company, such as from a central office to an operating plant for review and comment;

— Exchange of process engineering information from a plant description during the sale of the plant.

Application protocols provide the basis for developing implementations of ISO 10303 and abstract test suites for the conformance testing of AP implementations.

Clause 1 defines the scope of the application protocol and summarizes the functionality and data covered by the AP. Clause 3 lists the words defined in this part of ISO 10303 and gives pointers to words defined elsewhere. An application activity model that is the basis for the definition of the scope is provided in annex F. The information requirements of the application are specified in clause 4 using terminology appropriate to the application. A graphical representation of the information requirements, referred to as the application reference model (ARM), is given in annex G.

Resource constructs are interpreted to meet the information requirements. This interpretation produces the application interpreted model (AIM). This interpretation, given in 5.1, shows the correspondence between the information requirements and the AIM. The short listing of the AIM specifies the interface to the integrated resources and is given in 5.2. Note that the definitions and EXPRESS provided in the integrated resources for constructs used in the AIM may include select list items and subtypes which are not imported into the AIM. The expanded listing given in annex A contains the complete EXPRESS for the AIM without annotation. A graphical representation of the AIM is given in annex H. Additional requirements for specific implementation methods are given in annex C.

Industrial automation systems and integration — Product data representation and exchange — Part 231: Application protocol: Process engineering data: Process design and process specifications of major equipment

1 Scope

This part of ISO 10303 specifies the use of the integrated resources necessary for the scope and information requirements for the exchange of process engineering and conceptual design information of process plants, including process designs, unit operations, process simulations, stream characteristics, and design requirements for major process equipment. The primary life cycle perspective is that of conceptual process engineering done prior to the detailed design and construction of new process plants or the modification and operation of existing plants.

NOTES

1 - The application activity model in annex F provides a graphical representation of the processes and information flows that are the basis for the definition of the scope of this part of ISO 10303.

2 - Information defined as being within the scope of this part of ISO 10303 can be used throughout the lifecycle of a process plant.

3 - Figure 2 illustrates the basic life-cycle stages of a process plant. Process design life-cycle phases are enclosed in a box labeled AP 231 - Process Design (solid line). Downstream life-cycle phases that may be useful are enclosed in a box labeled AP 231 (dashed line).

4 - Figure 3 illustrates areas of overlap between this part of ISO 10303 and ISO 10303-221 [7] and ISO 10303-227 [8].

The following are within the scope of this part of ISO 10303:

— geometry required to support functional design of a physical object or piece of equipment;

— thermophysical properties for substances used or produced by the process industries;

— 2D geometry used to represent pictorial elements on a PFD;

— the process engineering input specification for a steady-state process simulation and steady-state process simulation results;

— the process engineering portion of a dynamic process simulation input specification and dynamic simulation results that can be described as a snap-shot of the process state at any particular time in the simulation;

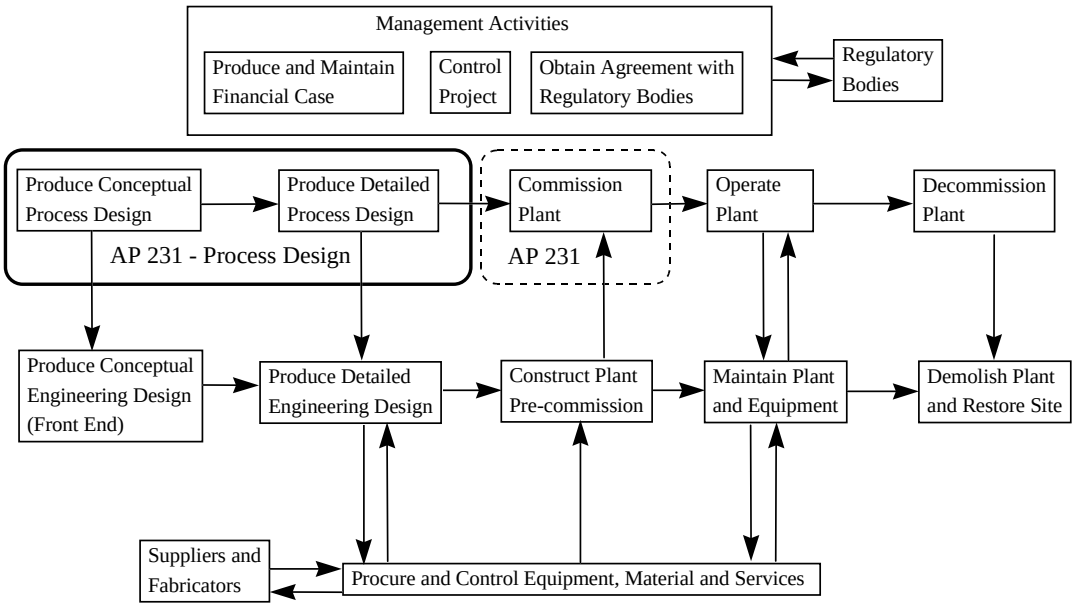


Figure 2 - Life cycle activity coverage

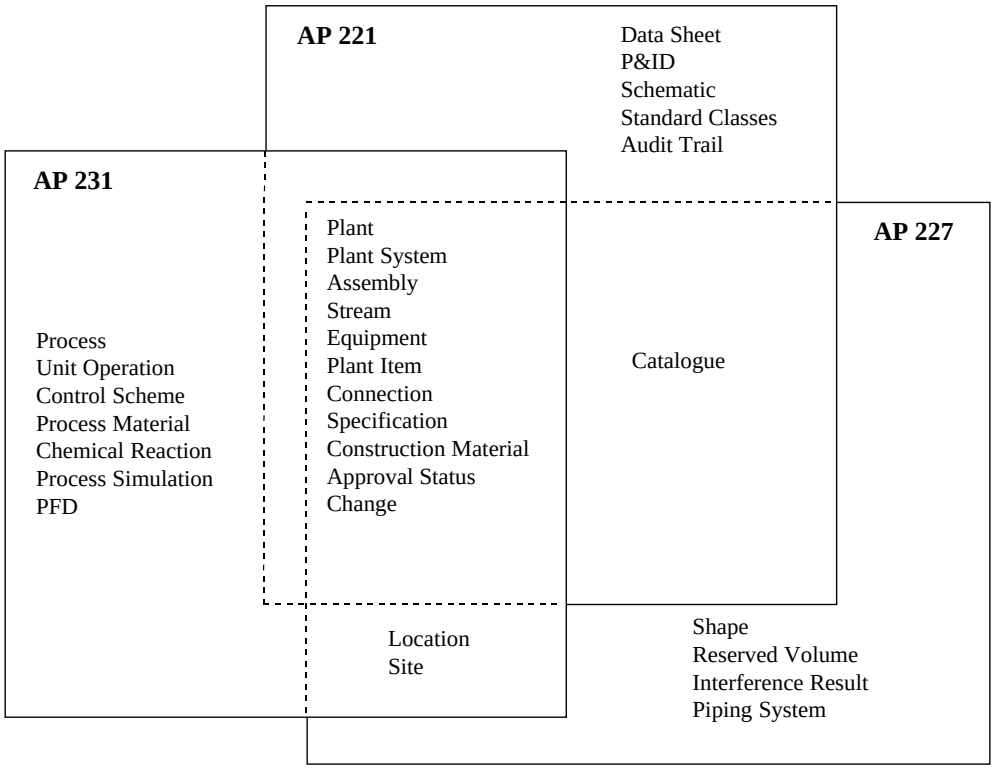


Figure 3 - Process plant AP coverage and overlaps

EXAMPLE 1 - The process state time descriptions include ‘at initial conditions’, ‘at final conditions’, or conditions at a time relative to the initial time.

— conceptual process design descriptions of major process equipment including data commonly found on major process equipment data sheets. Two approaches for describing major process equipment design and specification data are as follows:

a) a high-level description suitable for any type of process equipment;

b) in-depth data model descriptions for a few major process equipment types deemed to have high value for data exchange.

NOTES

5 - The selection criteria for determining high business value for this part of ISO 10303 is based on equipment that is commonly used by many companies in many process plants and that has a high equipment count within the plant. Using this criteria, shell and tube heat exchanger, process pressure vessel, centrifugal pump and compressor, and separation tower equipment types were selected.

6 - Over time, the process industry may choose to develop in-depth data models for other types of process equipment. The application reference model is structured to permit this type of future expansion.

— information needed to make a process flow diagram (PFD). This information includes the following:

a) identification, description, design conditions for, and operating conditions for process equipment;

b) identification, description, design conditions, operating conditions, composition, thermodynamic properties, physical properties, and transport properties for process streams;

c) identification and description of major instrumentation and control equipment needed to perform basic process control functions;

e) utilities requirements summaries;

f) associations between process system components and symbols to represent the components on a PFD.

— basic control strategies and event sequences;

NOTES

7 - Basic control is dedicated to establishing and maintaining a specific state of equipment or process operation. It includes regulatory control, interlocking, monitoring exception handling, and discrete or sequential control.

8 - Refer to International Society for Measurement and Control (ISA) ISA-S88.01-1995, *Batch Control, Part 1: Models and Terminology* [1], for further details of the Phase, Procedure, Unit Procedure, and Operation portions of the procedural control hierarchy.

— descriptions at specific times for plant items, materials, process definitions, PFDs, material amounts, streams, and process simulations;

NOTE 9 - Specific times can be absolute and relative.

EXAMPLE 2 - Specific time descriptions include startup, shutdown, standby, beginning of the catalyst cycle, and sequence of discrete time slices in a batch operation or a dynamic simulation.

— process topology;

— plant measurement data that can be described at a single instance in time;

— equipment data specifications used to prepare requests for bids or for purchase.

NOTE 10 - Partially completed equipment data specifications may be exchanged with a prospective vendor and the completed data specifications returned with the vendor's bid.

The following are outside the scope of this part of ISO 10303:

— geometry required to support detailed physical design of a piece of equipment;

— detailed simulation control methods for steady state and dynamic simulation;

— complete input specification for a dynamic process simulation model and a complete set of results from a dynamic process simulation;

— all schematics, except for PFDs, such as piping and instrumentation diagrams and logic diagrams that describe batch recipes, interlock logic, or event sequence logic;

— complete description of the batch recipe and control methods;

— detailed mechanical design of equipment;

— detailed requirements for dynamic unit operations;

EXAMPLE 3 - Specific dynamic unit operations include batch unit operations or adsorption units.

— management of design changes;

— validation and reconciliation of data;

— material safety data sheets (MSDS) and detailed requirements for MSDS;

— results from hazards and operability studies;

— cost data;

— detailed requirements for major process equipment not defined as within the scope of this part of ISO 10303;

— the full collection of plant measurement data, measurement uncertainties, and measurement statistics needed to reconcile plant data against process simulations of the plant;

— detailed analyses for reliability and failure data.

NOTE 11 - Reliability and failure data are not modelled as concepts within this part of ISO 10303, but may be represented with the process property construct of this part of ISO 10303. Refer to 4.2.1.1.14 for further information on this construct.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 10303. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 10303 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 8824-1:1995, *Information technology — Open systems interconnection — Abstract syntax notation one (ASN.1) — Part 1: Specification of basic notation.*

ISO 10303-1:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles*.

ISO 10303-11:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual.*

ISO 10303-21:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 21: Implementation methods: Clear text encoding of the exchange structure.*

ISO 10303-31:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 31: Conformance testing methodology and framework: General concepts.*

ISO 10303-41:TC184/SC4 N539, *Industrial automation systems and integration — Product data representation and exchange - Part 41: Integrated generic resources: Fundamentals of product description and support*.

ISO 10303-42:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 42: Integrated generic resources: Geometric and topological representation.*

ISO 10303-43:TC184/SC4 N540, *Industrial automation systems and integration — Product data representation and exchange — Part 43: Integrated generic resources: Representation structures.*

ISO 10303-44:TC184/SC4 N541, *Industrial automation systems and integration — Product data representation and exchange — Part 44: Integrated generic resources: Product structure configuration.*

ISO 10303-45:1998, *Industrial automation systems and integration — Product data representation and exchange — Part 45: Integrated generic resources: Material.*

ISO 10303-46:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 46: Integrated generic resources: Visual presentation.*

ISO-10303-49:1998, *Industrial automation systems and integration — Product data representation and exchange — Part 49: Integrated generic resources: Process structure and properties.*

3 Definitions and abbreviations

3.1 Terms defined in ISO 10303-1

This part of ISO 10303 makes use of the following terms defined in ISO 10303-1:

— abstract test suite (ATS);

— application;

— application activity model (AAM);

— application interpreted model (AIM);

— application object;

— application protocol (AP);

— application reference model (ARM);

— conformance class;

— data;

— data exchange;

— exchange structure;

— implementation method;

— information;

— integrated resource;

— interpretation;

— PICS proforma;

— presentation;

— product;

— product data;

— protocol information and conformance statement (PICS);

— resource construct;

— structure;

— unit of functionality (UoF).

3.2 Terms defined in ISO 10303-31

This part of ISO 10303 makes use of the following terms defined in ISO 10303-31:

— conformance testing;

— implementation under test (IUT);

— postprocessor;

— preprocessor.

3.3 Other definitions

For the purposes of this part of ISO 10303, the following definitions apply:

3.3.1 actual: descriptive adjective that, when applied to a thing (see 3.3.46), indicates that the thing exists at some time in the real world.

NOTES

1 - The terms actual, planned (see 3.3.27), and required (see 3.3.40) generally reflect life-cycle stages of a thing.

2 - Within the context of this part of ISO 10303, being actual can be specified for a thing that is:

— a plant item (see 3.3.28);

— an association between plant items such as a connection (see 3.3.6);

— an activity or an association between a plant item and an activity;

— a possession of a property (see 3.3.37) by a plant item or activity.

3 - A thing cannot be both actual and planned. An actual thing can be the realisation of an planned thing.

4 - An actual thing has properties that can be measured or observed.

3.3.2 assembly: a set of things (see 3.3.46) that has a relationship to each other apart from being members of the same set.

NOTE - Within the context of this part of ISO 10303, an assembly can be a set of things that are plant items (see 3.3.28).

3.3.3 catalogue: an electronic or paper document that contains information about a collection (see 3.3.4) of things (see 3.3.46).

NOTE - Within the context of this part of ISO 10303, a catalogue can be a collection of typical or reference plant items (see 3.3.28) that the definition of a specific occurrence of a plant item in the design (see 3.3.9) of a process plant (see 3.3.35) can be selected from.

3.3.4 collection: a set of things (see 3.3.46) that do not have any relationship to each other apart from being members of the same set.

NOTE - Within the context of this part of ISO 10303, a collection can be a set of things that are plant items (see 3.3.28).

3.3.5 component: a thing (see 3.3.46) that is part of another thing.

NOTES

1 - Within the context of this part of ISO 10303, a thing that is a component can be part of a functional (see 3.3.17) or physical (see 3.3.24) plant item (see 3.3.28) or part of a process material (see 3.3.34).

2 - A component can itself have components.

3.3.6 connection: an association between two items (see 3.3.20) that enables the flow of process material (see 3.3.34), energy, mechanical loads, or signals between them or constrains their relative positions.

NOTES

1 - Within the context of this part of ISO 10303, a connection can be between either functional (see 3.3.17) or physical (see 3.3.24) plant items (see 3.3.28).

2 - A connection can be the result of a physical joining.

3 - A functional connection can exist between two plant items without a physical joining of the plant items.

3.3.7 construction material: the substance or substances that a physical (see 3.3.24) thing (see 3.3.46) is made of.

NOTE - Within the context of this part of ISO 10303, the physical thing made from the construction material is a plant item (see 3.3.28).

3.3.8 data sheet: a document consisting of one or more pages presenting specification data relevant for defining one or more items (see 3.3.20) in a stylized form.

3.3.9 design: a collection (see 3.3.4) of information intended to create a process plant (see 3.3.35), portion of a process plant, or plant item (see 3.3.28), that is created for a specific purpose and uses a consistent syntax and symbology.

NOTE - A PFD (see 3.3.33) is a design that represents the flow and reaction of process materials (see 3.3.34). A P&ID (see 3.3.26) is a design that represents the logical functionality of a piping system. A three-dimensional geometric model is a design that represents the physical (see 3.3.24) shape and arrangement of the components (see 3.3.5) of a process plant or plant system (see 3.3.29). The purpose of all these designs is analysis and specification of a process plant, portion of a process plant, or plant item.

3.3.10 design package: a document containing site (see 3.3.41) or project specific drawings, specifications, data sheets (see 3.3.8), etc. for a particular process or component (see 3.3.5).

3.3.11 duty: the heat load on heat exchange equipment (see 3.3.14) based on its process service conditions.

EXAMPLE 4 - The load on a condenser for vapours from a distillation column is determined by the quantity and latent heat of vapourization of the vapours at the condensing conditions; or for gas coolers, by the flow of gas and the temperature rang required for the cooling.

For sensible heat changes:

$$q = W\ c_p\ (t_2 - t_1)$$

Where q is the sensible heat duty, W is the mass flow rate of the process fluid, c_p is the specific heat of the process fluid, and $(t_2 - t_1)$ is the temperature difference across the process fluid.

For latent heat changes:

$$q = W\ l_v$$

Where q is the latent heat duty, W is the mass flow rate of the process fluid, and l_v is the latent heat of vapourization.

For cooling (or heating) and latent heat change (condense or boil):

$$Q = q = W\ c_p\ (t_2 - t_1) + W\ l_v$$

NOTE - This definition of duty is from *Applied Process Design for Chemical and Petrochemical Plants* [4].

3.3.12 enthalpy: a thermodynamic state property that reflects the energy content of a fluid.

NOTE - When heat or work is added to a system containing a fluid, then the enthalpy of the fluid increases. Similarly, when heat or work is removed from a fluid, then the fluid enthalpy decreases.

3.3.13 entropy: a thermodynamic state property that indicates the effectiveness of energy conversion.

NOTE - An entropy change of zero indicates an ideal process. Entropy changes greater than zero indicates inefficiencies associated with a process.

3.3.14 equipment: an item (see 3.3.20) or assembly (see 3.3.2) of items that performs an operation and that may be treated as a single item for design (see 3.3.9), acquisition, or operation.

NOTES

1 - Equipment has both physical (see 3.3.24) and functional (see 3.3.17) aspects.

2 - Within the context of this part of ISO 10303, the equipment performs its operation on the process material (see 3.3.34).

3.3.15 equipment data sheet: a data sheet (see 3.3.8) for equipment (see 3.3.14).

NOTE - Equipment data sheets are initially produced and partially completed during conceptual process design. The equipment data sheets may be further elaborated during detailed mechanical design and are used in later design stages to seek bids from equipment suppliers prior to equipment bid evaluation and procurement.

3.3.16 function: as a verb, to act in a required or expected manner.

3.3.17 functional: descriptive adjective that, when applied to a thing (see 3.3.46), refers to the actions or activities that the thing provides or may provide to fulfill a function (see 3.3.16).

NOTE - Within the context of this part of ISO 10303, a thing is a plant item (see 3.3.28) that provides functional capability in a process plant (see 3.3.35).

3.3.18 instrument: an individually identifiable item (see 3.3.20) that contributes to monitoring or controlling the state of an item, a process, or the environment.

NOTE - Instruments include items such as control valves, sensors, and gauges.

3.3.19 insulation: a quantity of matter or space that provides resistance to the flow of heat, electricity, sound, or mechanical vibration.

3.3.20 item: a solid material (see 3.3.22) object.

NOTE - An item may be an assembly (see 3.3.2) or collection (see 3.3.4) of items.

3.3.21 major process equipment: equipment (see 3.3.14) that is considered significant or important to the process design (see 3.3.31).

EXAMPLE 5 - Major process equipment includes fluid transport equipment, heat transfer equipment, stills, extractors and absorbers, reactors, mixers and agitators, and process vessels.

3.3.22 material: the matter from which a thing (see 3.3.46) is made.

3.3.23 material stream: a flow of process material (see 3.3.34) past a defined point along a path.

3.3.24 physical: descriptive adjective that, when applied to a thing (see 3.3.46), refers to a set of characteristics, properties, or traits of the thing.

EXAMPLE 6 - Characteristics include weight, size, and location and orientation of the thing.

NOTE - Within the context of this part of ISO 10303, a physical object that is, or may be, installed as a plant item (see 3.3.28), can be identified by a serial number.

3.3.25 pipe: a plant item (see 3.3.28) that is hollow and approximately cylindrical, that may have a constant cross-section along its extent, and that conveys fluid, vapour, or particulate material (see 3.3.22).

NOTE - Heating, ventilation, and air conditioning (HVAC) duct that has a rectangular cross section is not a pipe.

3.3.26 piping and instrumentation diagram: a schematic representation (see 3.3.39) for equipment (see 3.3.14), piping, and instruments (see 3.3.18) that consists, as a minimum, of the functional (see 3.3.17) connection (see 3.3.6) and assembly (see 3.3.2) of plant items (see 3.3.28), and the identification of principal plant items.

NOTE - The piping and instrumentation diagram can also present the functional and physical (see 3.3.24) aspects of plant items.

3.3.27 planned: descriptive adjective that, when applied to a thing (see 3.3.46), indicates that a thing has been designed or predicted.

NOTES

1 - The terms actual (see 3.3.1), planned, and required (see 3.3.40) generally reflect life-cycle stages of a thing.

2 - Within the scope of this part of ISO 10303, being planned can be specified for a thing that is:

— a plant item (see 3.3.28);

— an association between plant items such as a connection (see 3.3.6);

— an activity or an association between a plant item and an activity;

— a possession of a property (see 3.3.37) by a plant item or activity.

3 - A thing cannot be both actual and planned. An actual thing can be the realisation of a planned item.

3.3.28 plant item: a physical (see 3.3.24) item (see 3.3.20) that is, or is intended to be, a part of a process plant (see 3.3.35).

NOTES

1 - A plant item can be an assembly (see 3.3.2) of other plant items.

2 - A plant item has both physical and functional (see 3.3.17) aspects.

3.3.29 plant system: a part of a process plant (see 3.3.35) that provides or performs, or is intended to provide or perform, a service or function contributing to, or enabling the operation of, a process plant.

NOTES

1 - A plant system consists of an assembly (see 3.3.2) of one or more plant items (see 3.3.28).

2 - A plant system has both physical (see 3.3.24) and functional (see 3.3.17) aspects.

3.3.30 process activity: an activity that transforms or transports process material (see 3.3.34) between its input to a process plant (see 3.3.35) as feed stock and its output from a process plant as a product or waste.

NOTE - The transformation can be a change of physical (see 3.3.24) state, a physical separation or mixing, or a biological or chemical process.

3.3.31 process design: the preparation of:

— process material and heat balances;

— process cycle development, correlation of pilot or research data, and correlation of physical data;

— auxiliary services material and heat balances;

— flowsheet development and detailed completion;

— chemical engineering performance design for specific items of equipment required for a flowsheet, and mechanical interpretation of this design to a practical and reasonable specification.

NOTE 1 - This part of the process design activity is where the process requirements are converted into hardware details to accomplish the process end results at each step in the product production process.

— Instrumentation as related to process performance, presentation, and interpretation of requirements to instrument specialists;

— Process interpretation for proper mechanical, structural, civil, electrical, instrument, etc., handling of the respective individual phases of the project;

— Preparation of specifications in proper form or detail for use by the project team as well as for the purchasing function;

— Evaluation of bids and recommendation of qualified vendor.

NOTE 2 - This definition of process design is from *Applied Process Design for Chemical and Petrochemical Plants* [4].

3.3.32 process engineering: the interpretation of the process requirements into the selection and topology of the appropriate new or existing equipment (see 3.3.14) to accomplish the process requirements.

3.3.33 process flow diagram: a schematic representation (see 3.3.39) that consists of, as a minimum, connecting process activities (see 3.3.30) with material streams (see 3.3.23) and identifying plant items (see 3.3.28) that perform the process activities.

NOTES

1 - The process activities shown on a process flow diagram can also be called unit operations.

2 - The process flow diagram can also present:

— properties (see 3.3.37) of process activities and material streams for particular cases;

— measurements that are made upon process activities and material streams;

— the flow of signals between sensors, controllers, and actuators;

— the control logic the controller implements.

3.3.34 process material: the material (see 3.3.22) that is transformed or transported by a process activity (see 3.3.30).

3.3.35 process plant: an assembly (see 3.3.2) of one or more plant systems (see 3.3.29) and plant items (see 3.3.28) that can, or are intended to perform, a chemical, physical (see 3.3.24) or transport process.

NOTES

1 - A process plant is identified as a single unit for of management and ownership.

2 - A process plant has both physical and functional (see 3.3.17) aspects.

3.3.36 process topology: the connections between the current and allowable directions, with respect to the process activities (see 3.3.30), including flows through those connections (streams), any hierarchical relationships among the process activities, and the specification of the boundary of the process.

3.3.37 property: a quantifiable aspect of a thing (see 3.3.46) in the real world that can be observed, measured, or derived from something that is observed or measured.

3.3.38 pseudo-component: a type of chemical component that is a combination of chemical species that are treated as though they were a single chemical specie and characterized by assigning "molecular" constants to it.

3.3.39 representation: a description, drawing, or depiction of something.

3.3.40 required: descriptive adjective that, when applied to a thing (see 3.3.46), indicates that a thing is essential or necessary, that is, it has to be provided to satisfy a functional (see 3.3.17) need.

NOTES

1 - The terms actual (see 3.3.1), planned (see 3.3.27), and required generally reflect life-cycle stages of a thing.

2 - Within the scope of this part of ISO 10303, being required can be specified for a thing that is:

— a plant item (see 3.3.28);

— an association between plant items such as a connection (see 3.3.6);

— an activity or an association between a plant item and an activity;

— a possession of a property (see 3.3.37) by a plant item or activity.

3.3.41 site: an area of land or water on which one or more process plants (see 3.3.35) is or may be situated.

3.3.42 stage: a sequence of one or more similar process activities (see 3.3.30) that compose another process activity.

3.3.43 standard conditions: a defined temperature and pressure.

EXAMPLE 7 - Standard conditions for a test inside a tank are 60 degrees Celsius and 1 atmosphere.

3.3.44 stream: a flow of something past a point along a path.

NOTE - This flow is assumed to be at a frozen point in time.

EXAMPLE 8 -The 'something' that flows along a path includes items such as materials (see 3.3.22), signals, energy, and information.

3.3.45 technology package: a document containing non-site or project specific drawings, stream (see 3.3.44) information, operations know-how, and specifications for one or more proprietary processes.

NOTE - This document may provide a basis for estimating the cost of designing and constructing a process plant (see 3.3.35) at a specific site (see 3.3.41).

3.3.46 thing: an unspecified physical (see 3.3.24) or functional (see 3.3.17) object, entity, idea, or action that is or may be thought about or perceived.

3.3.46 velocity head: the result of multiplying the fluid density (rho) times the velocity squared (v2).

3.4 Abbreviations

For the purposes of this part of ISO 10303, the following abbreviations apply:

AACE	american association of cost engineers;
AAM	application activity model;
AFD	approved for design;
AFNOR	association francaise de normalisation;
AIC	application interpreted construct;
AIChE	american institute of chemical engineers;
AIM	application interpreted model;
ANSI	american national standards institute;
AP	application protocol;
API	american petroleum institute;
ARM	application reference model;
ASME	american society of mechanical engineers;

ASN	abstract syntax notation;
ASTM	american society for testing and materials;
ATS	abstract test suite;
C&IS	control and information system;
CAD	computer-aided design;
Cc	centrifugal compressor;
CODAP	comprehensive occupational data analysis programs;
DIN	deutsches institut für normung;
DIPPR	design institute for physical property data;
E&C	engineering design and construction;
EPA	environmental protection agency;
FDA	food and drug administration;
HVAC	heating, ventilation, and air conditioning
I&C	instrumentation and controls
ISA	international society for measurement and control;
IUPAC	international union of pure and applied chemistry;
LMTD	log mean temperature difference;
MSDS	material safety data sheets;
NPSH	net positive suction head;
OSHA	occupational safety and health administration;
P&ID	piping and instrumentation diagram;
PF&CD	process flow and control diagram;
PFD	process flow diagram;
PICS	protocol information and conformance statement;
PIEBASE	process industry executive for achieving business advantage using standards for data exchange

POD process operation definition;

QFD quantity flow diagram;

rhov2 velocity head;

SFD simplified process flow diagram;

TEMA tubular exchanger manufacturers association;

Uo unit operation;

UoF unit of functionality;

VLE vapour liquid equilibrium.

4 Information requirements

This clause specifies the information required for the exchange of process engineering and conceptual design information.

The information requirements are specified as a set of units of functionality, application objects, and application assertions. These assertions pertain to individual application objects and to relationships between application objects. The information requirements are defined using the terminology of the subject area of this application protocol.

NOTES

1 - A graphical representation of the information requirements is given in annex G.

2 - The information requirements correspond to those of the activities identified as being within the scope of this application protocol in annex F.

3 - The mapping table specified in 5.1 shows how the integrated resources are used to meet the information requirements of this application protocol.

4.1 Units of functionality

This subclause specifies the units of functionality for the Process Engineering Data: Process Design and Process Specifications of Major Equipment application protocol. This part of ISO 10303 specifies the following units of functionality:

— chemical_reaction_data;

— control_strategy;

— heat_transfer_equipment_data;

— major_process_equipment_data;

— mass_transfer_equipment_data;

— material_data;

— material_transfer_equipment_data;

— plant_context;

— plant_item_data;

— plant_system_definition;

— process_description;

— process_flow_diagram;

— process_simulation_data;

— process_vessel_equipment_data;

— stream_data;

— substance_experimental_data;

— substance_model_data;

— unit_operation.

The units of functionality and a description of the functions that each UoF supports are given below. The application objects included in the UoFs are defined in 4.2. To aid in the understanding of this part of ISO 10303, the application objects are grouped by UoF and the UoFs are grouped into several broader categories in 4.2 as described below:

— process plant UoFs

  a) plant_context;

  b) plant_system_definition.

— process substance and material UoFs

  a) substance_experimental_data;

  b) substance_model_data;

  c) chemical_reaction_data.

— process design UoFs

a) process_description;

b) unit_operation;

c) stream_data;

d) process_simulation_data;

e) process_flow_diagram;

f) control_strategy.

— process equipment UoFs

a) plant_item_data;

b) major_process_equipment_data;

c) heat_transfer_equipment_data;

d) mass_transfer_equipment_data;

e) material_transfer_equipment_data;

f) process_vessel_equipment_data.

Figure 4 contains the data planning model that provides a high level description of the UoFs of this part of ISO 10303, as well as the relationships between these UoFs. Further details of key concepts in this part of ISO 10303 are provided below.

The ARM model includes several modelling abstractions to deal with the issue of defining those elements that are essential for describing equipment and the duty or function performed by the equipment. These key modelling abstraction concepts include Plant Item, Process Description, Process Simulation, Material, and Process Flow Diagram.

The Plant Item concept describes the data associated with a physical piece of equipment. Using the generic Plant_item application object, any piece of process equipment may be described in general terms, that is, each item has a tag, a weight, etc. Elaboration and detailed application object attribution of specific equipment was confined to shell and tube exchangers, process vessels, pumps, compressors, and distillation column internals as described in Clause 1. A plant item's 3D coordinate-based location and orientation relative to the plant or site can also be described. An alternate way of describing a piece of equipment may be representing it as a system. This may be done when the details the of function performed by the equipment or the internal details of the equipment are described.

> EXAMPLE 9 - A compressor is viewed as a plant item when discussing characteristics such as its external shape or weight. It is viewed as a system, however, when discussing the representation or simulation of its internal details.

The Process Description concept focuses on describing the process equipment's key functions and the various attributes associated with those functions. Using the generic Process_definition application

object, it is possible to describe any process by giving it a name and a description, which describes its function or optional technical data transmitted in textual form. Elaboration and attribution of Process_-definition application objects is included for many more types of process equipment than is described in Clause 1 for physical process equipment. Process definitions are organized primarily by various kinds of unit operations and classifications of unit operations that pertain to their general function. The set of unit operations that was included amounts to essentially a superset of the various unit operations found in currently available commercial process simulators. Another generic application object in the model associated with unit operations is called the Process_design_property_value. Using this structure it is possible to describe parameters associated with a generic process unit operation. The Process Description concept also includes the notion of streams which connect to various unit operations through ports. A Process Description is related to a Plant Item with a many to many relationship, thereby allowing a Process Description to be optionally associated with a particular Plant Item or set of Plant Items.

EXAMPLE 10 - A distillation column unit operation might be associated with the tower process vessel, tower internals such as sieve trays or packing, shell and tube exchangers that provide condensing and reboiling functions, and a pump for the column reflux.

A Process_definition application object identifies and describes a process. It is independent of the representation of the process, such as a process flow diagram or a simulation, and is also independent of the particular equipment used to carry out the process. The Process Simulation concept is a mathematical model of a portion of the process. A Process_simulation application object may be related to a Process_definition application object by a many to many relationship. Process_simulation application objects contain data that may be specific to a simulation representation of a unit operation.

EXAMPLE 11 - A convergence tolerance or specification of which calculation algorithm was used.

The Material concept is a modelling abstraction that is not intended to be instantiated. There are two subtypes of Material application objects that are instantiated: Construction_material and Process_material. A Construction_material is Material used to make Plant_items. A Process_material is a Material that is used in or produced by a process that is being described. A Process_material is not a physical Substance, but rather a process abstraction of that Substance.

EXAMPLE 12 - Cooling water is a Process_material commonly used in a process. The actual Substance that makes it up is a complex (and mostly indeterminate) mixture of water, dissolved salts, dissolved gases, dissolved and emulsified organic liquids, suspended solids, foams, biological components, and so on. The physical and thermodynamic properties of a Process_material are commonly estimated by approximating its contents with a Substance.

A PFD (Process Flow Diagram) is a schematic representation of the plant design. Therefore, it includes associations between the drawing elements and the engineering information from the Process Definition, the Major Process Equipment, and the Control Strategy. The PFD has relationships to key data entities such as process equipment and streams, connected by ports. Text elements on the PFD may contain Process design property values, which are the key equipment design attributes associated with the major process equipment shown on the PFD.

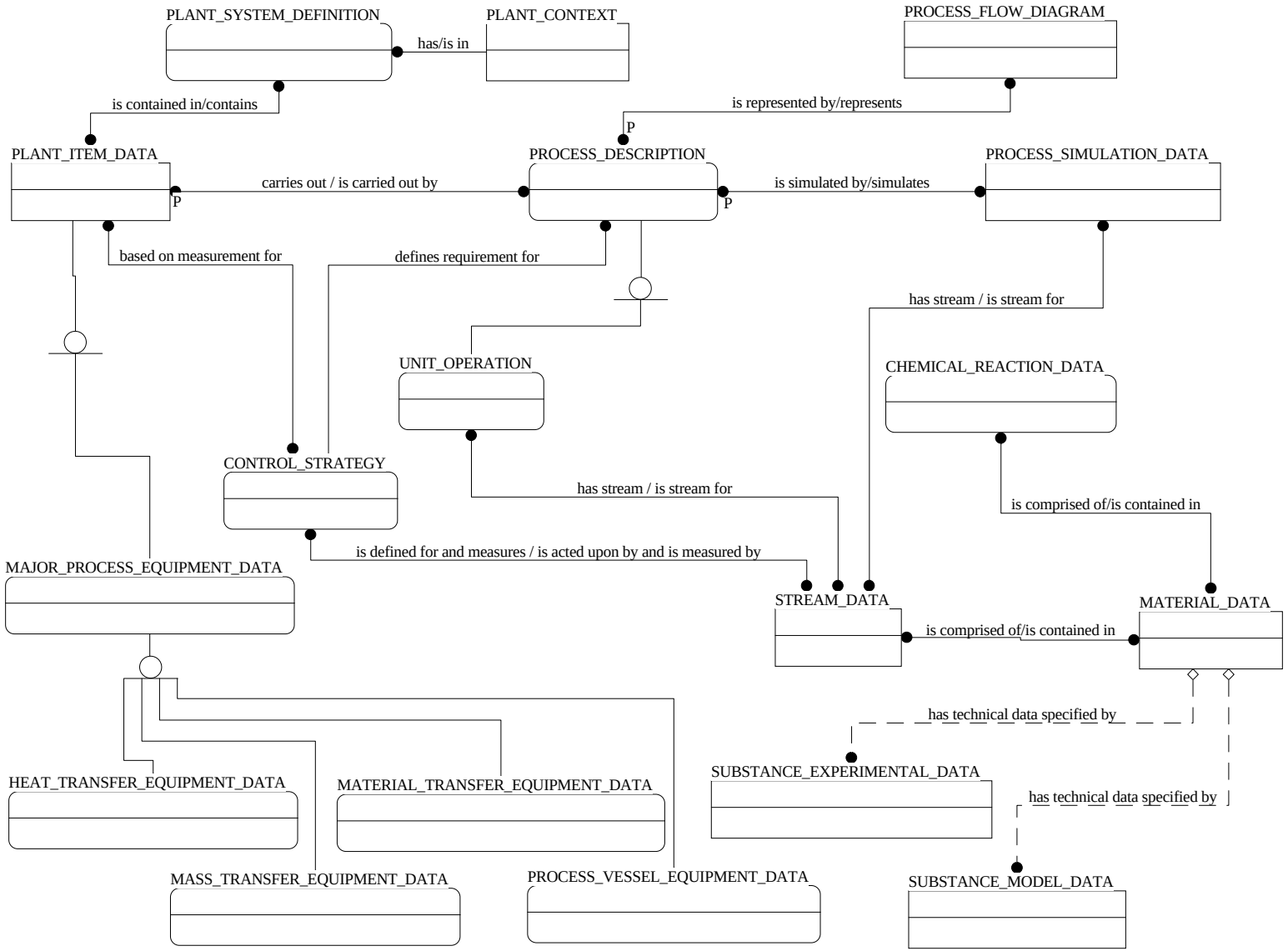


Figure 4 - Data planning model

4.1.1 chemical_reaction_data

The chemical_reaction_data UoF specifies chemical equilibria, chemical reaction rates, and chemical reaction conversion criteria and constraints on stream and unit operation models.

The following application objects are used by the chemical_reaction_data UoF:

— Arrhenius_reaction;

— Chemical_reaction;

— Extents_specified_chemical_reaction;

— Interphase_chemical_reaction;

— Reaction_order;

— Reaction_rate;

— Stoichiometric_coefficient.

4.1.2 control_strategy

The control_strategy UoF specifies one or more control schemes for controlling the plant operation to manufacture the desired product(s). These control schemes define:

— One or more measurements of a property of a stream, material amount, site or plant item;

— The control logic whereby the measurements are used with defined control algorithms to effect control events or process adjustments to plant items or to other control schemes.

Implementation details and all controls that may be required for regulation and safe operation may or may not all be in this UoF.

The following application objects are used by the control_strategy UoF:

— Continuous_control_objective;

— Continuous_control_scheme;

— Control_adjustment;

— Control_event;

— Control_logic;

— Control_logic_condition;

— Control_loop;

— Discrete_control_objective;

— Discrete_control_scheme;

— Logical_operation;

— Trigger.

4.1.3 heat_transfer_equipment_data

The heat_transfer_equipment_data UoF specifies the most common information about types of process equipment that are used to provide a means by which fluids at different temperatures may be thermally contacted so that the heat transfer process may take place and heat is transferred from a hot stream to a cold stream.

NOTE - All the types of heat exchangers have not been explicitly listed directly in the model as entities. This was done on purpose. Other types of heat exchangers can be specified using an attribute of the object Heat_transfer_equipment called heat_exchanger_type, that is currently an open-ended text string. In addition, the Process_design_property_value generic mechanism can be used to provide supplemental details about equipment that are not explicitly included in the application reference model. For now, these are suitable means of extending the model. As more elaboration is driven by process industry need, extensions could be added to this part of ISO 10303 to accommodate these needs.

Generic information about all types of heat exchangers such as the heat_transfer_coefficient and the heat_exchanger_type attributes, that are listed in the Heat_transfer_equipment application object, the water_filled_weight, which is a generic attribute of all process equipment, and the tag, weight, etc., that are attributes of all Plant_items could be transferred in a useful manner for the non-elaborated exchanger types. Shell and tube heat exchangers are the only type of heat exchanger that is fully elaborated and attributed in this part of ISO 10303, because of its large perceived business benefit for actual practical data exchange (high equipment counts, used by many companies in many process plants). Others can be added as the industry is willing to do so in the future.

The following application objects are used by the heat_transfer_equipment_data UoF:

— Air_cooled_heat_exchanger_unit;

— Cross_baffle;

— Detuning_plate;

— Distributor_belt;

— End_partition_plate;

— Exchanger_assembly;

— Exchanger_bundle;

— Exchanger_design_criteria;

— Exchanger_end;

— Exchanger_nozzle;

— Exchanger_performance;

— Exchanger_shell;

— Exchanger_zone;

— Expansion_joint;

— External_circuit_component;

— Flow_vibration_analysis;

— Heat_release_curve;

— Heat_release_point;

— Heat_transfer_equipment;

— Impingement_protection;

— Longitudinal_baffle;

— Nozzle_dome;

— Nozzle_performance;

— Partition_seal_rod;

— Passlane;

— Phase_properties;

— Reboiler_piping;

— Shell_and_tube_heat_exchanger_unit;

— Shellside_design;

— Shellside_performance;

— Tie_rod;

— Tie_rod_spacer;

— Tube_external_characteristics;

— Tube_internal_characteristics;

— Tube_type;

— Tubesheet;

— Tubeside_design;

— Tubeside_performance;

— U_bend_support;

— Vapour_belt.

4.1.4 major_process_equipment_data

The major_process_equipment_data UoF specifies a Plant_item that carries out one or more operations on the process material. This UoF contains information associated with equipment items to be engineered for a specific process and not simply selected from a catalogue. There are two types of major equipment. One type is where the required function is used to engineer the equipment. The second type is where the function is found to be achieved by a proprietary equipment type in which the equipment is designated, and then a rating calculation and possibly vendor tests are performed to refine the equipment design. More details about process equipment may be found in the heat_transfer_equipment_data, mass_-transfer_equipment_data, material_transfer_equipment_data and process_vessel_equipment_data UoFs.

The following application objects are used by the major_process_equipment_data UoF:

— Buffer_gas_system;

— Casing_nozzle;

— Elbow_nozzle_section;

— External_treatment;

— Nozzle;

— Nozzle_section;

— Nozzle_section_connection;

— Process_equipment;

— Process_equipment_driver;

— Reaction_system_equipment;

— Reducing_nozzle_section;

— Solids_processing_equipment;

— Straight_nozzle_section.

4.1.5 mass_transfer_equipment_data

The mass_transfer_equipment_data UoF specifies the most common information about columns used to provide a means of transferring process material from one phase to another phase (distillation and mass transfer operations). The driving force for transfer is a difference in the process material chemical potential within the two or more phases and is used to separate and concentrate components within solution mixtures or to vapourize or condense pure components.

NOTES

1 - Refer to the *Introduction to Chemical Engineering Thermodynamics* [5] for further information on chemical potential.

2 - The application reference model provides general facilities for defining mass transfer equipment, however, detailed attribution of the current model is only done for vapour-liquid contacting devices such as trays and packing.

The following application objects are used by the mass_transfer_equipment_data UoF:

— Active_area_shape;

— Baffle_and_disengaging_panel_intersection;

— Baffle_and_seal_pan_intersection;

— Baffle_and_tray_panel_intersection;

— Blinding_strip;

— Blinding_strip_shape;

— Bubble_cap;

— Bubble_cap_shape;

— Bubble_slot_shape;

— Cap_shape;

— Cartesian_point;

— Corrugation;

— Curve;

— Demister_pad;

— Demister_pad_stack;

— Disengaging_panel_opening_shape;

— Downcomer;

— Downcomer_apron_section_shape;

— Downcomer_apron_shape;

— Downcomer_disengaging_panel_shape;

— Downcomer_hydraulics;

— Downcomer_liquid_flow_channel_shape;

— Downcomer_shape;

— Escape_area_shape;

— Flashing_feed_gallery;

— Mass_transfer_equipment;

— Packing_stack;

— Matched_perimeter_segments;

— Pad_and_pad_stack;

— Pattern;

— Perforation_cover;

— Perforation_cover_shape;

— Perforation_shape;

— Perimeter;

— Perimeter_segment;

— Pressure_equalization_channel_shape;

— Riser_and_tray_panel_shape;

— Riser_shape;

— Seal_pan;

— Seal_pan_recess_shape;

— Seal_pan_shape;

— Separation_efficiency;

— Separation_packing;

— Separation_packing_component;

— Separation_packing_internal;

— Separation_packing_stack;

— Separation_tower;

— Separation_tower_internal;

— Separation_tray;

— Separation_tray_baffle;

— Separation_tray_baffle_shape;

— Separation_tray_component;

— Separation_tray_hydraulics;

— Separation_tray_shape;

— Separation_tray_stack;

— Separation_tray_structural_component;

— Tray_and_tray_stack;

— Tray_cascade;

— Tray_panel;

— Tray_panel_and_perforation_shape;

— Tray_panel_and_slot_shape;

— Tray_panel_hydraulics;

— Tray_panel_shape;

— Tray_slot_shape;

— Tray_support;

— Tray_support_shape;

— Valve_cap;

— Valve_cap_shape;

— Weir;

— Weir_and_disengaging_panel_intersection;

— Weir_and_seal_pan_intersection;

— Weir_and_tray_panel_intersection;

— Weir_shape.

4.1.6 material_data

The material_data UoF specifies a physical material at its related stream conditions that is used in or by a chemical process.

NOTE - A material_data is typified by its intrinsic properties. That is, a quantity may be divided between two vessels and each portion will have the same intrinsic properties.

The following application objects are used by the material_data UoF:

— Bulk_thermodynamic_properties;

— Bulk_thermophysical_properties;

— Bulk_vapour_liquid_equilibrium_properties;

— Component_in_mixture_properties;

— Construction_material;

— Density_properties;

— Excess_properties;

— Interphase_thermophysical_properties;

— Material;

— Material_amount;

— Material_cost;

— Phase_distribution_coefficient;

— Process_material;

— Process_property_curve;

— Process_property_curve_point;

— Single_phase_thermophysical_properties;

— Thermodynamic_conditions;

— Thermodynamic_properties;

— Transport_properties.

4.1.7 material_transfer_equipment_data

The material_transfer_equipment_data UoF specifies the most common information about pumps and compressors used to provide a means of transferring process material from one location to another location or from one thermodynamic state to another thermodynamic state.

NOTE - Many of the application objects listed below make use of "Cc_" at the beginning of the application object name. "Cc_" in the context of this part to ISO 10303 is an abbreviation for "Centrifugal compressor".

The following application objects are used by the material_transfer_equipment_data UoF:

— Cc_balance_piston;

— Cc_casing;

— Cc_critical_speed;

— Cc_diaphragm;

— Cc_impeller;

— Cc_labyrinth;

— Cc_lateral_critical_speed;

— Cc_miscellaneous;

— Cc_shaft_sleeve;

— Cc_speed_control_method;

— Cc_speed_control_signal;

— Cc_torsional_critical_speed;

— Cc_weights;

— Centrifugal_compressor;

— Centrifugal_compressor_stage;

— Centrifugal_pump;

— Fluid_transfer_machine;

— Gas_transfer_machine;

— Material_transfer_equipment;

— Positive_displacement_compressor;

— Pump;

— Pump_casing;

— Pump_casing_test;

— Pump_gland;

— Pump_gland_taps;

— Pump_impeller;

— Pump_packing;

— Reciprocating_compressor;

— Reciprocating_compressor_stage;

— Service_connections.

4.1.8 plant_context

The plant_context UoF specifies information about the plant, the site, locations of plants and items within the plant, site utilities, time references, external references, and process design and process control values. This UoF provides for external constraints on a plant design. It also contains information that may be independent of a specific process design.

The following application objects are used by the plant_context UoF:

— Absolute_time_reference;

— Clock_time;

— Date;

— Electrical_service;

— External_classification;

— External_reference;

— Item_property_reference;

— Location_in_plant;

— Location_in_site;

— Material_amount_reference_time;

— Plant;

— Plant_item_reference_time;

— Process_definition_reference_time;

— Process_design_property_value;

— Process_design_property_variable_usage;

— Process_material_reference_time;

— Process_simulation_reference_time;

— Reference_time_relationship;

— Referenced_object;

— Relative_time_reference;

— Site;

— Site_reference_time;

— Site_standard_conditions;

— Site_utility_service;

— Sited_plant;

— Stream_reference_time;

— Sub_plant_relationship;

— Time_reference;

— Utility_material_service.

4.1.9 plant_item_data

The plant_item_data UoF specifies the most common information about a physical object that is or may be a part of a process plant. Additional details about process equipment plant items may be found in the major_process_equipment_data, heat_transfer_equipment_data, mass_transfer_equipment_data, material_transfer_equipment_data and process_vessel_equipment_data UoFs.

The following application objects are used by the plant_item_data UoF:

— Alternating_current_port;

— Baseplates_and_soleplates;

— Bearing;

— Bearing_housing;

— Buttweld;

— Centrifugal_compressor_tests;

— Compression;

— Conditional_property_value;

— Connected_equipment_port;

— Coupling;

— Design_project;

— Design_project_assignment;

— Direct_current_port;

— Electrical_power_port;

— Energy_port;

— Equipment_port;

— Equipment_port_connection;

— Female_end;

— Flanged;

— Flanged_end;

— Functional_volume;

— Functional_volume_service_case;

— Gasket;

— Heat_port;

— Inspection_and_tests;

— Location_conditions;

— Male_end;

— Material_port;

— Mechanical_component;

— Mechanical_power_port;

— Mechanical_seal;

— Noise_specification;

— Packaging;

— Performance_curve;

— Performance_map;

— Performance_map_curve;

— Performance_point;

— Piping_connector;

— Plant_item;

— Plant_item_assembly_relationship;

— Plant_item_collection_relationship;

— Plant_item_connector;

— Plant_item_group_relationship;

— Plant_item_location;

— Port_service_case;

— Power_port;

— Process_design_case;

— Process_design_case_relationship;

— Radial_bearing;

— Reciprocating_power_port;

— Rotating_equipment_tests;

— Rotating_power_port;

— Shaft;

— Shop_testing_requirement;

— Signal_port;

— Simple_performance_curve;

— Socket;

— Space_requirements;

— Spare_item_relationship;

— Threaded;

— Thrust_bearing.

4.1.10 plant_system_definition

The plant_system_definition UoF specifies a part of a plant that provides or performs a service or function contributing to or enabling the operation of a plant. A plant system consists of an assembly or grouping of one or more plant items.

NOTE - In many organizations, different design engineers have responsibility for "design areas" within a large plant and their area of responsibility and coordination between their areas is enhanced by designating a group of plant items as a system.

EXAMPLE 13 - All the utilities may be organized into a system such as "the refrigeration system." The "utility side" of heat exchangers may be grouped together for clarity to communicate between the process to the power engineers. A system such as "the hydrogen feed system" may be shown as a system for clarity.

The following application objects are used by the plant_system_definition UoF:

— Plant_system;

— Plant_system_assembly;

— Process_control_unit;

— Process_train.

4.1.11 process_description

The process_description UoF specifies the description of the functional characteristics of a process. This is the connection between the equipment that will perform the function, the streams that will contain the process materials, and the method for integration of functions into a workable process. The process description is independent of its physical implementation in the form of process equipment and independent of its process representation (e.g., in a process simulation or a PFD). Additional details of process descriptions may be found in the unit_operation and control_strategy UoFs.

NOTE - Refer to ISA-S88.01-1995 [1].

The following application objects are used by the process_description UoF:

— Aggregation_relationship;

— Alternate_relationship;

— Connected_process_port;

— Event_sequence;

— Process_definition;

— Process_definition_relationship;

— Process_port;

— Process_port_connection;

— Process_port_stream_case;

— Process_service.

4.1.12 process_flow_diagram

The process_flow_diagram UoF specifies the associations between process engineering information and symbols on process flow diagrams. These process flow diagram associations should correspond to equipment and piping represented on a piping and instrumentation diagram.

The following application objects are used by the process_flow_diagram UoF:

— PFD;

— PFD_curve;

— PFD_element;

— PFD_point;

— PFD_presentation_component;

— PFD_presentation_component_composition;

— PFD_symbol_definition;

— PFD_symbol_occurrence;

— PFD_text;

— PFD_title_block.

4.1.13 process_simulation_data

The process_simulation_data UoF specifies process characteristics, performance, and assumptions that are specific only to process simulations. Additional details for data used by process simulators may be found in the unit_operation, stream_data, material_data and substance_model_data UoFs.

The following application objects are used by the process_simulation_data UoF:

— Algorithm_type_parameter;

— Balance;

— Convergence_block_property_value_usage;

— Externally_defined_simulation_algorithm;

— Process_simulation;

— Process_simulation_relationship;

— Simulated_process_definition;

— Simulation_block;

— Simulation_centrifuge;

— Simulation_compressor;

— Simulation_countercurrent_solids_decanter;

— Simulation_crystallizer;

— Simulation_dissolver;

— Simulation_distillation;

— Simulation_distillation_stage;

— Simulation_electrostatic_precipitator;

— Simulation_fabric_filter;

— Simulation_flash;

— Simulation_gas_solid_separator;

— Simulation_heat_exchanger;

— Simulation_hydrocyclone;

— Simulation_liquid_solid_separator;

— Simulation_pipeline;

— Simulation_pipeline_node;

— Simulation_polytropic_compressor;

— Simulation_polytropic_compressor_stage;

— Simulation_rotary_filter;

— Simulation_section_relationship;

— Simulation_unit_operation;

— Stream_convergence_block;

— Thermophysical_property_method;

— Thermophysical_property_method_option;

— Trace_component_specification;

— Variable_adjustment_specification;

— Variable_convergence_block;

— Variable_convergence_specification.

4.1.14 process_vessel_equipment_data

The process_vessel_equipment_data UoF specifies the most common information about process equipment that is required to contain fluid or solid materials either under a pressure or a vacuum.

NOTE - This type of equipment would include pressure vessels, bins, and atmospheric tanks.

The following application objects are used by the process_vessel_equipment_data UoF:

— Atmospheric_tank;

— Bin_section;

— Boot;

— Boot_location_on_cylinder_section;

— Boot_location_on_head_section;

— Boot_section_relationship;

— Bounded_curve;

— Conical_head;

— Cylindrical_pressure_vessel;

— Cylindrical_pressure_vessel_connection;

— Cylindrical_pressure_vessel_section;

— Cylindrical_pressure_vessel_cylinder_section;

— Cylindrical_pressure_vessel_eccentric_section;

— Cylindrical_pressure_vessel_head_section;

— Ellipsoidal_head;

— Flat_head;

— Hemispherical_head;

— Intersection_description;

— Nozzle_location_for_pressure_vessel_cylinder_section;

— Nozzle_location_for_pressure_vessel_head_section;

— Pressure_vessel;

— Process_vessel;

— Process_vessel_level;

— Solids_storage_bin;

— Spherical_pressure_vessel;

— Spheroidal_pressure_vessel;

— Standard_dished_head;

— Torispherical_head.

4.1.15 stream_data

The stream_data UoF specifies the process material, thermal or work energy, signals or information flowing past a defined point along a path at a particular time. Streams usually flow into or out of a unit operation or through a port connection associated with process equipment.

The following application objects are used by the stream_data UoF:

— Distillation_stage_phase;

— Energy_stream;

— Heat_exchanger_internal_phase;

— Information_stream;

— Internal_stream_phase;

— Material_amount_phase;

— Material_stream;

— Material_stream_phase;

— Particle_fraction;

— Particle_size;

— Particle_size_distribution;

— Particle_size_distribution_values;

— Phase_region;

— Phases_in_equilibrium;

— Specific_phase;

— Stream;

— Thermal_stream;

— Utility_service_stream_demand;

— Utility_stream;

— Work_stream.

4.1.16 substance_experimental_data

The substance_experimental_data UoF specifies data that is measured or generated from an equation fit to experimental data, and is used to prepare or adjust the predictive model parameters to better match predictions against experimental data. This is most often required for pseudo components that are defined by standard test methods to measure the boiling range of the material.

The following application objects are used by the substance_experimental_data UoF:

— Citation;

— Data_entry;

— Data_quality;

— Data_source;

— Distillation_curve;

— Experiment;

— Property_data_group;

— Property_data_set;

— Property_note;

— Reaction_parametric_data.

4.1.17 substance_model_data

The substance_model_data UoF specifies the data associated with mathematical model parameters that can be used to predict substance thermodynamic, physical, and transport properties.

The following application objects are used by the substance_model_data UoF:

— Amorphous_solid;

— Binary_parameter;

— Binary_parameter_value;

— Chemical_component;

— Chemical_specie;

— Chemical_specie_structural_group_relationship;

— Coefficient;

— Composition_relationship;

— Equation_group;

— Externally_defined_variable_value;

— Family;

— Mixture;

— Petroleum_cut;

— Petroleum_mixture;

— Phase;

— Pseudo_component;

— Reference_state;

— Specific_equation;

— Structural_group;

— Substance;

— Substance_name;

— Substance_property;

— Substance_property_value;

— Variable;

— Variable_approval_context;

— Variable_value.

4.1.18 unit_operation

The unit_operation UoF specifies process functions that perform one or more defined transformations on process stream(s) and whose performance are calculated as single logical entities. These transformations are generally closely aligned with equipment that will execute the function.

NOTE - Many of the application objects listed below make use of "Uo_" at the beginning of the application object name. "Uo_" in the context of this part of ISO 10303 is an abbreviation for "unit operation".

The following application objects are used by the unit_operation UoF:

— Citation_reference;

— Fluid_transfer_performance_data_point;

— Heat_exchanger_internal_data;

— Heat_transfer_coefficient;

— Process_unit_operation;

— Reactor_yield;

— Stage_column_section;

— Stream_separation_specification;

— Stream_split_specification;

— Uo_air_cooled_heat_exchanger;

— Uo_centrifugal_compressor;

— Uo_centrifugal_compressor_stage;

— Uo_centrifuge;

— Uo_completely_stirred_reactor;

— Uo_complex_distillation;

— Uo_compressor;

— Uo_compressor_stage;

— Uo_countercurrent_solids_decant;

— Uo_crush;

— Uo_crystallization;

— Uo_cyclone;

— Uo_dissolve;

— Uo_distillation;

— Uo_distillation_stage;

— Uo_distillation_stage_phase_pump_around;

— Uo_double_pipe_heat_exchanger;

— Uo_electrostatic_precipitator;

— Uo_expander;

— Uo_extent_specified_reactor;

— Uo_extract;

— Uo_fabric_filter;

— Uo_fired_heater;

— Uo_fired_reactor;

— Uo_flash;

— Uo_fluid_transfer;

— Uo_gas_solid_separation;

— Uo_heat_exchanger;

— Uo_heat_exchanger_fluid;

— Uo_heat_exchanger_side;

— Uo_hydrocyclone;

— Uo_jet_ejector;

— Uo_liquid_liquid_flash;

— Uo_liquid_solid_separation;

— Uo_liquid_vapour_flash;

— Uo_melt;

— Uo_mix;

— Uo_multi_phase_flash;

— Uo_phase_change;

— Uo_pipeline;

— Uo_pipeline_node;

— Uo_pipeline_segment;

— Uo_plug_flow_reactor;

— Uo_positive_displacement_compressor;

— Uo_positive_displacement_compressor_stage;

— Uo_pressure_change;

— Uo_pump;

— Uo_reactor;

— Uo_restrict;

— Uo_rotary_filter;

— Uo_screen;

— Uo_separation;

— Uo_separator_three_phase_flash;

— Uo_shell_and_tube_heat_exchanger;

— Uo_single_phase_flash;

— Uo_solid_solid_separation;

— Uo_solids_decant_stage;

— Uo_solids_drying;

— Uo_specified_yield_reactor;

— Uo_split;

— Uo_stream_split;

— Uo_substance_split;

— Uo_valve;

— Uo_vapourize;

— Uo_venturi_scrubber.

4.2 Application objects

This subclause specifies the application objects for the process plant engineering application protocol. Each application object is an atomic element that embodies a unique application concept and contains attributes specifying the data elements of the object. The application objects and their definitions are given below.

Many of the application objects that represent elements of the conceptual design of the plant have a list of attributes that specify characteristics of interest for this part of ISO 10303. The attributes given are neither required nor exhaustive. The attributes are representative of the most common information that is recorded by process engineers when designing a particular element within a plant. The requirements for this part of ISO 10303 are specified in a flexible manner such that any characteristic of key process design elements may be recorded and given a value.

4.2.1 Process plant UoFs

The UoFs within the process plant grouping define the plant context and systems in the plant. These areas are related to activities defined in the AAM described in annex F. AAM activity A1 defines the requirements for the plant and activity A22 defines the conceptual design required to satisfy those requirements.

4.2.1.1 plant_context

Refer to 4.1.8 for a description of what this UoF specifies. The ARM diagrams related to this UoF are provided as figures G.24 through G.27 in annex G of this part to ISO 10303.

4.2.1.1.1 Absolute_time_reference

An Absolute_time_reference is a type of Time_reference (see 4.2.1.1.28) that defines an independent temporal context.

NOTE - This context is usually a baseline from which other times can be established.

The data associated with Absolute_time_reference are the following:

— absolute_time_name.

The absolute_time_name specifies a textual label for the Absolute_time_reference.

4.2.1.1.2 Clock_time

A Clock_time is a local point in time based upon an offset from Greenwich mean time.

The data associated with Clock_time are the following:

— hour;

— minute;

— second;

— time_zone.

4.2.1.1.2.1 hour

A hour specifies the number in the 24 hour clock.

NOTE - The hour shall be an integer between 0 and 24.

4.2.1.1.2.2 minute

A minute specifies the number of minutes after the hour.

NOTE - The minute shall be an integer between 0 and 59.

4.2.1.1.2.3 second

A second specifies the number of seconds after the minute.

NOTE - The second shall be a number between 0 and 59.

4.2.1.1.2.4 time_zone

A time_zone specifies the offset from Greenwich mean time.

4.2.1.1.3 Date

The Date is a day in a month in a year.

The data associated with Date are the following:

— day;

— month;

— year;

4.2.1.1.3.1 day

A day specifies the day within a month.

NOTE - The day shall be an integer between 1 and 31.

4.2.1.1.3.2 month

A month specifies the month within a year.

NOTE - The month shall be an integer between 1 and 12.

4.2.1.1.3.3 year

A year specifies the year for a date.

NOTE - The year shall be specified according to the Gregorian calendar.

4.2.1.1.4 Electrical_service

An Electrical_service is a type of Site_utility_service (see 4.2.1.1.24) available at a Site (see 4.2.1.1.21) where the service is electricity.

The data associated with Electrical_service are the following:

— continuous_current_demand;

— current_category;

— line_voltage;

— number_of_phases;

— peak_current_demand.

4.2.1.1.4.1 continuous_current_demand

A continuous_current_demand specifies the current demand that is available on a continuous basis for the Electrical_service at the Site (see 4.2.1.1.21).

4.2.1.1.4.2 current_category

A current_category specifies an enumerated attribute that indicates whether the current of the Electrical_-service is alternating current or direct current. The value of the current_category attribute shall be one of the following:

— alternating;

— direct.

4.2.1.1.4.2.1 alternating**:** an indication that the current of the Electrical_service is alternating current.

4.2.1.1.4.2.2 direct**:** an indication that the current of the Electrical_service is direct current.

4.2.1.1.4.3 line_voltage

A line_voltage specifies the voltage of the Electrical_service available at the Site (see 4.2.1.1.21).

4.2.1.1.4.4 number_of_phases

A number_of_phases specifies the number of alternating current electrical phases for the Electrical_-service at the Site (see 4.2.1.1.21).

4.2.1.1.4.5 peak_current_demand

A peak_current_demand specifies the peak current demand that is available for the Electrical_service at the Site (see 4.2.1.1.21).

4.2.1.1.5 External_classification

An External_classification is a grouping or categorization of Plant_items (see 4.2.4.1.39) or Plant_-systems (see 4.2.1.2.1) that has a source external to this part of ISO 10303.

The data associated with External_classification are the following:

— description;

— name;

— source.

4.2.1.1.5.1 description

A description specifies a textual explanation or summary of the group or category.

4.2.1.1.5.2 name

A name specifies a textual label for the group or category.

4.2.1.1.5.3 source

A source specifies a reference for where the group or category is defined.

4.2.1.1.6 External_reference

An External_reference is a reference used to describe a Process_definition (see 4.2.3.1.5), Plant_item (see 4.2.4.1.39), or Plant_system (see 4.2.1.2.1) that has a source external to this part of ISO 10303.

The data associated with External_reference are the following:

— name;

— source.

4.2.1.1.6.1 name

A name specifies a textual label for the Process_definition (see 4.2.3.1.5), Plant_item (see 4.2.4.1.39), or Plant_system (see 4.2.1.2.1).

4.2.1.1.6.2 source

A source specifies a reference for where the Process_definition (see 4.2.3.1.5), Plant_item (see 4.2.4.1.39), or Plant_system (see 4.2.1.2.1) is defined.

4.2.1.1.7 Item_property_reference

An Item_property_reference is the identification of a Process_design_property_value (see 4.2.1.1.14) and the Referenced_object (see 4.2.1.1.19) of which the Process_design_property_value is the value.

4.2.1.1.8 Location_in_plant

A Location_in_plant is a type of Plant_item_location (see 4.2.4.1.44) that is the position of the Plant_-item (see 4.2.4.1.39) relative to a defined reference location or set of coordinates in the Plant (see 4.2.1.1.11).

4.2.1.1.9 Location_in_site

A Location_in_site is a type of Plant_item_location (see 4.2.4.1.44) that is the position of the Plant_item (see 4.2.4.1.39) relative to a defined reference location or set of coordinates in the Site (see 4.2.1.1.21).

4.2.1.1.10 Material_amount_reference_time

A Material_amount_reference_time is a snapshot of a Material_amount (see 4.2.2.4.10) at a specified point in time.

4.2.1.1.11 Plant

A Plant is an aggregate of one or more Plant_items (see 4.2.4.1.39) interconnected so as to provide mechanisms for the interchange of Material (see 4.2.2.4.9), energy, or signals. The Plant is intended to isolate Material from the surroundings so that one or more chemical or physical transformations can be made to occur on the Material.

The data associated with Plant are the following:

— description;

— function;

— name;

— plant_id;

— sub_plant_type.

4.2.1.1.11.1 description

A description specifies a textual explanation or summary of the Plant.

4.2.1.1.11.2 function

A function specifies a description of the intended function of the Plant.

4.2.1.1.11.3 name

A name specifies a textual label given to the Plant.

4.2.1.1.11.4 plant_id

A plant_id specifies a unique identifier for the Plant.

4.2.1.1.11.5 sub_plant_type

A sub_plant_type specifies a descriptive name for a Plant when it is contained within another Plant.

4.2.1.1.12 Plant_item_reference_time

A Plant_item_reference_time is a snapshot of a Plant_item (see 4.2.4.1.39) at a specified point in time.

4.2.1.1.13 Process_definition_reference_time

A Process_definition_reference_time is a snapshot of a Process_definition (see 4.2.3.1.5) at a specified point in time.

4.2.1.1.14 Process_design_property_value

A Process_design_property_value is a characteristic and value or set of values for the characteristic. A Process_design_property_value may be a Conditional_property_value (see 4.2.4.1.8). Process_design_-property_value is used in four ways:

The first usage is to specify a characteristic of a Chemical_reaction (see 4.2.2.3.2), Convergence_block_-property_value_usage (see 4.2.3.4.3), Equipment_port (see 4.2.4.1.16), Material (see 4.2.2.4.9), Phase (see 4.2.2.2.15), Plant (see 4.2.1.1.11), Plant_item (see 4.2.4.1.39), Plant_system (see 4.2.1.2.1), Process_unit_operation (see 4.2.3.2.5), Reaction_rate (see 4.2.2.3.6), Site (see 4.2.1.1.21), Stream (see 4.2.3.3.16), Substance (see 4.2.2.2.20), or Thermodynamic_conditions (see 4.2.2.4.17) that is not explicitly given in the attribute list.

The second usage is to specify an additional value for a characteristic that is already explicitly given in an Equipment_port, Phase, Plant, Plant_item, Plant_system, Site, Specific_phase (see 4.2.3.3.15), or Stream. The interpretation of this value depends on the context of its use within the data exchange.

The third usage is to specify characteristic information about a Material_amount (see 4.2.2.4.10), Material, Plant_item, Process_definition (see 4.2.3.1.5), Process_simulation (see 4.2.3.4.5), Site, or Stream at a specific point in time.

The fourth usage is to specify characteristic information about basic control strategies: a setpoint variable for a Control_loop (see 4.2.3.6.7), a measured value for a Control_loop, a manipulated variable for a Control_adjustment (see 4.2.3.6.3), a controlled variable for a Continuous_control_objective (see 4.2.3.6.1), a threshold value for a Control_logic (see 4.2.3.6.5), a participating variable in the evaluation of a Control_logic_condition (see 4.2.3.6.6), a manipulated variable for a Control_event (see 4.2.3.6.4), and a controlled variable for a Discrete_control_objective (see 4.2.3.6.8).

NOTES

1 - Support for the information described in a Process_design_property_value is not a requirement of applications that conform to this standard.

2 - Reliability and failure data are not modelled as concepts within this part of ISO 10303, but may be included in a representation by using Process_design_property_value for alphanumeric data. If numeric data is to be included in the representation, then a corresponding unit of measure will need to be declared.

— attribute_id;

— lower_limit_value;

— nominal_value;

— property_description;

— property_name;

— source_designation;

— upper_limit_value.

4.2.1.1.14.1 attribute_id

An attribute_id specifies a unique identifier for the attribute whose value is being described.

4.2.1.1.14.2 lower_limit_value

A lower_limit_value specifies the low value for the property.

4.2.1.1.14.3 nominal_value

A nominal_value specifies a value for the property that is not defined as a limiting value.

4.2.1.1.14.4 property_description

A property_description specifies a textual explanation or summary of the Process_design_property_-value.

4.2.1.1.14.5 property_name

A property_name specifies a textual label given to the Process_design_property_value.

4.2.1.1.14.6 source_designation

A source_designation specifies the way in which the Process_design_property_value came into existence.

EXAMPLE 14 - The source_designation may be 'measured', 'calculated', 'derived', 'asserted', etc.

4.2.1.1.14.7 upper_limit_value

An upper_limit_value specifies the high value for the property.

4.2.1.1.15 Process_design_property_variable_usage

A Process_design_property_variable_usage is the use of exactly one Process_design_property_value (see 4.2.1.1.14) or Item_property_reference (see 4.2.1.1.7) as a dependent, independent, or fixed variable by exactly one Performance_point (see 4.2.4.1.37) or Process_property_curve_point (see 4.2.2.4.15).

The data associated with Process_design_property_variable_usage are the following:

— variable_type.

A variable_type specifies an enumerated attribute that indicates the type of usage of the Process_design_-property_value (see 4.2.1.1.14). The value of the variable_type attribute shall be one of the following:

— dependent;

— fixed;

— independent.

4.2.1.1.15.0.1 dependent**:** an indication that the Process_design_property_value (see 4.2.1.1.14) is considered to be a variable that is a function of other variables.

4.2.1.1.15.0.2 fixed**:** an indication that the Process_design_property_value (see 4.2.1.1.14) is considered to be a constant, not a variable.

4.2.1.1.15.0.3 independent**:** an indication that the Process_design_property_value (see 4.2.1.1.14) is not considered to be a variable that is a function of other variables.

4.2.1.1.16 Process_material_reference_time

A Process_material_reference_time is a snapshot of a Material (see 4.2.2.4.9) at a specified point in time.

4.2.1.1.17 Process_simulation_reference_time

A Process_simulation_reference_time is a snapshot of a Process_simulation (see 4.2.3.4.5) at a specified point in time.

4.2.1.1.18 Reference_time_relationship

A Reference_time_relationship specifies an association between two Time_references (see 4.2.1.1.28) where one Time_reference occurs prior to another Time_reference.

4.2.1.1.19 Referenced_object

A Referenced_object is an object that is associated with at least one Process_design_property_value (see 4.2.1.1.14) by an Item_property_reference (see 4.2.1.1.7). The possible objects referenced are: Bulk_-thermophysical_properties (see 4.2.2.4.2), Chemical_reaction (see 4.2.2.3.2), Composition_relationship (see 4.2.2.2.8), Equipment_port (see 4.2.4.1.16), Material (see 4.2.2.4.9), Phase (see 4.2.2.2.15), Plant_-item (see 4.2.4.1.39), Plant_system (see 4.2.1.2.1), Reaction_rate (see 4.2.2.3.6), Site (see 4.2.1.1.21), Specific_phase (see 4.2.3.3.15), Stream (see 4.2.3.3.16), Substance (see 4.2.2.2.20), and Thermodynamic_conditions (see 4.2.2.4.17).

4.2.1.1.20 Relative_time_reference

A Relative_time_reference is a type of Time_reference (see 4.2.1.1.28) that is specified as a time displacement measured from a particular Absolute_time_reference (see 4.2.1.1.1).

The data associated with Relative_time_reference are the following:

— relative_time_name;

— offset_amount.

4.2.1.1.20.1 relative_time_name

A relative_time_name specifies a textual label for the Relative_time_reference.

4.2.1.1.20.2 offset_amount

An offset_amount specifies a measure of time by which the Relative_time_reference is displaced from the Absolute_time_reference (see 4.2.1.1.1).

4.2.1.1.21 Site

A Site is a geographical specification associated with a collection of one or more Plant (see 4.2.1.1.11) objects.

The data associated with Site are the following:

— address;

— area;

— coordinates;

— elevation;

— environmental_references;

— legal_description;

— locality;

— name;

— orientation;

— owners;

— site_id.

4.2.1.1.21.1 address

An address specifies the street address, including city, state, and zip code, as appropriate, of the Site.

4.2.1.1.21.2 area

An area specifies the extent of the measure of the land at the Site.

4.2.1.1.21.3 coordinates

A coordinates specifies the longitude and latitude coordinates of the Site with respect to a known point on the Site.

4.2.1.1.21.4 elevation

An elevation specifies the distance that the Site is located above sea level with respect to a known point on the Site.

NOTE - The known point referenced here is the same known point referenced under coordinates.

4.2.1.1.21.5 environmental_references

An environmental_references specifies a reference to a document that provides environmental information relevant to the Site.

EXAMPLE 15 - Environmental information includes the temperature, humidity, precipitation pattern, and wind patterns of the region.

4.2.1.1.21.6 legal_description

A legal_description specifies the legal explanation or summary for the land at the Site.

4.2.1.1.21.7 locality

A locality specifies the municipality or region where the Site is located.

4.2.1.1.21.8 name

A name specifies a textual label given to the Site.

4.2.1.1.21.9 orientation

An orientation specifies the relative alignment of the Site with respect to a given compass direction.

4.2.1.1.21.10 owners

An owners specify the company or organization that is financially responsible for the Site.

4.2.1.1.21.11 site_id

A site_id specifies a unique identifier for the Site.

4.2.1.1.22 Site_reference_time

A Site_reference_time is either an absolute or relative time to be applied to a Site (see 4.2.1.1.21) for the assignment of a temporal context.

4.2.1.1.23 Site_standard_conditions

A Site_standard_conditions is the legally accepted values of temperature and pressure for custody transfer of gases and liquids on a volumetric basis.

The data associated with Site_standard_conditions are the following:

— custody_type;

— description;

— pressure;

— temperature.

4.2.1.1.23.1 custody_type

A custody_type specifies an enumerated attribute that indicates the type of Material (see 4.2.2.4.9) that the Site_standard_conditions is being specified for. The value of the custody_type attribute shall be one of the following:

— gas;

— gas_and_liquid;

— liquid.

4.2.1.1.23.1.1 gas**:** an indication that the standard conditions are for gas volumes.

4.2.1.1.23.1.2 gas_and_liquid**:** an indication that the standard conditions are for both gas and liquid volumes.

4.2.1.1.23.1.3 liquid**:** an indication that the standard conditions are for liquid volumes.

4.2.1.1.23.2 description

A description specifies a textual explanation or summary of key aspects of or references for the Site_-standard_conditions.

4.2.1.1.23.3 pressure

A pressure specifies the pressure associated with the Site_standard_condition.

4.2.1.1.23.4 temperature

A temperature specifies the temperature associated with the Site_standard_conditions.

4.2.1.1.24 Site_utility_service

A Site_utility_service is a utility service available at a Site (see 4.2.1.1.21). Each Site_utility_service may be one of the following: an Electrical_service (see 4.2.1.1.4) or a Utility_material_service (see 4.2.1.1.29).

The data associated with Site_utility_service are the following:

— cost_basis;

— cost_basis_value;

— site_utility_service_name;

— source;

— type.

4.2.1.1.24.1 cost_basis

A cost_basis specifies the basis conditions used to determine the cost_basis_value.

EXAMPLE 16 - For example, 150 pounds force per square inch steam, 25C standard gas conditions.

4.2.1.1.24.2 cost_basis_value

A cost_basis_value specifies the cost basis used to calculate a utility cost.

EXAMPLE 17 - Examples include $/kilowatt hour, $/1000 pounds steam, and $/1000 standard cubic feet.

4.2.1.1.24.3 site_utility_service_name

A site_utility_service_name specifies a textual label assigned to each Site_utility_service at a Site (see 4.2.1.1.21). The site_utility_service_name must be unique for each Site_utility_service at a Site.

4.2.1.1.24.4 source

A source specifies whether the utilities are produced on-site or off-site.

4.2.1.1.24.5 type

A type specifies that a Site_utility_service is either a Utility_material_service (see 4.2.1.1.29) or an Electrical_service (see 4.2.1.1.4) or some other type of Site_utility_service.

4.2.1.1.25 Sited_plant

A Sited_plant is a Plant (see 4.2.1.1.11) for which a location and orientation relative to a Site (see 4.2.1.1.21) has been defined.

The data associated with Sited_plant are the following:

— plant_site_location;

— plant_site_orientation.

4.2.1.1.25.1 plant_site_location

A plant_site_location specifies the geographic position of the Plant (see 4.2.1.1.11) relative to the Site (see 4.2.1.1.21) or a feature of the Site.

4.2.1.1.25.2 plant_site_orientation

A plant_site_orientation specifies the directional orientation of the Plant (see 4.2.1.1.11) with respect to the Site (see 4.2.1.1.21) or a feature of the Site.

4.2.1.1.26 Stream_reference_time

A Stream_reference_time is a snapshot of a Stream (see 4.2.3.3.16) at a specified point in time.

4.2.1.1.27 Sub_plant_relationship

A Sub_plant_relationship is the relationship between Plant (see 4.2.1.1.11) objects and sub-plants and defines their relative locations.

The data associated with Sub_plant_relationship are the following:

— location_and_orientation.

A location_and_orientation specifies the relative position and orientation of the sub-plant within the Plant.

4.2.1.1.28 Time_reference

A Time_reference is either an absolute or relative time to be applied to an item in the plant design for the assignment of a temporal context. Each Time_reference shall be one of the following: an Absolute_-time_reference (see 4.2.1.1.1) or a Relative_time_reference (see 4.2.1.1.20).

The data associated with Time_reference are the following:

— description.

A description specifies a textual explanation or summary of key aspects of the Time_reference.

4.2.1.1.29 Utility_material_service

An Utility_material_service is a type of Site_utility_service (see 4.2.1.1.24) available at a Site (see 4.2.1.1.21) where the service is a utility Material (see 4.2.2.4.9).

The data associated with Utility_material_service are the following:

— utility_material_category.

An utility_material_category specifies an enumerated attribute that indicates whether the Utility_-material_service is fuel, steam, water, or air. The value of the utility_material_category attribute shall be one of the following:

— air;

— fuel;

— steam;

— water.

4.2.1.1.29.0.1 air**:** an indication that the utility Material (see 4.2.2.4.9) is air.

4.2.1.1.29.0.2 fuel**:** an indication that the utility Material (see 4.2.2.4.9) is a fuel.

4.2.1.1.29.0.3 steam**:** an indication that the utility Material (see 4.2.2.4.9) is steam.

4.2.1.1.29.0.4 water**:** an indication that the utility Material (see 4.2.2.4.9) is water.

4.2.1.2 plant_system_definition

Refer to 4.1.10 for a description of what this UoF specifies. The ARM diagram related to this UoF is provided as figure G.34 in annex G of this part to ISO 10303.

4.2.1.2.1 Plant_system

A Plant_system is a combination of Plant_item (see 4.2.4.1.39) objects that perform a function required for the Plant (see 4.2.1.1.11) to operate to produce product(s). Each Plant_system may be one of the following: a Process_train (see 4.2.1.2.4) or a Process_control_unit (see 4.2.1.2.3).

EXAMPLE 18 - Types of plant systems include piping system, control system, protection system, and utility system.

The data associated with Plant_system are the following:

— name;

— plant_system_id;

— service_description.

4.2.1.2.1.1 name

A name specifies a textual label assigned to the Plant_system.

4.2.1.2.1.2 plant_system_id

A plant_system_id specifies a unique identifier for the Plant_system.

4.2.1.2.1.3 service_description

A service_description specifies a textual label for the system.

> EXAMPLE 19 - Labels include Boiler Feedwater System, Paraxylene System, Pipe Rack K, and 4160V Power System.

4.2.1.2.2 Plant_system_assembly

A Plant_system_assembly is a relationship of Plant_system (see 4.2.1.2.1) objects in which one Plant_-system is a super-system and one is a sub-system.

4.2.1.2.3 Process_control_unit

A Process_control_unit is a type of Plant_system (see 4.2.1.2.1) that is a collection of one or more associated control elements, control modules, and equipment modules that performs a coordinated function. Process_control_unit objects operate relatively independently of one another. A Process_-control_unit includes both physical equipment and all associated control functions.

> NOTE - This definition was adapted from ISA-S88.01-1995.

The data associated with Process_control_unit are the following:

— function.

A function specifies a description of the intended function of the Process_control_unit.

4.2.1.2.4 Process_train

A Process_train is a type of Plant_system (see 4.2.1.2.1) that is a collection of one or more associated Process_control_units (see 4.2.1.2.3) and equipment modules, arranged in serial or parallel paths, used to make a complete batch.

NOTE - This definition was adapted from ISA-S88.01-1995.

The data associated with Process_train are the following:

— function.

A function specifies a description of the intended function of the Process_train.

4.2.2 Process substance and material UoFs

The UoFs within the process substance and material grouping define the experimental data required to design the process. These areas are related to activities defined in the AAM described in annex F. This data is generally obtained in the research that precedes AAM activity 223 and is prepared for use in design during activity A22332.

4.2.2.1 substance_experimental_data

Refer to 4.1.16 for a description what this UoF specifies. The ARM diagram related to this UoF is provided as figure G.46 in annex G of this part to ISO 10303.

4.2.2.1.1 Citation

A Citation is a literature or source reference.

The data associated with Citation are the following:

— bibliographic_info;

— name.

4.2.2.1.1.1 bibliographic_info

A bibliographic_info specifies bibliographic information for the Citation.

4.2.2.1.1.2 name

A name specifies an identifying textual label for the Citation.

4.2.2.1.2 Data_entry

A Data_entry is the association of an independent Variable_value (see 4.2.2.2.26), which is fixed or controlled, and a dependent Variable_value, which causally depends on the independent Variable_value either through a computation or a measurement.

The data associated with Data_entry are the following:

— data_entry_name.

A data_entry_name specifies a textual label for the Data_entry.

4.2.2.1.3 Data_quality

A Data_quality is a measurement or estimation of the quality of the data in a Variable_value (see 4.2.2.2.26).

The data associated with Data_quality are the following:

— accuracy;

— standard_deviation.

4.2.2.1.3.1 accuracy

An accuracy specifies the absolute accuracy of the Variable_value (see 4.2.2.2.26).

4.2.2.1.3.2 standard_deviation

A standard_deviation specifies the standard deviation of the accuracies of the group of values that the Variable_value (see 4.2.2.2.26) is a part.

4.2.2.1.4 Data_source

A Data_source is information about the source and nature of the data contained in one or more Variable_-values (see 4.2.2.2.26).

The data associated with Data_source are the following:

— accuracy_source;

— date_of_update;

— kind_of_data;

— nature_of_data_source;

— provider.

4.2.2.1.4.1 accuracy_source

An accuracy_source specifies an enumerated attribute that specifies the source of the reported accuracy of the data in the Data_source. The value of the accuracy_source attribute shall be one of the following:

— author;

— reviewer.

4.2.2.1.4.1.1 author**:** an indication that the reported accuracy was supplied by the author or provider of the Data_source.

4.2.2.1.4.1.2 reviewer**:** an indication that the reported accuracy was supplied by an independent reviewer or source.

4.2.2.1.4.2 date_of_update

A date_of_update specifies the date when the Data_source was last updated.

4.2.2.1.4.3 kind_of_data

A kind_of_data specifies an enumerated attribute that specifies the general nature of the data in the Data_source. The value of the kind_of_data attribute shall be one of the following:

— calculated;

— estimated;

— literature;

— raw_experimental;

— regressed;

— smoothed_experimental;

— unspecified.

4.2.2.1.4.3.1 calculated**:** an indication that the data in the Data_source was generated from some model with fitted or estimated parameters.

4.2.2.1.4.3.2 estimated**:** an indication that the data in the Data_source was generated by an estimation technique from similar experimental or regressed data.

4.2.2.1.4.3.3 literature**:** an indication that the Data_source is from a published journal or databank with no further indication of the nature of the data contained.

4.2.2.1.4.3.4 raw_experimental**:** an indication that the Data_source contains unprocessed experimental data.

4.2.2.1.4.3.5 regressed**:** an indication that the data is the result of applying regression technique(s) to some other data.

4.2.2.1.4.3.6 smoothed_experimental**:** an indication that the Data_source contains experimental data that has been modified by some smoothing or data reconciliation technique(s).

4.2.2.1.4.3.7 unspecified**:** an indication that the nature of the data in the Data_source is not specified.

4.2.2.1.4.4 nature_of_data_source

A nature_of_data_source specifies an enumerated attribute that specifies the general reliability of the Data_source. The value of the nature_of_data_source shall be one of the following:

— approved;

— evaluated;

— unevaluated.

4.2.2.1.4.4.1 approved**:** an indication that the Data_source has been approved and is suitable for the current use.

4.2.2.1.4.4.2 evaluated**:** an indication that the Data_source has been evaluated and its reliability is known.

4.2.2.1.4.4.3 unevaluated**:** an indication that the Data_source has not yet been evaluated for reliability or suitability.

4.2.2.1.4.5 provider

A provider specifies the name of the person or organization who publishes, provides, or maintains the Data_source.

4.2.2.1.5 Distillation_curve

A Distillation_curve is a data set that is used for a distillation curve.

The data associated with Distillation_curve are the following:

— method_used.

A method_used specifies the method used to produce the Distillation_curve.

4.2.2.1.6 Experiment

An Experiment is a type of Property_data_group (see 4.2.2.1.7) that is an activity to produce sets of measured or generated process properties.

The data associated with Experiment are the following:

— type.

A type specifies a classification of the Experiment.

> EXAMPLE 20 - Types of Experiments include constant volume depletion, petroleum distillation and differential liberation, and temperature-pressure-composition.

4.2.2.1.7 Property_data_group

A Property_data_group is a number of related Property_data_sets (see 4.2.2.1.8). Each Property_data_-group may be one of the following: an Experiment (see 4.2.2.1.6).

The data associated with Property_data_group are the following:

— description.

A description specifies the text that explains the purpose, content, and Substances(s) (see 4.2.2.2.20) of the Property_data_group.

4.2.2.1.8 Property_data_set

A Property_data_set is data generated from a group of Specific_equations (see 4.2.2.2.18). Each Property_data_set may be one of the following: a Distillation_curve (see 4.2.2.1.5).

The data associated with Property_data_set are the following:

— data_set_name.

A data_set_name specifies a unique textual label for the Property_data_set.

4.2.2.1.9 Property_note

A Property_note is explanatory text about another object.

The data associated with Property_note are the following:

— note_name;

— note_string.

4.2.2.1.9.1 note_name

A note_name specifies a textual label for the Property_note.

4.2.2.1.9.2 note_string

A note_string specifies the text of a Property_note.

4.2.2.1.10 Reaction_parametric_data

A Reaction_parametric_data (see 4.2.2.1.10) is the parametric data for a Chemical_reaction (see 4.2.2.3.2) at a given temperature and pressure.

4.2.2.2 substance_model_data

Refer to 4.1.17 for a description of what this UoF specifies. The ARM diagrams related to this UoF are provided as figures G.47 through G.49 in annex G of this part to ISO 10303.

4.2.2.2.1 Amorphous_solid

An Amorphous_solid is a solid Substance (see 4.2.2.2.20) of unknown composition.

NOTE - An Amorphous_solid does not have a known molecular weight.

4.2.2.2.2 Binary_parameter

A Binary_parameter is a variable_method property between exactly two Chemical_components (see 4.2.2.2.4), that describes the departure from ideal mixing assumptions. A Binary_parameter is an input Variable (see 4.2.2.2.24) used by variable method equations for the purpose of calculating more accurate Phase (see 4.2.2.2.15) equilibrium behaviour of Mixtures (see 4.2.2.2.12) containing the two specified Chemical_components.

The data associated with Binary_parameter are the following:

— symmetric.

A symmetric specifies whether the value of the Binary_parameter is dependent on the order of the Chemical_components (see 4.2.2.2.4), that is whether the ijth element is equal to the jith element.

4.2.2.2.3 Binary_parameter_value

A Binary_parameter_value is a type of Variable_value (see 4.2.2.2.26) that indicates the interaction of two Substances (see 4.2.2.2.20) in phase behaviour models that cause the phase behaviour to depart from ideal mixing assumptions

4.2.2.2.4 Chemical_component

A Chemical_component is a Substance (see 4.2.2.2.20) that is viewed as a single indivisible chemical compound. Each Chemical_component may be one of the following: Chemical_specie (see 4.2.2.2.5) or a Pseudo_component (see 4.2.2.2.16).

4.2.2.2.5 Chemical_specie

A Chemical_specie is a type of Chemical_component (see 4.2.2.2.4) that is a single molecular species.

The data associated with Chemical_specie are the following:

— cas_registry_number;

— chemical_formula;

— cma_number;

— dippr_id;

— dot_number;

— iupac_name;

— molecular_weight.

4.2.2.2.5.1 cas_registry_number

A cas_registry_number specifies a string containing the registry number issued by the Chemical Abstracts Registry System of the Chemical Abstracts Services for the Chemical_specie.

4.2.2.2.5.2 chemical_formula

A chemical_formula specifies the molecular formula for a Chemical_specie in "Hill Order".

NOTE - "Hill Order" specifies the elements of a chemical_formula in the following manner; carbons followed by the number, hydrocarbons, followed by the remaining elements in alphabetical order. If no carbons exist, then all the elements are listed alphabetically.

EXAMPLE 21 - C12H13C12NO2.

4.2.2.2.5.3 cma_number

A cma_number specifies a unique identifier assigned to a Chemical_specie by the Chemical Manufacturers Association.

4.2.2.2.5.4 dippr_id

A dippr_id specifies the identification given to a Chemical_specie for the Design Institute for Physical PRoperty data (DIPPR) databank.

4.2.2.2.5.5 dot_number

A dot_number specifies the number issued by the United States of America Department of Transport for a Substance (see 4.2.2.2.20).

NOTE - Only those numbers that are issued for Chemical_species are part of this data model.

4.2.2.2.5.6 iupac_name

An iupac_name specifies a standard textual label for the Chemical_specie approved by the International Union of Pure and Applied Chemistry (IUPAC).

NOTE - These names are not necessarily unique for a species.

4.2.2.2.5.7 molecular_weight

A molecular_weight specifies the numerical value of the amount of mass contained in one mole of the Chemical_specie.

4.2.2.2.6 Chemical_specie_structural_group_relationship

A Chemical_specie_structural_group_relationship is the association between a Chemical_specie (see 4.2.2.2.5) and a Structural_group (see 4.2.2.2.19) present in the Chemical_specie.

The data associated with Chemical_specie_structural_group_relationship are the following:

— group_occurrence_quantity.

A group_occurrence_quantity specifies the number of occurrences of a Structural_group (see 4.2.2.2.19) in a Chemical_specie (see 4.2.2.2.5).

4.2.2.2.7 Coefficient

A Coefficient is an object that holds the value for a coefficient of a Specific_equation (see 4.2.2.2.18).

The data associated with Coefficient are the following:

— _name;

— symbol

— type.

4.2.2.2.7.1 _name

A _name specifies the textual label for a coefficient in a given Specific_equation (see 4.2.2.2.18).

4.2.2.2.7.2 symbol

A symbol specifies which coefficient in the Specific_equation (see 4.2.2.2.18) is referenced.

4.2.2.2.7.3 type

A type specifies the type of coefficient in the Specific_equation (see 4.2.2.2.18).

4.2.2.2.8 Composition_relationship

A Composition_relationship specifies the fraction of a Substance (see 4.2.2.2.20) in a Mixture (see 4.2.2.2.12).

The data associated with Composition_relationship are the following:

— mass_fraction;

— mole_fraction;

— special_equilibrium;

— volume_fraction.

4.2.2.2.8.1 mass_fraction

A mass_fraction specifies the ratio of the mass of one Substance (see 4.2.2.2.20) in a Mixture (see 4.2.2.2.12) to the total mass of that Mixture.

4.2.2.2.8.2 mole_fraction

A mole_fraction specifies the ratio of the moles of one Substance (see 4.2.2.2.20) in a Mixture (see 4.2.2.2.12) to the total moles of the Mixture.

4.2.2.2.8.3 special_equilibrium

A special_equilibrium specifies an enumerated attribute that indicates the type of equilibrium relationship that the Substance (see 4.2.2.2.20) participates in the Mixture (see 4.2.2.2.12). The value of the special_equil attribute shall be one of the following:

— inert_solid;

— noncondensable;

— nonvolatile;

— normal;

— supercritical.

4.2.2.2.8.3.1 inert_solid**:** an indication that the Substance (see 4.2.2.2.20) is a solid that does not participate in the equilibrium of the Mixture (see 4.2.2.2.12) under the time frame of consideration.

4.2.2.2.8.3.2 noncondensable**:** an indication the Substance (see 4.2.2.2.20) may be present only vapour phase of the Mixture (see 4.2.2.2.12).

4.2.2.2.8.3.3 nonvolatile**:** an indication that the Substance (see 4.2.2.2.20) will not be present in the vapour phase of the Mixture (see 4.2.2.2.12).

4.2.2.2.8.3.4 normal**:** an indication that the Substance (see 4.2.2.2.20) participates in normal equilibrium relationships within the Mixture (see 4.2.2.2.12).

4.2.2.2.8.3.5 supercritical**:** an indication that within liquid Phases (see 4.2.2.2.15) of the Mixture (see 4.2.2.2.12) the Substance (see 4.2.2.2.20) exists as a dissolved supercritical gas.

4.2.2.2.8.4 volume_fraction

A volume_fraction specifies the ratio of the volume occupied by one Substance (see 4.2.2.2.20) in a Mixture (see 4.2.2.2.12) to the entire volume of the Mixture.

4.2.2.2.9 Equation_group

An Equation_group is a collection of related Specific_equations (see 4.2.2.2.18).

The data associated with Equation_group are the following:

— description;

— equation_type;

— name.

4.2.2.2.9.1 description

A description specifies a textual explanation or summary of key aspects about the Equation_group.

4.2.2.2.9.2 equation_type

An equation_type specifies a category for organizing the general type of an Equation_group.

4.2.2.2.9.3 name

A name specifies a textual label for the thermodynamic mathematical model or method associated with the Equation_group.

NOTE 1 - The value of the name may be one of a set of predefined values or may be user supplied.

The value of the name attribute may be one of the following:

— BWR;

— BWRS;

— Chao-Seader;

— Lee-Kesler;

— Margules;

— NRTL;

— PR;

— SRK;

— UNIQUAC;

— Van Laar;

— Wilson.

4.2.2.2.9.3.1 BWR: Bennedict-Webb-Rubin equation of state.

4.2.2.2.9.3.2 BWRS: Bennedict-Webb-Rubin-Starling equation of state.

4.2.2.2.9.3.3 Chao-Seader: Chao-Seader method.

4.2.2.2.9.3.4 Lee-Kesler: Lee-Kesler method.

4.2.2.2.9.3.5 Margules: Margules excess Gibbs free energy method.

4.2.2.2.9.3.6 NRTL: Non-Random Two Liquid method.

4.2.2.2.9.3.7 PR: Peng-Robinson equation of state.

4.2.2.2.9.3.8 SRK: Soave-Redlich-Kwong equation of state.

4.2.2.2.9.3.9 UNIQUAC: Unified Quasi-chemical method.

4.2.2.2.9.3.10 Van Laar: Van Laar equation.

4.2.2.2.9.3.11 Wilson: Wilson's excess Gibbs free energy method.

4.2.2.2.10 Externally_defined_variable_value

An Externally_defined_variable_value is a type of Variable_value (see 4.2.2.2.26) that is defined from an external reference source.

The data associated with Externally_defined_variable_value are the following:

— source.

4.2.2.2.10.1 source

A source specifies a text string referring to the source of the Externally_defined_variable_value.

4.2.2.2.11 Family

A Family is a group of structurally related Chemical_species.

The data associated with Family are the following:

— name.

A name specifies a textual label for a Family.

4.2.2.2.12 Mixture

A Mixture is a Substance (see 4.2.2.2.20) that is made up of a combination of two or more other Substances. Each Mixture may be a Petroleum_mixture (see 4.2.2.2.14).

The data associated with Mixture are the following:

— type_name.

A type_name specifies the textual label assigned to the type of Mixture.

4.2.2.2.13 Petroleum_cut

A Petroleum_cut is a type of Petroleum_mixture (see 4.2.2.2.14) described over a specified range of distillation temperatures.

NOTE - A Petroleum_cut is similar to a petroleum fraction but is further divided.

The data associated with Petroleum_cut are the following:

— begin_temperature;

— end_temperature.

4.2.2.2.13.1 begin_temperature

A begin_temperature specifies the Petroleum_cut starting temperature for a distillation that describes the Petroleum_cut.

4.2.2.2.13.2 end_temperature

A end_temperature specifies the Petroleum_cut ending temperature for a distillation that describes the Petroleum_cut.

4.2.2.2.14 Petroleum_mixture

A Petroleum_mixture is a Mixture (see 4.2.2.2.12) that is primarily petroleum or a derivative of petroleum. Each Petroleum_mixture may be a Petroleum_cut (see 4.2.2.2.13).

4.2.2.2.15 Phase

A Phase is a homogeneous region of matter.

NOTE - A Phase need not be continuous.

The data associated with Phase are the following:

— description;

— name;

— physical_state.

4.2.2.2.15.1 description

A description specifies a textual explanation or summary of key aspects about the Phase.

4.2.2.2.15.2 name

A name specifies a textual label for the Phase.

4.2.2.2.15.3 physical_state

A physical_state specifies the physical behaviour of the Phase. The value of the physical_state attribute shall be one of the following:

— dense;

— liquid;

— solid;

— vapour.

4.2.2.2.15.3.1 dense**:** a Phase that is in the supercritical region with liquid-like densities and vapour-like behaviours.

4.2.2.2.15.3.2 liquid**:** a Phase that is in liquid form.

4.2.2.2.15.3.3 solid**:** a Phase that is in solid form.

4.2.2.2.15.3.4 vapour**:** a Phase that is in vapour form.

4.2.2.2.16 Pseudo_component

A Pseudo_component is a type of Chemical_component (see 4.2.2.2.4) that is a combination of Chemical_species (see 4.2.2.2.5) that is treated as though it were a single Chemical_specie and characterized by assigning "molecular" constants to it.

The data associated with Pseudo_component are the following:

— average_temperature;

— begin_temperature;

— end_temperature;

— generating_source;

— molecular_weight;

— specific_gravity;

— type.

4.2.2.2.16.1 average_temperature

A average_temperature specifies the average temperature for a distillation cut for a Pseudo_component characterized by a distillation method or estimation.

4.2.2.2.16.2 begin_temperature

A begin_temperature specifies the lower temperature bound for a distillation cut for a Pseudo_component characterized by a distillation method or estimation.

4.2.2.2.16.3 end_temperature

A end_temperature specifies the upper temperature bound for a distillation cut for a Pseudo_component characterized by a distillation method or estimation.

4.2.2.2.16.4 generating_source

A generating_source specifies the laboratory measurement or equation that generated the Pseudo_-component.

> EXAMPLE 22 - A laboratory measurement generating_source may be the laboratory name, sample identifier, and date.

4.2.2.2.16.5 molecular_weight

A molecular_weight specifies the ratio of the average mass of one molecule of a Pseudo_component to one-twelfth of the mass of an atom of carbon-12.

4.2.2.2.16.6 specific_gravity

A specific_gravity specifies the ratio of the density of a Pseudo_component to the density of a standard, usually water for a liquid or solid or air for a gas.

4.2.2.2.16.7 type

A type specifies a Pseudo_component is measured or calculated.

4.2.2.2.17 Reference_state

A Reference_state is a collection of Variables (see 4.2.2.2.24) that define a set of reference conditions for calculating thermodynamic state variables such as enthalpy and entropy. Numeric values for thermodynamic state variables are reported as differences between the current thermodynamic conditions and the reference state where the value has been agreed to be zero or some arbitrary value.

The data associated with Reference_state are the following:

— basis;

— value.

4.2.2.2.17.1 basis

A basis specifies an enumerated attribute that is an assumption about, model of, simplification of, or statement about the thermodynamic behaviour or state of a mixture used as the Reference_state. The value of the basis attribute shall be one of the following:

— ideal_gas;

— ideal_solution;

— infinite_dilution;

— other_mixture_type;

— pure_component;

— real_mixture.

4.2.2.2.17.1.1 ideal_gas**:** an indication the Reference_state is for an ideal gas.

4.2.2.2.17.1.2 ideal_solution**:** an indication the Reference_state is an ideal solution.

4.2.2.2.17.1.3 infinite_dilution**:** an indication the Reference_state is for a Mixture (see 4.2.2.2.12) with infinite dilution for solutes.

4.2.2.2.17.1.4 other_mixture_type**:** an indication the Reference_state is for a Mixture (see 4.2.2.2.12) type not defined by the other values.

4.2.2.2.17.1.5 pure_component**:** an indication the Reference_state is for a pure Chemical_component (see 4.2.2.2.4) basis.

4.2.2.2.17.1.6 real_mixture**:** an indication the Reference_state is for a real Mixture (see 4.2.2.2.12).

4.2.2.2.17.2 value

A value specifies the numeric value of the variable at the Reference_state. It is often set equal to zero, but can be specified as having another non-zero value.

4.2.2.2.18 Specific_equation

A Specific_equation is a single equation for a Substance (see 4.2.2.2.20) in a given Phase (see 4.2.2.2.15) with a given set of constants.

The data associated with Specific_equation are the following:

— name.

A name specifies a textual label for the Specific_equation.

4.2.2.2.19 Structural_group

A Structural_group is a subdivision of a molecule defined for a given group contribution method for a property estimation.

The data associated with Structural_group are the following:

— category;

— description;

— name;

— type.

4.2.2.2.19.1 category

A category specifies the functional category for the Structural_group.

4.2.2.2.19.2 description

A description specifies the molecular structure of the Structural_group.

4.2.2.2.19.3 name

A name specifies a unique textual label for the Structural_group.

4.2.2.2.19.4 type

A type specifies the type of group contribution method the Structural_group is defined for.

4.2.2.2.20 Substance

A Substance is any chemical substance. Each Substance may be one of the following: an Amorphous_solid (see 4.2.2.2.1), a Chemical_component (see 4.2.2.2.4), or a Mixture (see 4.2.2.2.12).

The data associated with Substance are the following:

— substance_identifier.

A substance_identifier specifies a unique textual label for the Substance.

4.2.2.2.21 Substance_name

A Substance_name is a common or specific textual label given to a Substance (see 4.2.2.2.20).

NOTE - More than one Substance_name may be associated with a given Substance and a given Substance_name may not always refer to the same Substance.

The data associated with Substance_name are the following:

— name_of_substance;

— name_source.

4.2.2.2.21.1 name_of_substance

A name_of_substance specifies a label for the Substance_name.

4.2.2.2.21.2 name_source

A name_source specifies the source of the Substance_name.

EXAMPLE 23 - A name_source might be the American Petroleum Institute.

4.2.2.2.22 Substance_property

A Substance_property is a property that has a specific value for a Substance (see 4.2.2.2.20). Substance_properties may be either constants or common properties that are expressed with respect to a standard state.

NOTE - A Substance_property inherits a variable name. A number of these are reserved and defined.

4.2.2.2.23 Substance_property_value

A Substance_property_value is a type of Variable_value (see 4.2.2.2.26) that is the value for a Substance_property (see 4.2.2.2.22) for a Substance (see 4.2.2.2.20).

4.2.2.2.24 Variable

A Variable is a variable for an equation, an Equation_group (see 4.2.2.2.9), a Reference_state (see 4.2.2.2.17), or a Property_data_set (see 4.2.2.1.8). Each Variable may be one of the following: a Binary_-parameter (see 4.2.2.2.2) or a Substance_property (see 4.2.2.2.22).

NOTE - Properties may be expressed as a Variable.

The data associated with Variable are the following:

— name;

— type.

4.2.2.2.24.1 name

A name specifies a textual label for the Variable.

4.2.2.2.24.2 type

A type specifies the name of the sub-type of the Variable, which may be a Substance_property (see 4.2.2.2.22) or a Binary_parameter (see 4.2.2.2.2).

4.2.2.2.25 Variable_approval_context

A Variable_approval_context is the suitability of a Variable_value (see 4.2.2.2.26) for use in an Equation_group (see 4.2.2.2.9) or equations specified by a Specific_equation (see 4.2.2.2.18).

The data associated with Variable_approval_context are the following:

— approved_by;

— description.

4.2.2.2.25.1 approved_by

An approved_by specifies who or what body states the suitability of the Variable_value (see 4.2.2.2.26).

4.2.2.2.25.2 description

A description specifies a textual explanation or summary of key aspects about the Variable_approval_-context.

4.2.2.2.26 Variable_value

A Variable_value is a specific value of a Variable (see 4.2.2.2.24) for a Phase (see 4.2.2.2.15). Each Variable_value may be one of the following: a Binary_parameter_value (see 4.2.2.2.3), an Externally_-defined_variable_value (see 4.2.2.2.10), or a Substance_property_value (see 4.2.2.2.23).

The data associated with Variable_value are the following:

— raw_or_approved;

— type;

— value.

4.2.2.2.26.1 raw_or_approved

A raw_or_approved specifies whether the Variable_value is from raw data or from data that has been processed or evaluated for a particular use.

4.2.2.2.26.2 type

A type specifies a textual label indicating the type of the Variable_value.

4.2.2.2.26.3 value

A value specifies the numerical value for a Variable_value.

4.2.2.3 chemical_reaction_data

Refer to 4.1.1 for a description of what this UoF specifies. The ARM diagram related to this UoF is provided as figure G.1 in annex G of this part to ISO 10303.

4.2.2.3.1 Arrhenius_reaction

An Arrhenius_reaction is a subtype of Reaction_rate (see 4.2.2.3.6) that is a collection of parametric values for an Arrhenius equation that describes a chemical reaction rate.

NOTE - An Arrhenius equation is a form to relate the temperature dependency of the rate of a chemical reaction. Specifically, the Arrhenius equation is [6]:

$$k = A * e^{-E/RT}$$

where k is the reaction rate constant, E is the activation energy, A is the frequency factor, R is the universal gas constant, and T is the temperature. The rate of a chemical reaction is typically given in the form:

$$-r_A = k\, f(C^a_A, C^b_B, ...)$$

where r_A is the change of the number of moles of a specific component per unit time and C_A, C_B, ... are the concentration of the various chemical species.

The data associated with Arrhenius_reaction are the following:

— arrhenius_activation_energy;

— arrhenius_coefficient;

— arrhenius_pre_exponential.

4.2.2.3.1.1 arrhenius_activation_energy

An arrhenius_activation_energy specifies the value of the activation energy parameter to be used in the Arrhenius expression for a reaction in a reactor in the simulation.

4.2.2.3.1.2 arrhenius_coefficient

An arrhenius_coefficient specifies the value of the Arrhenius coefficient parameter for a reaction in a reactor in the simulation.

4.2.2.3.1.3 arrhenius_pre_exponential

An arrhenius_pre_exponential specifies the pre-exponential factor for the rate expression of the power law kinetics model.

4.2.2.3.2 Chemical_reaction

A Chemical_reaction is the chemical transformation of one or more Substances (see 4.2.2.2.20) into one or more different Substances.

The data associated with Chemical_reaction are the following:

— reaction_name;

A reaction_name specifies a textual label that uniquely identifies a reaction in a reactor in the simulation.

4.2.2.3.3 Extents_specified_chemical_reaction

An Extents_specified_chemical_reaction is an indication of the amount of reactants in a Chemical_-reaction (see 4.2.2.3.2) that will react.

The data associated with Extents_specified_chemical_reaction are the following:

— amount_of_reaction_extent;

— key_component_conversion;

— reaction_temperature_offset.

4.2.2.3.3.1 amount_of_reaction_extent

An amount_of_reaction_extent specifies the extent of a reaction in the simulation, defined by the moles generated for a Chemical_component (see 4.2.2.2.4) divided by its stoichiometric coefficient.

4.2.2.3.3.2 key_component_conversion

An key_component_conversion specifies the fraction conversion of the key Chemical_component (see 4.2.2.2.4) in a reactor.

4.2.2.3.3.3 reaction_temperature_offset

An reaction_temperature_offset specifies the reaction temperature offset related attribute of the Amount_of_reaction, associated with the Uo_reactor (see 4.2.3.2.57) objects in the simulation.

4.2.2.3.4 Interphase_chemical_reaction

An Interphase_chemical_reaction is a chemical reaction that takes place on the boundary between two Specific_phases (see 4.2.3.3.15).

4.2.2.3.5 Reaction_order

A Reaction_order is the exponential factor for the activity or concentration of a Substance (see 4.2.2.2.20) in a rate expression for a Reaction_rate (see 4.2.2.3.6), where the rate expression is in a power law form.

The data associated with Reaction_order are the following:

— order_value.

An order_value specifies the numerical value of the exponent.

4.2.2.3.6 Reaction_rate

A Reaction_rate (see 4.2.2.3.6) is the reaction rate of a Chemical_reaction (see 4.2.2.3.2) associated with the Uo_reactor (see 4.2.3.2.57) objects in the simulation. Each Reaction_rate may be an Arrhenius_-reaction (see 4.2.2.3.1).

The data associated with Reaction_rate are the following:

— description;

— reaction_constant.

4.2.2.3.6.1 description

A description specifies a textual explanation or summary of key aspects of the Reaction_rate.

4.2.2.3.6.2 reaction_constant

A reaction_constant specifies a reaction constant of the Substance (see 4.2.2.2.20) for the Reaction_rate (see 4.2.2.3.6).

4.2.2.3.7 Stoichiometric_coefficient

A Stoichiometric_coefficient is the number of molecules of a particular Substance (see 4.2.2.2.20) that participate in a Chemical_reaction (see 4.2.2.3.2).

The data associated with Stoichiometric_coefficient are the following:

— value.

A value specifies a positive or negative numeric value for the Stoichiometric_coefficient.

NOTE - A positive number indicates a Substance is produced as the result of a chemical reaction. A negative number indicates that molecules are consumed in a chemical reaction.

4.2.2.4 material_data

Refer to 4.1.6 for a description of what this UoF specifies. The ARM diagrams related to this UoF are provided as figures G.16 through G.19 in annex G of this part to ISO 10303.

4.2.2.4.1 Bulk_thermodynamic_properties

A Bulk_thermodynamic_properties is a collection of properties loosely classified as thermodynamic properties that can be estimated or calculated for the composite, or bulk, contents of a Material_stream (see 4.2.3.3.7), a Material_amount (see 4.2.2.4.10), a Specific_phase (see 4.2.3.3.15), or a Process_-material (see 4.2.2.4.13) at a given Thermodynamic_conditions (see 4.2.2.4.17).

The data associated with Bulk_thermodynamic_properties are the following:

— heat_capacity_mass_basis;

— heat_capacity_mole_basis;

— heat_of_fusion;

— heat_of_vapourization;

— ideal_gas_heat_capacity_mass_basis;

— ideal_gas_heat_capacity_mole_basis;

— specific_enthalpy_mass_basis;

— specific_enthalpy_mole_basis;

— specific_entropy_mass_basis;

— specific_entropy_mole_basis.

4.2.2.4.1.1 heat_capacity_mass_basis

A heat_capacity_mass_basis specifies the instantaneous rate of change of the enthalpy with respect to changes in temperature at constant pressure for a unit mass of the bulk fluid.

4.2.2.4.1.2 heat_capacity_mole_basis

A heat_capacity_mass_basis specifies the instantaneous rate of change of the enthalpy with respect to changes in temperature at constant pressure for a unit mole of the bulk fluid.

4.2.2.4.1.3 heat_of_fusion

A heat_of_fusion specifies the heat required to change the bulk fluid from a solid phase to a liquid phase at its normal freezing point and one atmosphere pressure per mole of bulk fluid.

4.2.2.4.1.4 heat_of_vapourization

A heat_of_vapourization specifies the heat required to change the bulk fluid from a liquid phase to a vapour phase at the temperature and pressure of the fluid per mole of the bulk fluid.

4.2.2.4.1.5 ideal_gas_heat_capacity_mass_basis

An ideal_gas_heat_capacity_mass_basis specifies the instantaneous rate of change of the enthalpy with respect to changes in temperature at constant pressure for a unit mass of an ideal gas of the same composition as the bulk fluid.

4.2.2.4.1.6 ideal_gas_heat_capacity_mole_basis

An ideal_gas_heat_capacity_mole_basis specifies the instantaneous rate of change of the enthalpy with respect to changes in temperature at constant pressure for a unit mole of an ideal gas of the same composition as the bulk fluid.

4.2.2.4.1.7 specific_enthalpy_mass_basis

A specific_enthalpy_mass_basis specifies the enthalpy per unit mass of the bulk fluid or any phase thereof.

4.2.2.4.1.8 specific_enthalpy_mole_basis

A specific_enthalpy_mole_basis specifies the enthalpy per unit mole of the bulk fluid or any phase thereof.

4.2.2.4.1.9 specific_entropy_mass_basis

A specific_entropy_mass_basis specifies the entropy per unit mass of the bulk fluid at the thermodynamic state or any phase thereof.

4.2.2.4.1.10 specific_entropy_mole_basis

A specific_entropy_mole_basis specifies the entropy per unit mole of the bulk fluid at the thermodynamic state of any phase thereof.

4.2.2.4.2 Bulk_thermophysical_properties

A Bulk_thermophysical_properties is a collection of commonly used physical and thermodynamic properties calculated or estimated for the composite, or bulk, phase of a fluid. The fluid may be a Material_stream (see 4.2.3.3.7), a Material_amount (see 4.2.2.4.10), or a Specific_phase (see 4.2.3.3.15) at a given Thermodynamic_conditions (see 4.2.2.4.17). Each Bulk_thermophysical_properties shall be related to exactly one Material_amount, Material_stream, or Specific_phase.

4.2.2.4.3 Bulk_vapour_liquid_equilibrium_properties

A Bulk_vapour_liquid_equilibrium_properties is a collection of commonly used properties that describe the vapour liquid equilibrium (VLE) of a bulk fluid.

The data associated with Bulk_vapour_liquid_equilibrium_properties are the following:

— bubble_point_pressure;

— bubble_point_temperature;

— dew_point_pressure;

— dew_point_temperature;

— retrograde_dew_point_pressure;

— vapour_quality.

4.2.2.4.3.1 bubble_point_pressure

A bubble_point_pressure specifies the pressure that a liquid of the same composition and temperature as the bulk fluid may be in equilibrium with a small amount of vapour (bubble).

4.2.2.4.3.2 bubble_point_temperature

A bubble_point_temperature specifies the temperature that a liquid of the same composition and pressure as the bulk fluid may be in equilibrium with a small amount of vapour (bubble).

4.2.2.4.3.3 dew_point_pressure

A dew_point_pressure specifies the pressure that a vapour of the same composition and temperature as the bulk fluid may be in equilibrium with a small amount of liquid (dew drop).

4.2.2.4.3.4 dew_point_temperature

A dew_point_temperature specifies the temperature that a vapour of the same composition and pressure as the bulk fluid may be in equilibrium with a small amount of liquid (dew drop).

4.2.2.4.3.5 retrograde_dew_point_pressure

A retrograde_dew_point_pressure specifies the second pressure that a vapour of the same composition and temperature of the bulk fluid may be in equilibrium with a drop of liquid.

> NOTE - The Phase (see 4.2.2.2.15) behaviour at the retrograde region is counter-intuitive to the "normal dew point" in that decreasing the bulk fluid pressure from the retrograde_dew_point_pressure results in additional condensation of liquid. Continuing to decrease pressure isothermally will eventually re-vapourize the liquid condensate and return it to the normal dew point at the lower pressure. Retrograde condensation may occur in a mixture above its critical temperature. If a Retrograde_dew_point exists, it is the higher of the two dew point pressures predicted.

4.2.2.4.3.6 vapour_quality

A vapour_quality specifies the ratio of moles of vapour to the total moles of the bulk fluid.

4.2.2.4.4 Component_in_mixture_properties

A Component_in_mixture_properties is a collection of properties for one Chemical_component (see 4.2.2.2.4) of one Phase (see 4.2.2.2.15) of a multi-component mixture. The Phase may be a Specific_-phase (see 4.2.3.3.15), or one Phase of a Material_amount (see 4.2.2.4.10), Material_stream (see 4.2.3.3.7), or one Phase of a Process_material (see 4.2.2.4.13) at a given Thermodynamic_conditions (see 4.2.2.4.17).

The data associated with Component_in_mixture_properties are the following:

— activity_coefficient;

— activity_coefficient_pressure_correction;

— diffusion_coefficient;

— fugacity;

— partial_molar_volume.

4.2.2.4.4.1 activity_coefficient

An activity_coefficient specifies the ratio of the activity of one Chemical_component (see 4.2.2.2.4) in a liquid or solid Phase (see 4.2.2.2.15) of a Mixture (see 4.2.2.2.12) to its mole fraction in that Phase.

4.2.2.4.4.2 activity_coefficient_pressure_correction

An activity_coefficient_pressure_correction specifies the exponent of the integral for the vapour pressure of a Chemical_component (see 4.2.2.2.4) in a Mixture (see 4.2.2.2.12) to the pressure of that Mixture of the molar volume of the Chemical_component divided by the product of the temperature of the Mixture and the ideal gas constant.

4.2.2.4.4.3 diffusion_coefficient

A diffusion_coefficient specifies the diffusion coefficient for one Chemical_component (see 4.2.2.2.4) in a Phase (see 4.2.2.2.15). The diffusion coefficient is a proportionality coefficient for the mass flux of a Chemical_component in a Phase to the mass gradient for that Chemical_component.

4.2.2.4.4.4 fugacity

A fugacity specifies a function used instead of chemical potential to define equilibrium of a Chemical_-component (see 4.2.2.2.4) in a Mixture (see 4.2.2.2.12). As pressure of the Mixture approaches zero, the fugacity approaches the mole fraction of the Chemical_component in the Mixture times the pressure of the Mixture.

4.2.2.4.4.5 partial_molar_volume

A partial_molar_volume specifies the molar volume occupied in a Mixture (see 4.2.2.2.12) by a specific component. The partial_molar_volume is a derivative thermodynamic property that specifies the instantaneous change in volume of a Phase (see 4.2.2.2.15) with the change in the number of moles of a Chemical_component (see 4.2.2.2.4) with the number of moles of all other Chemical_components and the temperature and pressure of the Phase held constant.

4.2.2.4.5 Construction_material

A Construction_material is a type of Material (see 4.2.2.4.9) that is used to fabricate the Process_-equipment (see 4.2.4.2.8) or other Plant_items (see 4.2.4.1.39) that may contain Process_material (see 4.2.2.4.13).

4.2.2.4.6 Density_properties

A Density_properties is a collection of properties that specify the relationships between volume and moles or mass for a Phase (see 4.2.2.2.15) in a Mixture (see 4.2.2.2.12) at a given Thermodynamic_-conditions (see 4.2.2.4.17). Density_properties must be used by at least one Single_phase_-thermophysical_properties (see 4.2.2.4.16) or one Bulk_thermophysical_properties (see 4.2.2.4.2).

The data associated with Density_properties are the following:

— average_molecular_weight;

— compressibility;

— density_mass_basis;

— density_mole_basis;

— specific_volume_mass_basis;

— specific_volume_mole_basis.

4.2.2.4.6.1 average_molecular_weight

An average_molecular_weight specifies the mole fraction weighted average of the molecular weights of all Substances (see 4.2.2.2.20) present.

4.2.2.4.6.2 compressibility

A compressibility specifies the ratio of the product of the pressure and volume of the Phase (see 4.2.2.2.15) to the product of the ideal gas constant, the temperature, and the number of moles contained in that Phase.

4.2.2.4.6.3 density_mass_basis

A density_mass_basis specifies the ratio of the mass of a Phase (see 4.2.2.2.15) to its volume.

4.2.2.4.6.4 density_mole_basis

A density_mole_basis specifies the ratio of the number of moles of a Phase (see 4.2.2.2.15) to its volume.

4.2.2.4.6.5 specific_volume_mass_basis

A specific_volume_mass_basis specifies the ratio of the volume of a Phase (see 4.2.2.2.15) to its mass.

4.2.2.4.6.6 specific_volume_mole_basis

A specific_volume_mole_basis specifies the ratio of the volume of a Phase (see 4.2.2.2.15) to the number of moles in that Phase.

4.2.2.4.7 Excess_properties

An Excess_properties is a collection of Thermodynamic_properties (see 4.2.2.4.18) for a given Phase (see 4.2.2.2.15) in a Mixture (see 4.2.2.2.12) that are calculated with respect to a Reference_state (see 4.2.2.2.17), where the Reference_state is defined as an ideal solution at the same temperature, pressure, and composition as the Phase.

The data associated with Excess_properties are the following:

— excess_enthalpy_mass_basis;

— excess_enthalpy_mole_basis;

— excess_entropy_mass_basis;

— excess_entropy_mole_basis;

— excess_gibbs_free_energy_mass_basis;

— excess_gibbs_free_energy_mole_basis;

— excess_helmholtz_free_energy_mass_basis;

— excess_helmholtz_free_energy_mole_basis.

4.2.2.4.7.1 excess_enthalpy_mass_basis

An excess_enthalpy_mass_basis specifies the difference between the enthalpies per unit mass at the temperature, pressure, and composition of the Phase (see 4.2.2.2.15) and at the ideal solution Reference_-state (see 4.2.2.2.17).

4.2.2.4.7.2 excess_enthalpy_mole_basis

An excess_enthalpy_mole_basis specifies the difference between the enthalpies per mole of the Phase (see 4.2.2.2.15) and the ideal solution Reference_state (see 4.2.2.2.17).

4.2.2.4.7.3 excess_entropy_mass_basis

An excess_entropy_mass_basis specifies the difference between the entropies per unit mass of the Phase (see 4.2.2.2.15) and the ideal solution Reference_state (see 4.2.2.2.17).

4.2.2.4.7.4 excess_entropy_mole_basis

An excess_entropy_mole_basis specifies the difference between the entropies per mole of the Phase (see 4.2.2.2.15) and the ideal solution Reference_state (see 4.2.2.2.17).

4.2.2.4.7.5 excess_gibbs_free_energy_mass_basis

An excess_gibbs_free_energy_mass_basis specifies the difference between the Gibbs free energies per unit mass of the Phase (see 4.2.2.2.15) and the ideal solution Reference_state (see 4.2.2.2.17).

4.2.2.4.7.6 excess_gibbs_free_energy_mole_basis

An excess_gibbs_free_energy_mole_basis specifies the difference between the Gibbs free energies per mole of the Phase (see 4.2.2.2.15) and the ideal solution Reference_state (see 4.2.2.2.17).

4.2.2.4.7.7 excess_helmholtz_free_energy_mass_basis

An excess_Helmholtz_free_energy_mass_basis specifies the difference between the Helmholtz free energy per unit mass of the Phase (see 4.2.2.2.15) and the ideal solution Reference_state (see 4.2.2.2.17).

4.2.2.4.7.8 excess_helmholtz_free_energy_mole_basis

An excess_Helmholtz_free_energy_mole_basis specifies the difference between the Helmholtz free energies per mole of the Phase (see 4.2.2.2.15) and the ideal solution Reference_state (see 4.2.2.2.17).

4.2.2.4.8 Interphase_thermophysical_properties

An Interphase_thermophysical_properties is a loose collection of properties of the interface between two Specific_phases (see 4.2.3.3.15).

The data associated with Interphase_thermophysical_properties are the following:

— surface_tension.

A surface_tension specifies the force per unit length exerted by the surface at the interface.

4.2.2.4.9 Material

A Material is matter that is produced, consumed, transformed, used by a process, or used as a Construction_material (see 4.2.2.4.5) for a Plant_item (see 4.2.4.1.39). Each Material is one of the following: Construction_material or Process_material (see 4.2.2.4.13).

The data associated with Material are the following:

— description;

— name.

4.2.2.4.9.1 description

A description specifies a textual explanation or summary of key aspects of the Material.

4.2.2.4.9.2 name

A name specifies a textual label that uniquely identifies a Material.

4.2.2.4.10 Material_amount

A Material_amount is an inventory or hold-up of Process_material (see 4.2.2.4.13) within a Process_-unit_operation (see 4.2.3.2.5) or within a Plant_item (see 4.2.4.1.39).

The data associated with Material_amount are the following:

— description;

— mass;

— material_amount_name;

— moles;

— volume.

4.2.2.4.10.1 description

A description specifies a textual explanation or summary of key aspects about the Material_amount.

4.2.2.4.10.2 mass

A mass specifies the amount of mass in a Material_amount.

4.2.2.4.10.3 material_amount_name

A material_amount_name specifies a textual label that identifies a Material_amount.

4.2.2.4.10.4 moles

A moles specifies the number of moles present in a Material_amount.

4.2.2.4.10.5 volume

A volume specifies the volume occupied by a Material_amount.

4.2.2.4.11 Material_cost

A Material_cost is the value or cost for a Process_material (see 4.2.2.4.13) at a specified location, quality, temperature, and pressure.

The data associated with Material_cost are the following:

— average_cost;

— cost_basis.

4.2.2.4.11.1 average_cost

An average_cost specifies the average cost of the Process_material (see 4.2.2.4.13) over the quality range between the Material_cost point and the previous cost point.

4.2.2.4.11.2 cost_basis

A cost_basis specifies the ratio of the currency unit to the amount unit on which the average_cost is computed.

4.2.2.4.12 Phase_distribution_coefficient

A Phase_distribution_coefficient is the partitioning of a Chemical_component (see 4.2.2.2.4) between two Specific_phases (see 4.2.3.3.15).

The data associated with Phase_distribution_coefficient are the following:

— coefficient_type;

— value.

4.2.2.4.12.1 coefficient_type

A coefficient_type indicates the type of partitioning specified by the Phase_distribution_coefficient. The value of the coefficient_type attribute shall be one of the following:

— k_value;

— partition_coefficient.

4.2.2.4.12.1.1 k_value**:** an indication that the partitioning is between a liquid and a vapour phase in equilibrium.

4.2.2.4.12.1.2 partition_coefficient**:** an indication that the partitioning is between two liquid phases in equilibrium.

4.2.2.4.12.2 value

A value specifies the ratio of the mole or mass fraction of the Chemical_component (see 4.2.2.2.4) in the light Specific_phase (see 4.2.3.3.15) to the mole or mass fraction in the heavy Specific_phase.

4.2.2.4.13 Process_material

A Process_material is a type of Material (see 4.2.2.4.9) that is used in or produced by a process that is being described. Material is not a physical Substance (see 4.2.2.2.20) but rather a processes abstraction of that Substance.

> EXAMPLE 24 - Cooling water is a Material commonly used in a process. The actual Substance that makes it up is a complex (and mostly indeterminate) mixture of water, dissolved salts, dissolved gases, dissolved and emulsified organic liquids, suspended solids, foams, biological components, and so on. The physical and thermodynamic properties of a Material are commonly estimated by approximating its contents with a Substance.

The data associated with Process_material are the following:

— class.

A class specifies an enumerated attribute indicating the use of the Process_material (see 4.2.2.4.13) in a process. The value of the class attribute shall be one of the following:

— ambient_process_material;

— internal_process_material;

— product_process_material;

— raw_process_material;

— unspecified_process_material;

— utility_process_material;

— waste_process_material.

4.2.2.4.13.0.1 ambient_process_material**:** an indication that the Material (see 4.2.2.4.9) has an ambient source when used by a process.

> EXAMPLE 25 - For example, Atmospheric Air used by a blower.

4.2.2.4.13.0.2 internal_process_material**:** an indication that the Material (see 4.2.2.4.9) is used only internally by a process.

4.2.2.4.13.0.3 product_process_material**:** an indication that the Material (see 4.2.2.4.9) is produced as a product in a process.

4.2.2.4.13.0.4 raw_process_material**:** an indication the Material (see 4.2.2.4.9) is used by a process as a raw or feed Material (see 4.2.2.4.9).

4.2.2.4.13.0.5 unspecified_process_material**:** an indication that no use is specified for the Material (see 4.2.2.4.9).

4.2.2.4.13.0.6 utility_process_material**:** an indication the Material (see 4.2.2.4.9) is used as a Utility_-stream (see 4.2.3.3.19) in a process.

4.2.2.4.13.0.7 waste_process_material**:** an indication the Material (see 4.2.2.4.9) is produced as a waste by a process.

4.2.2.4.14 Process_property_curve

A Process_property_curve is a curve or a set of curves that describe how the thermophysical properties of a Process_material (see 4.2.2.4.13) vary with temperature or temperature and pressure. The properties described may be bulk properties or the properties of one or more phases.

The data associated with Process_property_curve are the following:

— curve_name.

A curve_name specifies what independent variables should be used for the curve. The value of curve_-name shall be one of the following:

— T;

— P;

— TP.

4.2.2.4.14.0.1 T: specifies that a single independent variable, temperature, is to be used. Pressure is to be fixed.

4.2.2.4.14.0.2 P: specifies that a single independent variable, pressure, is to be used. Temperature is fixed.

4.2.2.4.14.0.3 TP: specifies that two independent variables are used, temperature and pressure.

4.2.2.4.15 Process_property_curve_point

A Process_property_curve_point is single data point in a Process_property_curve (see 4.2.2.4.14). Exactly one of the Process_design_property_variable_usage (see 4.2.1.1.15) in the one to many set is an independent variable, and that same Process_design_property_variable_usage is used by an Item_-property_reference (see 4.2.1.1.7) that is defined by a Thermodynamic_conditions (see 4.2.2.4.17).

4.2.2.4.16 Single_phase_thermophysical_properties

A Single_phase_thermophysical_properties is a collection of commonly used physical and thermodynamic properties calculated or estimated for a single Phase (see 4.2.2.2.15) of a Mixture (see 4.2.2.2.12). The Mixture may be a single Specific_phase (see 4.2.3.3.15) or may be a composite Mixture contained in a Material_amount (see 4.2.2.4.10), Material_stream (see 4.2.3.3.7), or Specific_phase or may be a Process_material (see 4.2.2.4.13) at a given Thermodynamic_conditions (see 4.2.2.4.17).

4.2.2.4.17 Thermodynamic_conditions

A Thermodynamic_conditions specifies the thermodynamic state for a Material_amount (see 4.2.2.4.10), Material_stream (see 4.2.3.3.7), or Specific_phase (see 4.2.3.3.15) or specifies the independent variables for a Process_material_property_curve_point (see 4.2.2.4.15).

The data associated with Thermodynamic_conditions are the following:

— enthalpy;

— description;

— pressure;

— temperature.

4.2.2.4.17.1 enthalpy

An enthalpy specifies the sum of the internal energy and the product of pressure and volume for any given portion of a fluid.

4.2.2.4.17.2 description

A description specifies additional textual explanation or summary about the Thermodynamic_conditions in addition to temperature and pressure.

4.2.2.4.17.3 pressure

A pressure specifies the amount of force per unit area that any portion of a Material (see 4.2.2.4.9) exerts on its surroundings at the thermodynamic state.

4.2.2.4.17.4 temperature

A temperature specifies the temperature of a Material (see 4.2.2.4.9) at the thermodynamic state measured in one of the common scales of thermodynamic or thermometric temperature.

4.2.2.4.18 Thermodynamic_properties

A Thermodynamic_properties is a collection of properties loosely classified as thermodynamic properties for a Material (see 4.2.2.4.9) for one Phase (see 4.2.2.2.15) of a Mixture (see 4.2.2.2.12) at a given Thermodynamic_conditions (see 4.2.2.4.17).

The data associated with Thermodynamic_properties are the following:

— heat_capacity_constant_pressure_mass_basis;

— heat_capacity_constant_pressure_mole_basis;

— heat_capacity_ratio;

— specific_enthalpy_mass_basis;

— specific_enthalpy_mole_basis;

— specific_entropy_mass_basis;

— specific_entropy_mole_basis;

— specific_gibbs_free_energy_mass_basis;

— specific_gibbs_free_energy_mole_basis;

— specific_helmholtz_free_energy_mass_basis;

— specific_helmholtz_free_energy_mole_basis.

4.2.2.4.18.1 heat_capacity_constant_pressure_mass_basis

A heat_capacity_constant_pressure_mass_basis specifies the instantaneous rate of change of the enthalpy with respect to changes in temperature at constant pressure for any given portion of a Material (see 4.2.2.4.9) at the thermodynamic state per unit mass.

4.2.2.4.18.2 heat_capacity_constant_pressure_mole_basis

A heat_capacity_constant_pressure_mole_basis specifies the instantaneous rate of change of the enthalpy with respect to changes in temperature at constant pressure for any given portion of a Material (see 4.2.2.4.9) at the thermodynamic state per unit mole.

4.2.2.4.18.3 heat_capacity_ratio

A heat_capacity_ratio specifies the ratio of heat capacity at constant pressure either mass or mole base divided by heat capacity at constant volume either mass or mole base.

NOTE - The constant pressure and constant volume heat capacities that comprise the heat_capacity_ratio should be on the same basis, i.e., mass/mass or moles/moles.

4.2.2.4.18.4 specific_enthalpy_mass_basis

A specific_enthalpy_mass_basis specifies the enthalpy per unit mass for any given portion of Material (see 4.2.2.4.9) at the thermodynamic state.

4.2.2.4.18.5 specific_enthalpy_mole_basis

A specific_enthalpy_mole_basis specifies the enthalpy per unit mole for any given portion of a Material (see 4.2.2.4.9) at the thermodynamic state.

4.2.2.4.18.6 specific_entropy_mass_basis

A specific_entropy_mass_basis specifies the entropy per unit mass for any given portion of a Material (see 4.2.2.4.9) at the thermodynamic state.

4.2.2.4.18.7 specific_entropy_mole_basis

A specific_entropy_mole_basis specifies the entropy per unit mole for any given portion of a Material (see 4.2.2.4.9) at the thermodynamic state.

4.2.2.4.18.8 specific_gibbs_free_energy_mass_basis

A specific_gibbs_free_energy_mass_basis specifies the Gibbs free energy of a Substance (see 4.2.2.2.20) per unit mass. Gibbs free energy is the specific_enthalpy_mass_basis minus the product of the absolute temperature and the specific_entropy_mass_basis.

4.2.2.4.18.9 specific_gibbs_free_energy_mole_basis

A specific_gibbs_free_energy_mole_basis specifies the Gibbs free energy of a Substance (see 4.2.2.2.20) per unit mole. Gibbs free energy is the specific_enthalpy_mole_basis minus the product of the absolute temperature and the specific_entropy_mole_basis.

4.2.2.4.18.10 specific_helmholtz_free_energy_mass_basis

A specific_helmholtz_free_energy_mass_basis specifies the Helmholtz free energy of a Substance (see 4.2.2.2.20) per unit mass. The Helmholtz energy is the internal energy per unit mass minus the product of the absolute temperature and the specific_entropy_mass_basis.

4.2.2.4.18.11 specific_helmholtz_free_energy_mole_basis

A specific_helmholtz_free_energy_mole_basis specifies the Helmholtz free energy of a Substance (see 4.2.2.2.20) per unit mole. The Helmholtz energy is the internal energy per mole minus the product of the absolute temperature and the specific_entropy_mole_basis.

4.2.2.4.19 Transport_properties

A Transport_properties is a collection of properties loosely classified as transport properties for a bulk fluid or for one Phase (see 4.2.2.2.15) of a Mixture (see 4.2.2.2.12).

The data associated with Transport_properties are the following:

— thermal_conductivity;

— viscosity.

4.2.2.4.19.1 thermal_conductivity

A thermal_conductivity specifies the amount of thermal energy per unit time, per unit length, and per unit temperature that a Mixture (see 4.2.2.2.12) will transport by conduction.

4.2.2.4.19.2 viscosity

A viscosity specifies the ratio of the shearing stress per unit area for a given portion of a Mixture (see 4.2.2.2.12) to the velocity gradient necessary to produce that stress.

4.2.3 Process design UoFs

The UoFs within the process design grouping contain the process design data. This area is related to activities defined in the AAM described in annex F of this part of ISO 10303. Generally, activities A22333, A22336 and A22337 define the technology that is to be implemented by the process. Activity A22334 defines the equipment needed to implement that technology. Rarely are these major activities done in isolation. However, the nature of the data requires different data models.

4.2.3.1 process_description

Refer to 4.1.11 for a description of what this UoF specifies. The ARM diagram related to this UoF is provided as figure G.35 in annex G of this part to ISO 10303.

4.2.3.1.1 Aggregation_relationship

An Aggregation_relationship is a type of Process_definition_relationship (see 4.2.3.1.6). This allows a Process_definition (see 4.2.3.1.5) to be defined as containing, or consisting of one or more other Process_definitions.

> EXAMPLE 26 - A distillation column may be represented as an aggregation of Uo_distillation_stages (see 4.2.3.2.24), or a reactive distillation stage unit operation may be represented as an aggregation of a Uo_-distillation_stage and Uo_completely_stirred_reactor (see 4.2.3.2.14).

4.2.3.1.2 Alternate_relationship

An Alternate_relationship is a type of Process_definition_relationship (see 4.2.3.1.6) where the relationship is between two Process_definitions (see 4.2.3.1.5) that describe either alternate processing

choices for that portion of a larger process or describe alternate views of the same processing, typically differing in the amount of detail described.

4.2.3.1.3 Connected_process_port

A Connected_process_port is a Process_port (see 4.2.3.1.7) that has a connection to another Process_-port.

The data associated with Connected_process_port are the following:

— flow_state.

A flow_state specifies an enumerated attribute that indicates that the flow of a Connected_process_port is in the intended direction, the opposite of the intended direction, or is not occurring. The value of the flow_state attribute shall be one of the following:

— normal;

— reverse;

— static.

4.2.3.1.3.0.1 normal**:** an indication that the flow in a Connected_process_port is in the intended direction as defined by the normal flow direction of the Process_port (see 4.2.3.1.7).

4.2.3.1.3.0.2 reverse**:** an indication that the flow in a Connected_process_port is in the reverse of the intended direction as defined by the normal flow direction of the Process_port (see 4.2.3.1.7).

4.2.3.1.3.0.3 static**:** an indication that flow in a Connected_process_port is not occurring.

4.2.3.1.4 Event_sequence

An Event_sequence is a type of Process_definition_relationship (see 4.2.3.1.6) that correlates the execution of two related Process_definitions (see 4.2.3.1.5).

The data associated with Event_sequence are the following:

— sequence_type.

A sequence_type specifies the type of execution relationship between the Process_definitions. The value of the sequence_type attribute shall be one of the following:

— parallel;

— sequential;

— serial;

— unspecified.

4.2.3.1.4.0.1 parallel**:** an indication that the two Process_definitions (see 4.2.3.1.5) are executing coincidentally.

4.2.3.1.4.0.2 sequential**:** an indication that there is a numbered position among all peers that are related to a common parent by a set of sequential relationships.

4.2.3.1.4.0.3 serial**:** an indication that the two Process_definitions (see 4.2.3.1.5) are to be performed one after another.

4.2.3.1.4.0.4 unspecified**:** an indication that the type of execution relationship of the two Process_-definitions (see 4.2.3.1.5) is not specified.

4.2.3.1.5 Process_definition

A Process_definition is the identification and description of a process activity or control function. It is independent of the representation of the process, such as a process flow diagram or a simulation, and also independent of the particular equipment used to carry out the process. Each Process_definition may be one of the following: a Control_adjustment (see 4.2.3.6.3), a Control_event (see 4.2.3.6.4), a Process_-service (see 4.2.3.1.10), or a Process_unit_operation (see 4.2.3.2.5).

The data associated with Process_definition are the following:

— description;

— process_definition_name;

— type.

4.2.3.1.5.1 description

A description specifies a textual explanation or summary of the function or purpose of the Process_-definition.

EXAMPLE 27 - For a Process_definition involving cleaning a tank, the description might be "Clean the tank to prepare for new batch".

4.2.3.1.5.2 process_definition_name

A process_definition_name specifies a textual label given to the Process_definition.

EXAMPLE 28 - For a Process_definition involving cleaning a tank, the process_definition_name might be "ct1".

4.2.3.1.5.3 type

A type specifies the general nature or category of a given Process_definition.

EXAMPLE 29 - For a Process_definition involving cleaning a tank, the type might be "clean tank".

4.2.3.1.6 Process_definition_relationship

A Process_definition_relationship specifies an association between two Process_definition (see 4.2.3.1.5) objects. Each Process_definition_relationship may be an Aggregation_relationship (see 4.2.3.1.1), an Alternate_relationship (see 4.2.3.1.2), or an Event_sequence (see 4.2.3.1.4).

NOTE - Specializations of this relationship may indicate that one Process_definition (see 4.2.3.1.5) follows another.

The data associated with Process_definition_relationship are the following:

— description;

— type.

4.2.3.1.6.1 description

A description specifies a textual explanation or summary of the function or purpose of the Process_-definition_relationship.

EXAMPLE 30 - For a Process_definition_relationship involving a change to an air-cooler, the description might by "Revision 1 of air-cooler".

4.2.3.1.6.2 type

A type specifies the general nature or category of a given Process_definition_relationship.

EXAMPLE 31 - For a Process_definition_relationship involving a new version of a Process_definition (see 4.2.3.1.5), the type might by "Later version of a Process_definition".

4.2.3.1.7 Process_port

A Process_port represents a flow of material, energy, or signal through the boundary of a Process_-definition (see 4.2.3.1.5) or a Process_simulation (see 4.2.3.4.5).

The data associated with a Process_port are the following:

— function;

— normal_flow_direction;

— port_name;

— type.

4.2.3.1.7.1 function

A function specifies the role the flow through the Process_port plays in the Process_definition (see 4.2.3.1.5) or the Process_simulation (see 4.2.3.4.5) that contains the Process_port.

EXAMPLE 32 - For a distillation column, the roles of the port are feeds, overheads, or bottoms.

4.2.3.1.7.2 normal_flow_direction

A normal_flow_direction is an enumerated attribute that specifies the normal direction of the flow through the Process_port. Normal direction defines the meaning of positive and negative flow rates of items associated with the Process_port. The value for normal_flow_direction shall be one of the following:

— inlet;

— outlet;

— static.

4.2.3.1.7.2.1 inlet: an indication that the normal flow direction is through the Process_port into the containing Process_definition (see 4.2.3.1.5) or Process_simulation (see 4.2.3.4.5).

4.2.3.1.7.2.2 outlet: an indication that the normal flow direction is out of the containing Process_-definition (see 4.2.3.1.5) or Process_simulation (see 4.2.3.4.5) through the Process_port.

4.2.3.1.7.2.3 static: an indication that no flow is occurring through the Process_port.

4.2.3.1.7.3 port_name

A port_name is a textual label that uniquely identifies the Process_port.

4.2.3.1.7.4 type

A type specifies an enumerated attribute that specifies what flows through the Process_port. The value of type shall be one of the following:

— energy;

— material;

— signal.

4.2.3.1.7.4.1 energy: an indication the thermal or mechanical energy flows through the Process_port.

4.2.3.1.7.4.2 material: an indication that material flows through the Process_port.

4.2.3.1.7.4.3 signal: an indication that information or a digital or an analog signal flows through the Process_port.

4.2.3.1.8 Process_port_connection

A Process_port_connection is the directed connection of two Process_ports (see 4.2.3.1.7).

The data associated with Process_port_connection are the following:

— description.

A description specifies a textual explanation or summary of key aspects of the Process_port_connection.

4.2.3.1.9 Process_port_stream_case

A Process_port_stream_case is the Stream (see 4.2.3.3.16) defined at the point of the Process_port (see 4.2.3.1.7).

4.2.3.1.10 Process_service

A Process_service is a type of Process_definition (see 4.2.3.1.5) that provides a simple description of a portion of a process. There are no additional attributes required beyond those found in Process_-definition. Process_service is used to describe a Process_definition associated with a Performance_curve (see 4.2.4.1.34), a Port_service_case (see 4.2.4.1.45) used with an Equipment_port (see 4.2.4.1.16), or a Functional_volume_service_case (see 4.2.4.1.22) associated with a Plant_item (see 4.2.4.1.39) capacity. A Process_service may not contain any subordinate Process_definitions.

NOTE - The purpose of Process_service is to indicate what kind of Process_definition is associated with an equipment port, plant item capacity, or performance curve. This recognizes that an equipment port, plant item capacity, or performance curve may be different depending on the service in which it is used.

4.2.3.2 unit_operation

Refer to 4.1.18 for a description of what this UoF specifies. The ARM diagrams related to this UoF are provided as figures G.50 through G.55 in annex G of this part to ISO 10303.

NOTE - A process unit operation specifies a portion of the process that is carried out, it does not specify the physical equipment that implements that process. However, it is a common process engineering practice to characterize or parameterize some unit operations by the hypothetical piece of equipment that might be used to implement that process, typically supplying some key parameters for the equipment. The names and attributes of some types of process unit operation reflect that the unit operation is characterized in such a manner.

4.2.3.2.1 Citation_reference

A Citation_reference is a reference that relates a Process_unit_operation (see 4.2.3.2.5) to a Citation (see 4.2.2.1.1).

The data associated with Citation_reference are the following:

— purpose.

A purpose specifies the intended use of the Citation_reference.

4.2.3.2.2 Fluid_transfer_performance_data_point

A Fluid_transfer_performance_data_point is one data point for the specified or calculated performance of a Uo_compressor_stage (see 4.2.3.2.17).

The data associated with Fluid_transfer_performance_data_point are the following:

— actual_efficiency;

— adiabatic_efficiency;

— delta_pressure;

— head_developed;

— inlet_volume_flow_rate;

— polytropic_efficiency.

4.2.3.2.2.1 actual_efficiency

An actual_efficiency specifies the actual efficiency of the compression stage at the data point.

4.2.3.2.2.2 adiabatic_efficiency

An adiabatic_efficiency specifies the adiabatic efficiency of the compressor stage at the data point.

4.2.3.2.2.3 delta_pressure

A delta_pressure specifies the pressure difference across the compressor stage unit operation at the data point.

4.2.3.2.2.4 head_developed

A head_developed specifies the fluid head developed at the data point.

4.2.3.2.2.5 inlet_volume_flow_rate

An inlet_volume_flow_rate specifies the volumetric flow rate at inlet conditions for the data point.

4.2.3.2.2.6 polytropic_efficiency

A polytropic_efficiency specifies the polytropic efficiency of the compressor stage at the data point.

4.2.3.2.3 Heat_exchanger_internal_data

A Heat_exchanger_internal_data is the collection of data that specifies the thermal performance of a Uo_heat_exchanger_side (see 4.2.3.2.39) at some position or zone along that side.

The data associated with Heat_exchanger_internal_data are the following:

— heat_exchanger_cumulative_duty;

— heat_exchanger_position;

— heat_exchanger_pressure;

— heat_exchanger_temperature.

4.2.3.2.3.1 heat_exchanger_cumulative_duty

A heat_exchanger_cumulative_duty specifies the heat transferred from the inlet of the exchanger through the current zone or position.

4.2.3.2.3.2 heat_exchanger_position

A heat_exchanger_position specifies the location of the heat exchanger in the heat exchanger unit relative to the first exchanger in the unit.

4.2.3.2.3.3 heat_exchanger_pressure

A heat_exchanger_pressure specifies the system pressure at any point within the heat exchanger unit.

4.2.3.2.3.4 heat_exchanger_temperature

A heat_exchanger_temperature specifies the system temperature at any point within the heat exchanger unit.

4.2.3.2.4 Heat_transfer_coefficient

A Heat_transfer_coefficient is the heat transfer coefficient to use when the conditions in the Uo_heat_-exchanger (see 4.2.3.2.37) match its key.

The data associated with Heat_transfer_coefficient are the following:

— coefficient_of_heat_transfer;

— phase_coefficient_key.

4.2.3.2.4.1 coefficient_of_heat_transfer

A coefficient_of_heat_transfer specifies the value of the Heat_transfer_coefficient associated with the Uo_heat_exchanger (see 4.2.3.2.37) in the simulation.

4.2.3.2.4.2 phase_coefficient_key

A phase_coefficient_key specifies an enumerated attribute, that defines the different phases used for the calculation of the Heat_transfer_coefficient in the simulation. The value of the phase_coefficient_key attribute shall be one of the following:

— B-B;

— B-L;

— B-V;

— L-B;

— L-L;

— L-V;

— V-B;

— V-L;

— V-V.

4.2.3.2.4.2.1 B-B**:** an indication of the phase_coefficient_key, defining a shell side boiling liquid - tube side boiling liquid relation, for the Heat_transfer_coefficient in the simulation.

4.2.3.2.4.2.2 B-L**:** an indication of the phase_coefficient_key, defining a shell side boiling liquid - tube side liquid relation, for the Heat_transfer_coefficient in the simulation.

4.2.3.2.4.2.3 B-V**:** an indication of the phase_coefficient_key, defining a shell side boiling liquid - tube side vapour relation, for the Heat_transfer_coefficient in the simulation.

4.2.3.2.4.2.4 L-B**:** an indication of the phase_coefficient_key, defining a shell side liquid - tube side boiling liquid relation, for the Heat_transfer_coefficient in the simulation.

4.2.3.2.4.2.5 L-L**:** an indication of the phase_coefficient_key, defining a shell side liquid- tube side liquid relation, for the Heat_transfer_coefficient in the simulation.

4.2.3.2.4.2.6 L-V**:** an indication of the phase_coefficient_key, defining a shell side liquid - tube side vapour relation, for the Heat_transfer_coefficient in the simulation.

4.2.3.2.4.2.7 V-B**:** an indication of the phase_coefficient_key, defining a shell side vapour - tube side boiling liquid relation, for the Heat_transfer_coefficient in the simulation.

4.2.3.2.4.2.8 V-L**:** an indication of the phase_coefficient_key, defining a shell side vapour - tube side liquid relation, for the Heat_transfer_coefficient in the simulation.

4.2.3.2.4.2.9 V-V**:** an indication of the phase_coefficient_key, defining a shell side vapour - tube side vapour relation, for the Heat_transfer_coefficient in the simulation.

4.2.3.2.5 Process_unit_operation

A Process_unit_operation is a type of Process_definition (see 4.2.3.1.5) that is an abstraction for the chemical and physical transformations that can generally be performed in a Plant_item (see 4.2.4.1.39). Each Process_unit_operation may be one of the following: a Uo_complex_distillation (see 4.2.3.2.15), a Uo_crush (see 4.2.3.2.19), a Uo_distillation (see 4.2.3.2.23), a Uo_fired_heater (see 4.2.3.2.32), a Uo_-flash (see 4.2.3.2.34), a Uo_gas_solid_separation (see 4.2.3.2.36), a Uo_heat_exchanger (see 4.2.3.2.37), a Uo_liquid_solid_separation (see 4.2.3.2.43), a Uo_mix (see 4.2.3.2.46), a Uo_pipeline (see 4.2.3.2.49), a Uo_pipeline_node (see 4.2.3.2.50), a Uo_pipeline_segment (see 4.2.3.2.51), a Uo_pressure_change (see 4.2.3.2.55), a Uo_reactor (see 4.2.3.2.57), a Uo_screen (see 4.2.3.2.60), a Uo_solids_drying (see 4.2.3.2.67), or a Uo_split (see 4.2.3.2.69).

> NOTE - A Process_unit_operation specifies a portion of the process that is carried out, it does not specify the physical equipment that implements that process. However, it is a common process engineering practice to characterize or parameterize some unit operations by the hypothetical piece of equipment that might be used to implement that process, typically supplying some key parameters for the equipment. The names and attributes of some subtypes of Process_unit_operation reflect that the unit operation is characterized in such a manner.

The data associated with Process_unit_operation are the following:

— process_unit_operation_type.

A process_unit_operation_type specifies a simple type discriminator.

> EXAMPLE 33 - Process_unit_operation_types include Uo_complex_distillation and Uo_crush.

4.2.3.2.6 Reactor_yield

A Reactor_yield is the reactor yield associated with the Uo_specified_yield_reactor (see 4.2.3.2.68) for one Substance (see 4.2.2.2.20) in one Phase (see 4.2.2.2.15).

The data associated with Reactor_yield are the following:

— mass_ratio;

— mole_ratio.

4.2.3.2.6.1 mass_ratio

A mass_ratio specifies the Reactor_yield, expressed as a mass ratio, associated with the Uo_specified_-yield_reactor (see 4.2.3.2.68) in the simulation.

4.2.3.2.6.2 mole_ratio

A mole_ratio specifies the Reactor_yield, expressed as a mole ratio, associated with the Uo_specified_-yield_reactor (see 4.2.3.2.68) in the simulation.

4.2.3.2.7 Stage_column_section

A Stage_column_section is a group of contiguous Uo_distillation_stages (see 4.2.3.2.24) within a Uo_-distillation. The grouping of stages into a section allows the stages to be assigned some common or average properties over the entire section.

The data associated with a Stage_column_section are the following:

— section_diameter;

— stage_range.

4.2.3.2.7.1 section_diameter

A section_diameter specifies the actual or the nominal inside diameter of the column throughout the section.

4.2.3.2.7.2 stage_range

A stage_range specifies the range of stage numbers that specifies what stages are in the section.

4.2.3.2.8 Stream_separation_specification

A Stream_separation_specification is a collection of values defining the separation for one Substance (see 4.2.2.2.20) in the inlet Stream(s) (see 4.2.3.3.16) of a Uo_substance_split (see 4.2.3.2.71).

The data associated with Stream_separation_specification are the following:

— separation_fraction;

— separation_mass_flow;

— separation_mole_flow;

— separation_residual_fraction;

— separation_standard_volume_flow.

4.2.3.2.8.1 separation_fraction

A separation_fraction specifies the fraction of the Substance (see 4.2.2.2.20) in the inlet that is present in the outlet.

NOTE - If no inlet is given then it is for all inlets to the unit operation.

4.2.3.2.8.2 separation_mass_flow

A separation_mass_flow specifies the mass flow of the Substance (see 4.2.2.2.20) in the outlet.

4.2.3.2.8.3 separation_mole_flow

A separation_mole_flow specifies the mole flow the Substance (see 4.2.2.2.20) in the outlet.

4.2.3.2.8.4 separation_residual_fraction

A separation_residual_fraction specifies the fraction in the outlet of all of the Substance (see 4.2.2.2.20) that is not specified elsewhere.

4.2.3.2.8.5 separation_standard_volume_flow

A separation_standard_volume_flow specifies the volumetric flow of the Substance (see 4.2.2.2.20) in the outlet at a Reference_state (see 4.2.2.2.17).

4.2.3.2.9 Stream_split_specification

A Stream_split_specification is the specification of the split of an inlet Stream (see 4.2.3.3.16) into an outlet Stream for a stream splitter.

NOTE - If no inlet Stream (see 4.2.3.3.16) is given, then the total of all inlet Streams to the unit operation is used.

The data associated with Stream_split_specification are the following:

— stream_split_fraction;

— stream_split_mass_flow;

— stream_split_mole_flow;

— stream_split_residual_fraction;

— stream_split_standard_volume_flow;

— stream_split_volume_flow.

4.2.3.2.9.1 stream_split_fraction

A stream_split_fraction specifies the fraction of the inlet split to the outlet in the Stream_split_-specification.

4.2.3.2.9.2 stream_split_mass_flow

A stream_split_mass_flow specifies the mass flow of the outlet of the Stream (see 4.2.3.3.16) split.

4.2.3.2.9.3 stream_split_mole_flow

A stream_split_mole_flow specifies the mole flow of the outlet of the Stream (see 4.2.3.3.16) split.

4.2.3.2.9.4 stream_split_residual_fraction

A stream_split_residual_fraction specifies the fraction of the outlet of anything that is not elsewhere specified.

4.2.3.2.9.5 stream_split_standard_volume_flow

A stream_split_standard_volume_flow specifies the volume flow of the outlet of the Stream (see 4.2.3.3.16) split at a Reference_state (see 4.2.2.2.17).

4.2.3.2.9.6 stream_split_volume_flow

A stream_split_volume_flow specifies the volume flow of the outlet of the Stream (see 4.2.3.3.16) split.

4.2.3.2.10 Uo_air_cooled_heat_exchanger

A Uo_air_cooled_heat_exchanger is a type of Process_unit_operation (see 4.2.3.2.5) that provides the capability to exchange heat between two Material_streams (see 4.2.3.3.7). One Material_stream flows through a tube bundle that is open to the atmosphere. Air is passed by the tube bundle by means of a fan.

4.2.3.2.11 Uo_centrifugal_compressor

A Uo_centrifugal_compressor is a type of Uo_compressor (see 4.2.3.2.16) that is the process performed by a Centrifugal_compressor (see 4.2.4.5.14).

The data associated with Uo_centrifugal_compressor are the following:

— radial_frequency.

A radial_frequency specifies the rotational speed of the Uo_centrifugal_compressor.

4.2.3.2.12 Uo_centrifugal_compressor_stage

A Uo_centrifugal_compressor_stage is a type of Uo_compressor_stage (see 4.2.3.2.17) that represents the process performed by a single stage for a Centrifugal_compressor (see 4.2.4.5.14).

The data associated with Uo_centrifugal_compressor_stage are the following:

— design_flowrate;

— design_head;

— design_speed;

— isentropic_efficiency;

— stage_number.

4.2.3.2.12.1 design_flowrate

A design_flowrate specifies the volumetric flowrate for the compressor at the design_speed.

4.2.3.2.12.2 design_head

A design_head specifies the head developed for the compressor at the design_speed.

4.2.3.2.12.3 design_speed

A design_speed specifies the design rotational speed (radial_frequency) of the compressor.

4.2.3.2.12.4 isentropic_efficiency

An isentropic_efficiency specifies the ideal efficiency of the Uo_centrifugal_compressor_stage.

4.2.3.2.12.5 stage_number

A stage_number specifies the order of the Uo_centrifugal_compressor_stages within the Uo_-centrifugal_compressor (see 4.2.3.2.11).

4.2.3.2.13 Uo_centrifuge

A Uo_centrifuge is a type of Uo_liquid_solid_separation (see 4.2.3.2.43) where the separation is achieved via a centrifuge. Mechanical energy is used to create a spinning motion that separates solids from liquids.

The data associated with Uo_centrifuge are the following:

— cake_surface_radius;

— diameter;

— filter_cake_compressibility_factor;

— filter_cake_particle_diameter;

— filter_cake_particle_sphericity;

— filter_cake_percent_solid;

— filter_cake_porosity;

— filter_cake_specific_resistance;

— filter_cloth_resistance;

— frequency;

— height;

— liquid_surface_radius.

4.2.3.2.13.1 cake_surface_radius

A cake_surface_radius specifies the inside radius of the surface of the solids caked, or pressed against, the rotating side of the centrifuge.

4.2.3.2.13.2 diameter

A diameter specifies the diameter associated with the unit operation, of the Uo_centrifuge.

4.2.3.2.13.3 filter_cake_compressibility_factor

A filter_cake_compressibility_factor specifies the compressibility factor of the filter cake layer associated with the unit operation, Uo_centrifuge.

4.2.3.2.13.4 filter_cake_particle_diameter

A filter_cake_particle_diameter specifies the average diameter of particles in the cake associated with the unit operation, of the Uo_centrifuge.

4.2.3.2.13.5 filter_cake_particle_sphericity

A filter_cake_particle_sphericity specifies a numeric value between 0.0 and 1.0 that indicates the average roundness of a solid particle for use in filtration calculations.

NOTE - A number close to 1.0 indicates an average particle sphericity similar to round balls. A number close to 0.0 indicates a very irregular average particle sphericity.

4.2.3.2.13.6 filter_cake_percent_solid

A filter_cake_percent_solid specifies the ratio of the amount of solids in the filter cake to the total amount of filter cake for the unit operation, of the Uo_centrifuge.

4.2.3.2.13.7 filter_cake_porosity

A filter_cake_porosity specifies the ratio of void volume to total volume of the filter cake associated with the unit operation, of the Uo_centrifuge.

4.2.3.2.13.8 filter_cake_specific_resistance

A filter_cake_specific_resistance specifies the specific resistance associated with the Uo_centrifuge.

4.2.3.2.13.9 filter_cloth_resistance

A filter_cloth_resistance specifies the resistance of the cloth for the Uo_centrifuge.

4.2.3.2.13.10 frequency

A frequency specifies the frequency of the spinning element for the Uo_centrifuge.

4.2.3.2.13.11 height

A height specifies the height of the centrifuge for the Uo_centrifuge.

4.2.3.2.13.12 liquid_surface_radius

A liquid_surface_radius specifies the radius of the liquid layer.

4.2.3.2.14 Uo_completely_stirred_reactor

A Uo_completely_stirred_reactor is a type of Uo_reactor (see 4.2.3.2.57) that represents a completely (ideal) stirred reactor unit operation.

The data associated with Uo_completely_stirred_reactor are the following:

— maximum_volume;

— residence_time;

— volume.

4.2.3.2.14.1 maximum_volume

A maximum_volume specifies the maximum reaction phase volume.

NOTE - This is used to calculate the volume of a boiling pot reactor.

4.2.3.2.14.2 residence_time

A residence_time specifies the residence time associated with the unit operation of the Uo_completely_-stirred_reactor.

4.2.3.2.14.3 volume

A volume specifies the reactor volume associated with the unit operation of the Uo_completely_stirred_-reactor.

4.2.3.2.15 Uo_complex_distillation

A Uo_complex_distillation is a type of Process_unit_operation (see 4.2.3.2.5) that is two or more interconnected Uo_distillation (see 4.2.3.2.23) unit operations.

4.2.3.2.16 Uo_compressor

A Uo_compressor is a type of Uo_pressure_change (see 4.2.3.2.55) that is the process performed by an equipment that mechanically compresses a gas Stream (see 4.2.3.3.16). Each Uo_compressor may be one of the following: a Uo_centrifugal_compressor (see 4.2.3.2.11) or a Uo_positive_displacement_-compressor (see 4.2.3.2.53).

The data associated with Uo_compressor are the following:

— cooler_differential_pressure;

— cooler_temperature;

— number_of_stages;

— overall_isentropic_efficiency;

— overall_polytropic_efficiency.

4.2.3.2.16.1 cooler_differential_pressure

A cooler_differential_pressure specifies the pressure drop across the compressor after-cooler.

4.2.3.2.16.2 cooler_temperature

A cooler_temperature specifies the outlet temperature for the compressor after-cooler.

4.2.3.2.16.3 number_of_stages

A number_of_stages specifies the number of stages in the Uo_compressor.

4.2.3.2.16.4 overall_isentropic_efficiency

An overall_isentropic_efficiency specifies the overall isentropic efficiency for the compressor.

4.2.3.2.16.5 overall_polytropic_efficiency

An overall_polytropic_efficiency specifies the overall polytropic efficiency for the compressor.

4.2.3.2.17 Uo_compressor_stage

A Uo_compressor_stage is a type of Uo_pressure_change (see 4.2.3.2.55) that is the process performed by one of a series of mechanical gas compression stages in a Uo_compressor (see 4.2.3.2.16) unit operation. Each Uo_compressor_stage may be one of the following: a Uo_centrifugal_compressor_stage (see 4.2.3.2.12), a Simulation_polytropic_compressor_stage (see 4.2.3.4.26), or a Uo_positive_-displacement_compressor_stage (see 4.2.3.2.54).

The data associated with Uo_compressor_stage are the following:

— cooler_differential_pressure;

— cooler_temperature.

4.2.3.2.17.1 cooler_differential_pressure

A cooler_differential_pressure specifies the pressure drop across the compressor stage after-cooler.

4.2.3.2.17.2 cooler_temperature

A cooler_temperature specifies the outlet temperature for the compressor stage after-cooler.

4.2.3.2.18 Uo_countercurrent_solids_decant

A Uo_countercurrent_solids_decant is a type of Uo_liquid_solid_separation (see 4.2.3.2.43) where the unit operation represents the separation of solids from a liquid Stream (see 4.2.3.3.16) by a series of decanting stages where the liquids and solids move from stage to stage in opposite directions.

The data associated with Uo_countercurrent_solids_decant are the following:

— heavy_key_recovery;

— light_key_recovery;

— stages.

4.2.3.2.18.1 heavy_key_recovery

A heavy_key_recovery specifies the recovery of one selected solid Chemical_component (see 4.2.2.2.4), the ratio of the amount of Chemical_component in the slurry feed Stream (see 4.2.3.3.16) to the amount of the Chemical_component in the solid outlet Stream, for the countercurrent decant.

4.2.3.2.18.2 light_key_recovery

A light_key_recovery specifies the recovery of one selected liquid Chemical_component (see 4.2.2.2.4), the ratio of the amount of Chemical_component in the slurry feed Stream (see 4.2.3.3.16) to the amount of the Chemical_component in the liquid outlet Stream, for the countercurrent decant.

4.2.3.2.18.3 stages

A stages specifies the number of identical countercurrent stages in the decant process.

4.2.3.2.19 Uo_crush

A Uo_crush is a type of Process_unit_operation (see 4.2.3.2.5) which is the grinding of a solid into smaller particles.

The data associated with Uo_crush are the following:

— crusher_type;

— operating_mode;

— outlet_diameter.

4.2.3.2.19.1 crusher_type

A crusher_type specifies the type of crusher that performs the Uo_crush. The value of the crusher_type attribute shall be one of the following:

— cage_mill;

— gyratory_jaw;

— multiple_roll;

— single_roll.

4.2.3.2.19.1.1 cage_mill**:** an indication the crusher is a cage mill type for the Uo_crush.

4.2.3.2.19.1.2 gyratory_jaw**:** an indication that the crusher is a gyratory or jaw type for the Uo_crush.

4.2.3.2.19.1.3 multiple_roll**:** an indication the crusher is a multiple roller type for the Uo_crush.

4.2.3.2.19.1.4 single_roll**:** an indication that the crusher is a single roller type for the Uo_crush.

4.2.3.2.19.2 operating_mode

An operating_mode specifies an enumerated attribute indicating whether the Uo_crush is a primary or secondary crush operation. The value of the operating_mode attribute shall be one of the following:

— primary;

— secondary.

4.2.3.2.19.2.1 primary**:** an indication that the crusher is operating as a primary crusher.

4.2.3.2.19.2.2 secondary**:** an indication that the crusher is operating as a secondary crusher.

4.2.3.2.19.3 outlet_diameter

An outlet_diameter specifies the outlet diameter of the crushed solids.

4.2.3.2.20 Uo_crystallization

A Uo_crystallization is a type of Uo_liquid_solid_separation (see 4.2.3.2.43) that is the separation of a dissolved solid from a liquid Stream (see 4.2.3.3.16) by crystallization.

> NOTE - Crystallization is used in industrial processes for the manufacturing of organics, inorganics, fertilizers, biochemicals, and polymers.

The data associated with Uo_crystallization are the following:

— duty;

— exchanger_delta_temperature;

— fraction;

— magma_density;

— outlet_pressure;

— pressure_drop;

— rate;

— recirculation_flow_rate;

— saturation_ratio;

— solute;

— solute_recovery;

— solvent;

— solvent_loss;

— temperature;

— volume.

4.2.3.2.20.1 duty

A duty specifies the heat removed from the Uo_crystallization.

4.2.3.2.20.2 exchanger_delta_temperature

An exchanger_delta_temperature specifies the temperature difference across a heat exchanger that performs the heat removal from the Uo_crystallization.

4.2.3.2.20.3 fraction

A fraction specifies the mole fraction of dissolved key solid component in the feed that is recovered in the crystallized bottom product Stream (see 4.2.3.3.16).

4.2.3.2.20.4 magma_density

A magma_density specifies the required density of the bottoms product Stream (see 4.2.3.3.16).

4.2.3.2.20.5 outlet_pressure

An outlet_pressure specifies the pressure at the outlet of the Uo_crystallization.

4.2.3.2.20.6 pressure_drop

A pressure_drop specifies the difference between the inlet pressure and the outlet pressure of the Uo_-crystallization.

4.2.3.2.20.7 rate

A rate specifies the rate of crystal formation in the crystallization.

4.2.3.2.20.8 recirculation_flow_rate

A recirculation_flow_rate specifies the amount of saturated magma that is recirculated from the outlet of the Uo_crystallization to the inlet.

4.2.3.2.20.9 saturation_ratio

A saturation_ratio specifies the supersaturation ratio of the key solid component in the bulk liquid of the crystallization process, that difference in the mole fraction of the key solid component in the bulk liquid and the equilibrium mole fraction of the key component divided by that equilibrium mole fraction.

4.2.3.2.20.10 solute

A solute specifies the component name for the crystal solute.

4.2.3.2.20.11 solute_recovery

A solute_recovery specifies the ratio of the amount of solute crystallized to the amount of solute dissolved in the feed.

4.2.3.2.20.12 solvent

A solvent specifies the component name for the predominant solvent component.

4.2.3.2.20.13 solvent_loss

A solvent_loss specifies the difference between the amount of solvent in the feed to the amount of solvent in the liquid portion of the outlet of the Uo_crystallization.

4.2.3.2.20.14 temperature

A temperature specifies the operating temperature of the Uo_crystallization.

4.2.3.2.20.15 volume

A volume specifies the internal volume of the Uo_crystallization.

4.2.3.2.21 Uo_cyclone

A Uo_cyclone is a type of Uo_gas_solid_separation (see 4.2.3.2.36) that is the process performed by a cyclone. A cyclone derives centrifugal force from the inlet gas pressure causing solids to accumulate in the base.

The data associated with Uo_cyclone are the following:

— cone_length;

— diameter;

— inlet_height;

— inlet_width;

— length;

— number_of_gas_turns;

— number_of_parallel_cyclones;

— overflow_diameter;

— overflow_length;

— type;

— underflow_diameter;

— vane_constant.

4.2.3.2.21.1 cone_length

A cone_length specifies the length of the cone of the cyclone.

4.2.3.2.21.2 diameter

A diameter specifies the inside diameter of the entrance section(s) for the cyclone.

4.2.3.2.21.3 inlet_height

An inlet_height specifies the height of the inlet gas duct for the cyclone.

4.2.3.2.21.4 inlet_width

An inlet_width specifies the width of the inlet gas duct for the cyclone.

4.2.3.2.21.5 length

A length specifies the overall length for the cyclone.

4.2.3.2.21.6 number_of_gas_turns

A number_of_gas_turns specifies the number of turns in the cyclone.

4.2.3.2.21.7 number_of_parallel_cyclones

A number_of_parallel_cyclones specifies the number of parallel stages in the cyclone.

4.2.3.2.21.8 overflow_diameter

An overflow_diameter specifies the inside diameter of the cyclone at the overflow outlet for the cyclone.

4.2.3.2.21.9 overflow_length

An overflow_length specifies the length of the cyclone at the overflow outlet for the cyclone.

4.2.3.2.21.10 type

A type specifies the type of the cyclone performing the Uo_cyclone.

4.2.3.2.21.11 underflow_diameter

An underflow_diameter specifies the inside diameter of the cyclone at the underflow outlet for the cyclone.

4.2.3.2.21.12 vane_constant

A vane_constant specifies the parameter for the effect of the gas vanes present in the cyclone.

4.2.3.2.22 Uo_dissolve

A Uo_dissolve is a type of Uo_liquid_solid_separation (see 4.2.3.2.43) that is a part of a solid Stream (see 4.2.3.3.16) preferentially dissolving into a solvent Stream.

The data associated with Uo_dissolve are the following:

— dissolution_fraction;

— dissolution_rate;

— duty;

— outlet_pressure;

— pressure_drop;

— solute;

— solute_recovery;

— solvent;

— solvent_loss;

— temperature;

— temperature_change_outlet_to_inlet;

— volume.

4.2.3.2.22.1 dissolution_fraction

A dissolution_fraction specifies the fraction of the total solute in the combined feeds that is to be dissolved.

4.2.3.2.22.2 dissolution_rate

A dissolution_rate specifies the rate that the solid dissolves in the solvent.

4.2.3.2.22.3 duty

A duty specifies the amount of heat supplied to or removed from the Uo_dissolve.

4.2.3.2.22.4 outlet_pressure

An outlet_pressure specifies the pressure at the outlet of the Uo_dissolve.

4.2.3.2.22.5 pressure_drop

A pressure_drop specifies the difference between the outlet pressure and the inlet pressure for the Uo_-dissolve.

4.2.3.2.22.6 solute

A solute specifies the component name for the crystal solute.

4.2.3.2.22.7 solute_recovery

A solute_recovery specifies the ratio of the amount of the solute dissolved in the outlet solvent Stream (see 4.2.3.3.16) to the amount present in the inlet solid Stream for the Uo_dissolve.

4.2.3.2.22.8 solvent

A solvent specifies the component name for the predominant solvent component.

4.2.3.2.22.9 solvent_loss

A solvent_loss specifies the difference between the amount of solvent in the outlet Stream (see 4.2.3.3.16) to the amount of solvent supplied in the inlet solvent Stream for the Uo_dissolve.

4.2.3.2.22.10 temperature

A temperature specifies the temperature of the Uo_dissolve.

4.2.3.2.22.11 temperature_change_outlet_to_inlet

A temperature_change_outlet_to_inlet specifies the temperature change between outlet and inlet of the Uo_dissolve.

4.2.3.2.22.12 volume

A volume specifies the internal volume of the Uo_dissolve.

4.2.3.2.23 Uo_distillation

A Uo_distillation is a type of Process_unit_operation (see 4.2.3.2.5) that is the separation of a liquid inlet Stream (see 4.2.3.3.16) into a lighter overhead liquid, a heavier bottoms liquid, and a possible overhead vapour Stream using distillation.

The data associated with Uo_distillation are the following:

— condenser_duty;

— condenser_subcooling;

— condenser_temperature;

— distillation_bottom_pressure;

— distillation_to_feed_ratio;

— distillation_top_pressure;

— distillation_type;

— feed_stage_number;

— feed_quality;

— heavy_key_recovery;

— height_equivalent_to_theoretical_plate;

— light_key_recovery;

— number_of_stages;

— reboiler_baffle;

— reboiler_duty;

— reboiler_type;

— reflux_ratio;

— stage_numbering_convention;

— total_or_partial_condenser.

4.2.3.2.23.1 condenser_duty

A condenser_duty specifies the heat removed by the overhead condenser heat exchanger associated with the unit operation, of the Uo_distillation.

4.2.3.2.23.2 condenser_subcooling

A condenser_subcooling specifies the degrees of subcooling of the reflux Stream (see 4.2.3.3.16) in the rigorous distillation input.

4.2.3.2.23.3 condenser_temperature

A condenser_temperature specifies the temperature in the condenser in the rigorous distillation input.

4.2.3.2.23.4 distillation_bottom_pressure

A distillation_bottom_pressure specifies the pressure of the bottom tray or stage of the unit operation, Uo_distillation.

4.2.3.2.23.5 distillation_to_feed_ratio

A distillation_to_feed_ratio specifies the ratio of the distillate to the feed in the Uo_distillation.

4.2.3.2.23.6 distillation_top_pressure

A distillation_top_pressure specifies the condenser pressure associated with the unit operation, of the Uo_distillation.

4.2.3.2.23.7 distillation_type

A distillation_type specifies an enumerated attribute for the type of distillation in the Uo_distillation. The value of the distillation_type attribute shall be one of the following:

— absorb;

— extraction;

— fractionation;

— stripping.

4.2.3.2.23.7.1 absorb**:** an indication that the distillation is an absorber.

4.2.3.2.23.7.2 extraction**:** an indication that the distillation is an extractor.

4.2.3.2.23.7.3 fractionation**:** an indication that the distillation is a fractionator.

4.2.3.2.23.7.4 stripping**:** an indication that the distillation is a stripper.

4.2.3.2.23.8 feed_stage_number

A feed_stage_number specifies the number of the feed stage for the Uo_distillation.

4.2.3.2.23.9 feed_quality

A feed_quality specifies the thermal quality of the feed Stream (see 4.2.3.3.16). The thermal quality is the ratio between the amount of energy required to convert the feed to a saturated vapour and the amount of energy required to convert a saturated liquid of the same composition as the feed to a saturated vapour.

4.2.3.2.23.10 heavy_key_recovery

A heavy_key_recovery specifies the heavy key recovery from the Uo_distillation. It is the moles of heavy key in the bottoms per mole of heavy key in the feed.

4.2.3.2.23.11 height_equivalent_to_theoretical_plate

A height_equivalent_to_theoretical_plate specifies the height of continuous counter-current contact of vapour and liquid to that which provides the same separation as one ideal distillation stage for the Uo_-distillation.

4.2.3.2.23.12 light_key_recovery

A light_key_recovery specifies the light key recovery from the Uo_distillation. It is the moles of light key in the overhead per mole of light key in the feed.

4.2.3.2.23.13 number_of_stages

A number_of_stages specifies either the number of theoretical stages or the number of actual stages in the Uo_distillation.

4.2.3.2.23.14 reboiler_baffle

A reboiler_baffle specifies the height of the liquid sump overflow baffle in the reboiler.

4.2.3.2.23.15 reboiler_duty

A reboiler_duty specifies the amount of heat transferred to the reboiler of the Uo_distillation.

4.2.3.2.23.16 reboiler_type

A reboiler_type specifies an enumerated attribute that specifies the type of reboiler that is attached to the Uo_distillation. The value of reboiler_type shall be one of the following:

— forced_circulation;

— kettle;

— none;

— thermosyphon.

4.2.3.2.23.16.1 forced_circulation**:** an indication that the Uo_distillation column is equipped with a reboiler circuit that uses forced circulation.

4.2.3.2.23.16.2 kettle**:** an indication that the Uo_distillation column reboiler is a kettle type reboiler.

4.2.3.2.23.16.3 none**:** an indication that the Uo_distillation column does not have a reboiler.

4.2.3.2.23.16.4 thermosyphon**:** an indication that the Uo_distillation column reboiler is a thermosyphon type reboiler.

4.2.3.2.23.17 reflux_ratio

A reflux_ratio specifies the ratio of the amount of liquid returned from the condenser to the top tray, reflux, to the amount of liquid removed as product from the condenser, distillate, for the Uo_distillation.

4.2.3.2.23.18 stage_numbering_convention

A stage_numbering_convention specifies an enumerated attribute describing the stage numbering convention for the Uo_distillation. The value of the stage_numbering_convention attribute shall be one of the following:

— bottom_up;

— top_down.

4.2.3.2.23.18.1 bottom_up**:** an indication the stages are numbered from bottom to the top in the Uo_-distillation.

4.2.3.2.23.18.2 top_down**:** an indication the stages are numbered from top to bottom in the Uo_-distillation.

4.2.3.2.23.19 total_or_partial_condenser

A total_or_partial_condenser specifies whether or not a total condenser is used in the Uo_distillation.

4.2.3.2.24 Uo_distillation_stage

A Uo_distillation_stage is a type of Process_definition (see 4.2.3.1.5) that is the contact and subsequent disengagement of a condensing vapour Stream (see 4.2.3.3.16) and a boiling liquid Stream in a distillation column. The Uo_distillation_stage may be the representation of a real or ideal stage. A Uo_-distillation_stage may represent a tray in a distillation column, the condenser in a column, or the reboiler in a column.

> NOTE - A distillation tower that uses physical trays is composed of one or more internal trays. A distillation tower that uses packing typically does not contain a stage.

The data associated with Uo_distillation_stage are the following:

— condenser_stage;

— distillation_stage_number;

— distillation_stage_pressure;

— distillation_stage_temperature;

— external_heat_exchanger_duty;

— hole_diameter;

— number_of_holes;

— reboiler_stage;

— stage_area;

— stage_type;

— volume_liquid;

— volume_vapour;

— weir_height;

— weir_length.

4.2.3.2.24.1 condenser_stage

A condenser_stage specifies that the Uo_distillation_stage represents a vapour condenser at the top of the distillation column.

NOTE - A condenser_stage is the first stage in a distillation tower. The typical convention is that the condenser_stage is numbered 1.

4.2.3.2.24.2 distillation_stage_number

The distillation_stage_number specifies the relative position of the Uo_distillation_stage in a Uo_-distillation (see 4.2.3.2.23).

NOTE - The typical convention is to number the stages starting from the top of the distillation tower. However, if a condenser is present, the first stage is specified as number 2 rather than 1.

4.2.3.2.24.3 distillation_stage_pressure

A distillation_stage_pressure specifies the operating pressure of the Uo_distillation_stage.

4.2.3.2.24.4 distillation_stage_temperature

A distillation_stage_temperature specifies the average operating temperature of the liquid on the Uo_-distillation_stage.

4.2.3.2.24.5 external_heat_exchanger_duty

An external_heat_exchanger_duty specifies the amount of heat supplied or removed from the Uo_-distillation_stage by an external heat exchanger.

NOTE - To accomplish this, one side of a heat exchanger is attached to an internal tray.

4.2.3.2.24.6 hole_diameter

A hole_diameter specifies the size of a single vapour opening onto the stage.

NOTE - The typical types of holes are valve, sieve, or bubble cap.

4.2.3.2.24.7 number_of_holes

A number_of_holes specifies how many vapour openings are present on the stage.

4.2.3.2.24.8 reboiler_stage

A reboiler_stage specifies an indication that the Uo_distillation_stage represents the distillation column's bottom liquid reboiler.

NOTE - The typical convention is that the reboiler_stage is numbered n where n is the total number of stages in the tower.

4.2.3.2.24.9 stage_area

A stage_area specifies the surface area of the contacting portion of the stage.

NOTE - The stage_area is typically close to the cross sectional area of the distillation unit taking into account the seals between the trays and the inside of the tower.

4.2.3.2.24.10 stage_type

A stage_type specifies an enumerated attribute that specifies the mechanism by which the vapour is brought into contact on the Uo_distillation_stage. A stage_type may also specify the type of actual tray the stage represents. The value of the stage_type attribute shall be one of the following:

— bubble_cap;

— ideal_tray;

— packed;

— sieve_tray;

— valve_tray.

4.2.3.2.24.10.1 bubble_cap**:** an indication that the stage represents a tray equipped with risers and bubble caps.

4.2.3.2.24.10.2 ideal_tray**:** an indication that the stage represents a generic distillation tray that operates under complete phase equilibrium conditions.

4.2.3.2.24.10.3 packed**:** an indication that the stage represents a volume of tower packing.

4.2.3.2.24.10.4 sieve_tray**:** an indication that the stage represents a sieve type distillation tray.

4.2.3.2.24.10.5 valve_tray**:** an indication that the stage represents a tray equipped with vapour valves.

4.2.3.2.24.11 volume_liquid

A volume_liquid specifies the total liquid volumetric holdup on the stage.

NOTE - This value can be expressed on either a mole or mass basis. For example, the stage contains 25 kilograms of liquid material on the stage.

4.2.3.2.24.12 volume_vapour

A volume_vapour specifies the total vapour volumetric holdup on the stage.

NOTE - This value can be expressed on either a mole or mass basis. For example, the stage contains 0.1 kilograms of vapour material above the stage.

4.2.3.2.24.13 weir_height

A weir_height specifies the height of the weir for the Uo_distillation_stage.

NOTE - The weir is a lip above the tray next to the downcomer that is used to maintain a liquid volume on the stage.

4.2.3.2.24.14 weir_length

A weir_length specifies the distance through which flow proceeds down the downcomer to the stage below.

NOTE - For a single pass tray, the weir_length is the distance from the wall of the tower to the edge of the weir. Specification of the weir_length for trays that have multiple flow paths is a little more difficult. One needs to know the distance between the weirs. Based on the location of the weir on the stage and the length, the weir_length can be determined.

4.2.3.2.25 Uo_distillation_stage_phase_pump_around

A Uo_distillation_stage_phase_pump_around is a type of Process_definition_relationship (see 4.2.3.1.6) that represents the transfer or pumping of some of the liquid Stream (see 4.2.3.3.16) on one stage or tray to a second tray or stage. A Uo_distillation_stage_phase_pump_around may pass through a heat exchanger before being returned to the second stage.

NOTE - The relating definition specifies the previous stage and the related definition specifies the subsequent stage.

The data associated with Uo_distillation_stage_phase_pump_around are the following:

— heat_duty;

— liquid_fraction;

— mass_flow_rate;

— mole_flow_rate;

— on_or_above_stage;

— pressure;

— temperature.

4.2.3.2.25.1 heat_duty

A heat_duty specifies the amount of heat removed from the pump around between the two stages.

4.2.3.2.25.2 liquid_fraction

A liquid_fraction specifies the ratio of the amount of liquid to the total amount of fluid in the pump around at the return to the distillation column.

4.2.3.2.25.3 mass_flow_rate

A mass_flow_rate specifies the amount of material being transferred by the pump around on a mass basis.

4.2.3.2.25.4 mole_flow_rate

A mole_flow_rate specifies the amount of material being transferred by the pump around on a molar basis.

4.2.3.2.25.5 on_or_above_stage

An on_or_above_stage specifies an enumerated attribute indicating where the pump around returns to as on stage or above stage.

4.2.3.2.25.6 pressure

A pressure specifies the pressure of the pump-around at the return to the distillation column.

4.2.3.2.25.7 temperature

A temperature specifies the temperature that the pump-around returns to the distillation column.

4.2.3.2.26 Uo_double_pipe_heat_exchanger

A Uo_double_pipe_heat_exchanger is a type of Process_unit_operation (see 4.2.3.2.5) that is the exchange of heat between two Material_streams (see 4.2.3.3.7) where the process is performed by one Material_stream flowing through a tube contained within a larger tube where the other Material_stream flows.

4.2.3.2.27 Uo_electrostatic_precipitator

A Uo_electrostatic_precipitator is a type of Uo_gas_solid_separation (see 4.2.3.2.36) that is the process performed by an electrostatic precipitator. An electrostatic precipitator generates an electrical charge to attract solids from the inlet gas.

The data associated with Uo_electrostatic_precipitator are the following:

— breakage_voltage;

— gas_velocity_maximum;

— gas_velocity_minimum;

— number_of_plates;

— plate_height;

— plate_height_maximum;

— plate_length;

— plate_length_maximum;

— plate_length_minimum;

— plate_to_wire_distance;

— plate_width_maximum;

— wire_diameter;

— wire_roughness.

4.2.3.2.27.1 breakage_voltage

A breakage_voltage specifies the breakage voltage for the electrostatic precipitator.

4.2.3.2.27.2 gas_velocity_maximum

A gas_velocity_maximum specifies the maximum gas velocity for the electrostatic precipitator.

4.2.3.2.27.3 gas_velocity_minimum

A gas_velocity_minimum specifies the minimum gas velocity for the electrostatic precipitator.

4.2.3.2.27.4 number_of_plates

A number_of_plates specifies the number of plates in the electrostatic precipitator.

4.2.3.2.27.5 plate_height

A plate_height specifies the plate height for the electrostatic precipitator.

4.2.3.2.27.6 plate_height_maximum

A plate_height_maximum specifies the maximum plate height for the electrostatic precipitator.

4.2.3.2.27.7 plate_length

A plate_length specifies the plate length for the electrostatic precipitator.

4.2.3.2.27.8 plate_length_maximum

A plate_length_maximum specifies the maximum plate length of the electrostatic precipitator.

4.2.3.2.27.9 plate_length_minimum

A plate_length_minimum specifies the minimum plate length of the electrostatic precipitator.

4.2.3.2.27.10 plate_to_wire_distance

A plate_to_wire_distance specifies the plate to wire distance for the electrostatic precipitator.

4.2.3.2.27.11 plate_width_maximum

A plate_width_maximum specifies the maximum plate width of the electrostatic precipitator.

4.2.3.2.27.12 wire_diameter

A wire_diameter specifies the diameter of the wire associated with the unit operation, of the electrostatic precipitator.

4.2.3.2.27.13 wire_roughness

A wire_roughness specifies the wire roughness associated with the electrostatic precipitator.

4.2.3.2.28 Uo_expander

A Uo_expander is a type of Uo_fluid_transfer (see 4.2.3.2.35) that is the production of mechanical energy by the expansion of a gas, typically across a turbine.

The data associated with Uo_expander are the following:

— design_flowrate;

— design_head;

— design_speed;

— pressure_design;

— radial_frequency.

4.2.3.2.28.1 design_flowrate

A design_flowrate specifies the volumetric flow to the inlet of the expander performing the expansion.

4.2.3.2.28.2 design_head

A design_head specifies the head developed for the expander at the design_speed.

4.2.3.2.28.3 design_speed

A design_speed specifies the design rotational speed (i.e., rotational_frequency) of the expander.

4.2.3.2.28.4 pressure_design

A pressure_design specifies the outlet pressure of the Uo_expander.

4.2.3.2.28.5 radial_frequency

A radial_frequency specifies the speed that the Uo_expander rotates at.

4.2.3.2.29 Uo_extent_specified_reactor

A Uo_extent_specified_reactor is a type of Uo_reactor (see 4.2.3.2.57) that specifies a type of reactor unit operation other than a completely stirred tank reactor unit operation, plug flow reactor unit operation, or a specified yield reactor unit operation.

The data associated with Uo_extent_specified_reactor are the following:

— reactor_type.

A reactor_type specifies an enumerated attribute that sets the type of Uo_extent_specified_reactor. The value of the reactor_type attribute shall be one of the following:

— gibbs;

— stoichiometric;

— equilibrium.

4.2.3.2.29.0.1 gibbs**:** an indication that the unit operation uses minimum Gibbs free energy calculations.

4.2.3.2.29.0.2 stoichiometric**:** an indication that the unit operation uses stoichiometric calculations.

4.2.3.2.29.0.3 equilibrium**:** an indication that the unit operation uses equilibrium calculations.

4.2.3.2.30 Uo_extract

A Uo_extract is a type of Process_unit_operation (see 4.2.3.2.5) that is the separation of Chemical_-components (see 4.2.2.2.4) in solution by their distribution between two immiscible liquid Phases (see 4.2.2.2.15). The process involves the transfer of mass from one liquid Phase into a second liquid immiscible liquid Phase.

4.2.3.2.31 Uo_fabric_filter

A Uo_fabric_filter is a type of Uo_gas_solid_separation (see 4.2.3.2.36) that is the process performed by a fabric filter. A fabric filter passes gas through a series of bags with fine pores to remove solids.

The data associated with Uo_fabric_filter are the following:

— bag_area;

— bag_cleaning_time;

— bag_diameter;

— dust_resistance;

— filtration_time;

— gas_velocity_maximum;

— gas_velocity_minimum;

— number_of_bags_per_cell;

— number_of_cells;

— number_of_cells_cleaned;

— pressure_drop_clean_bag;

— pressure_drop_maximum.

4.2.3.2.31.1 bag_area

A bag_area specifies the surface area of a filter bag.

4.2.3.2.31.2 bag_cleaning_time

A bag_cleaning_time specifies the cleaning time for a filter bag.

4.2.3.2.31.3 bag_diameter

A bag_diameter specifies the diameter of a filter bag.

4.2.3.2.31.4 dust_resistance

A dust_resistance specifies the dust resistance of a filter bag.

4.2.3.2.31.5 filtration_time

A filtration_time specifies the filtering time for the fabric filter.

4.2.3.2.31.6 gas_velocity_maximum

A gas_velocity_maximum specifies the maximum velocity through the fabric filter.

4.2.3.2.31.7 gas_velocity_minimum

A gas_velocity_minimum specifies the minimum velocity through the fabric filter.

4.2.3.2.31.8 number_of_bags_per_cell

A number_of_bags_per_cell specifies the number of bags per cell of the fabric filter.

4.2.3.2.31.9 number_of_cells

A number_of_cells specifies the number of cells of the fabric filter.

4.2.3.2.31.10 number_of_cells_cleaned

A number_of_cells_cleaned specifies the number of cells cleaned in the fabric filter.

4.2.3.2.31.11 pressure_drop_clean_bag

A pressure_drop_clean_bag specifies the difference between the bag inlet and outlet pressures when the bag is clean.

4.2.3.2.31.12 pressure_drop_maximum

A pressure_drop_maximum specifies the maximum difference between the bag inlet and outlet pressure for the fabric filter.

4.2.3.2.32 Uo_fired_heater

A Uo_fired_heater is a type of Process_unit_operation (see 4.2.3.2.5) that is the process performed by a fired heater. A fired heater increases the temperature of a process Stream (see 4.2.3.3.16) by combustion of fuel.

The data associated with Uo_fired_heater are the following:

— duty;

— fuel_efficiency;

— fuel_heating_value;

— outlet_temperature;

— pressure_drop.

4.2.3.2.32.1 duty

A duty specifies the amount of heat transferred to the process Stream (see 4.2.3.3.16) by the fired heater.

4.2.3.2.32.2 fuel_efficiency

A fuel_efficiency specifies the fuel efficiency of the fired heater.

4.2.3.2.32.3 fuel_heating_value

A fuel_heating_value specifies the heating value of the fuel used by the fired heater.

4.2.3.2.32.4 outlet_temperature

An outlet_temperature specifies the outlet temperature of the Uo_fired_heater.

4.2.3.2.32.5 pressure_drop

A pressure_drop specifies the difference between the fired heater inlet and outlet pressures.

4.2.3.2.33 Uo_fired_reactor

A Uo_fired_reactor is a type of Uo_reactor (see 4.2.3.2.57) where the energy required to drive the reaction is supplied by a combustion process.

4.2.3.2.34 Uo_flash

A Uo_flash is a type of Uo_separation (see 4.2.3.2.61) that is the separation of an inlet Stream (see 4.2.3.3.16) into one or more outlet Streams by an equilibrium phase split. A Uo_flash may be one of the following: a Uo_multi_phase_flash (see 4.2.3.2.47) or a Uo_single_phase_flash (see 4.2.3.2.64).

> NOTE - It may occur when a Stream (see 4.2.3.3.16) is throttled across a valve with the resulting pressure drop causing vapourization.

The data associated with Uo_flash are the following:

— duty;

— overhead_to_feed_mole_ratio;

— pressure;

— pressure_drop;

— specification;

— temperature.

4.2.3.2.34.1 duty

A duty specifies the heat to be supplied or removed from the Uo_flash to meet the flash specification. The duty may be a result or a specification.

4.2.3.2.34.2 overhead_to_feed_mole_ratio

An overhead_to_feed_mole_ratio specifies the total number of moles in the vapour overhead Stream (see 4.2.3.3.16) to the total number of moles in the feed Stream of the Uo_flash.

4.2.3.2.34.3 pressure

A pressure specifies the pressure that the equilibrium separation is performed at for the Uo_flash. The pressure is equal to the outlet pressure.

4.2.3.2.34.4 pressure_drop

A pressure_drop specifies the difference between outlet pressure and inlet pressure for the Uo_flash.

4.2.3.2.34.5 specification

A specification specifies which variables are used as inputs to specify the performance of the Uo_flash. Thermodynamic relationships constrain the solution of a Uo_flash to only certain possible combinations of input variables. The value of the specification attribute shall be one of the following:

— pressure_duty_flash;

— pressure_volume_fraction_flash;

— temperature_pressure_flash;

— temperature_duty_flash;

— temperature_volume_fraction_flash;

— unspecified.

4.2.3.2.34.5.1 pressure_duty_flash**:** an indication that the flash is a pressure and duty specified flash.

4.2.3.2.34.5.2 pressure_volume_fraction_flash**:** an indication that the flash is a pressure and volume fraction specified flash.

4.2.3.2.34.5.3 temperature_pressure_flash**:** an indication that the flash is a temperature and pressure specified flash.

4.2.3.2.34.5.4 temperature_duty_flash**:** an indication that the flash is a temperature and duty specified flash.

4.2.3.2.34.5.5 temperature_volume_fraction_flash**:** an indication that the flash is a temperature and volume fraction specified flash.

4.2.3.2.34.5.6 unspecified**:** an indication that the type of flash to be preformed is not specified.

4.2.3.2.34.6 temperature

A temperature specifies the temperature of the Uo_flash.

4.2.3.2.35 Uo_fluid_transfer

A Uo_fluid_transfer is a category of Process_unit_operation (see 4.2.3.2.5) that provides the capability of producing fluid flow through a conduit or channel by the transfer of energy.

> NOTE - The means employed to cause fluids to flow are gravity, displacement, centrifugal force, electromagnetic force, transfer of momentum, mechanical impulse, and combinations of these six basic means. Aside from gravity, the means most commonly employed is centrifugal force.

4.2.3.2.36 Uo_gas_solid_separation

A Uo_gas_solid_separation is a type of Process_unit_operation (see 4.2.3.2.5) that is the separation of solid particles from a gas Stream (see 4.2.3.3.16). Each Uo_gas_solid_separation may be one of the following: a Uo_cyclone (see 4.2.3.2.21), a Uo_electrostatic_precipitator (see 4.2.3.2.27), a Uo_fabric_-filter (see 4.2.3.2.31), or a Uo_venturi_scrubber (see 4.2.3.2.74).

The data associated with Uo_gas_solid_separation are the following:

— gas_velocity;

— pressure_drop;

— separation_efficiency.

4.2.3.2.36.1 gas_velocity

A gas_velocity specifies the gas velocity in the separator performing the separation.

4.2.3.2.36.2 pressure_drop

A pressure_drop specifies the difference between outlet pressure and inlet pressure for the separator.

4.2.3.2.36.3 separation_efficiency

A separation_efficiency specifies the ratio of the amount of solids removed from the gas Stream (see 4.2.3.3.16) to the amount of solids present in the inlet gas Stream.

4.2.3.2.37 Uo_heat_exchanger

A Uo_heat_exchanger is a type of Process_unit_operation (see 4.2.3.2.5) that is the heating or cooling of a single process Stream (see 4.2.3.3.16), the exchange of heat between two process Streams, or the exchange of heat between a process Stream and a Utility_stream (see 4.2.3.3.19) by a heat exchanger.

The data associated with Uo_heat_exchanger are the following:

— duty;

— flow_direction;

— LMTD_correction_factor;

— minimum_approach_temperature;

— number_shell_passes;

— number_tube_passes;

— overall_heat_transfer_coefficient;

— shell_pass;

— shell_volume;

— surface_area;

— tube_pass;

— tube_volume.

4.2.3.2.37.1 duty

A duty specifies the amount of heat transferred from the hot Stream (see 4.2.3.3.16) to the cold Stream by the exchanger.

4.2.3.2.37.2 flow_direction

A flow_direction specifies an enumerated attribute indicating the relative fluid flow direction between the shell side and the first tube side pass. The value of the flow_direction attribute shall be one of the following:

— cocurrent;

— countercurrent;

— crosscurrent;

— multipass;

— unspecified.

4.2.3.2.37.2.1 cocurrent**:** an indication that the flow of shell and tube side fluids are in the same direction.

4.2.3.2.37.2.2 countercurrent**:** an indication that the flow of shell and tube side fluids are in opposite directions.

4.2.3.2.37.2.3 crosscurrent**:** an indication that the flow of shell and tube side fluids are at 90 degree angles to each other.

4.2.3.2.37.2.4 multipass**:** an indication that the flow of shell and tube side fluids are partially cocurrent and partially countercurrent.

4.2.3.2.37.2.5 unspecified**:** an indication that the flow directions of shell and tube side fluids are not specified.

4.2.3.2.37.3 LMTD_correction_factor

A LMTD_correction_factor specifies the log mean temperature difference correction factor used in a two-sided heat exchanger.

4.2.3.2.37.4 minimum_approach_temperature

A minimum_approach_temperature specifies the minimum local difference in temperature between the shell side fluid and the tube side fluid at all points of contact in the exchanger.

4.2.3.2.37.5 number_shell_passes

A number_shell_passes specifies the number of times the flow path of the shell side fluid is directed across the tube bundle for the exchanger.

4.2.3.2.37.6 number_tube_passes

A number_tube_passes specifies the number of times the flow path of the tube side fluid is routed through the shell for the exchanger.

4.2.3.2.37.7 overall_heat_transfer_coefficient

An overall_heat_transfer_coefficient specifies the overall rate that heat is transferred from the hot fluid on one side of the heat exchanger to the cold fluid on the other side. This parameter relates the total amount of heat transferred by the exchanger to its heat transfer surface_area and the driving temperature differences.

4.2.3.2.37.8 shell_pass

A shell_pass specifies the number of paths the fluid takes across the shell side of the exchanger.

4.2.3.2.37.9 shell_volume

A shell_volume specifies the total volume available for Material (see 4.2.2.4.9) flow in the shell.

4.2.3.2.37.10 surface_area

A surface_area specifies the surface area of the heat transfer surface of the exchanger.

4.2.3.2.37.11 tube_pass

A tube_pass specifies the number of paths the fluid takes across the tube side of the exchanger.

4.2.3.2.37.12 tube_volume

A tube_volume specifies the total volume available for Material (see 4.2.2.4.9) flow in the tubes.

4.2.3.2.38 Uo_heat_exchanger_fluid

A Uo_heat_exchanger_fluid is a fluid flowing through a Uo_heat_exchanger_side (see 4.2.3.2.39).

The data associated with Uo_heat_exchanger_fluid are the following:

— heat_exchanger_shell_or_tube.

A heat_exchanger_shell_or_tube specifies an enumerated attribute indicating whether the fluid is on the shell side or the tube side. The value of the heat_exchanger_shell_or_tube attribute shall be one of the following:

— shell;

— tube.

4.2.3.2.38.0.1 shell**:** an indication that the fluid is on the shell side.

4.2.3.2.38.0.2 tube**:** an indication that the fluid is on the tube side.

4.2.3.2.39 Uo_heat_exchanger_side

A Uo_heat_exchanger_side is a type of Process_definition (see 4.2.3.1.5) that is either a hot side or a cold side of a Uo_heat_exchanger (see 4.2.3.2.37) and is characterized by pressure drop and temperature information.

The data associated with Uo_heat_exchanger_side are the following:

— heat_exchanger_side_delta_temperature;

— heat_exchanger_side_id;

— heat_exchanger_side_outlet_temperature;

— heat_exchanger_side_pressure_drop;

— hot_or_cold.

4.2.3.2.39.1 heat_exchanger_side_delta_temperature

A heat_exchanger_side_delta_temperature specifies the temperature across the Uo_heat_exchanger_side.

4.2.3.2.39.2 heat_exchanger_side_id

A heat_exchanger_side_id specifies a unique identifier for the Uo_heat_exchanger_side.

4.2.3.2.39.3 heat_exchanger_side_outlet_temperature

A heat_exchanger_side_outlet_temperature specifies the outlet temperature associated with the Uo_-heat_exchanger_side.

4.2.3.2.39.4 heat_exchanger_side_pressure_drop

A heat_exchanger_side_pressure_drop specifies the pressure drop across the Uo_heat_exchanger_side.

4.2.3.2.39.5 hot_or_cold

A hot_or_cold specifies whether the Uo_heat_exchanger_side specified is the hot or cold side.

4.2.3.2.40 Uo_hydrocyclone

A Uo_hydrocyclone is a type of Uo_liquid_solid_separation (see 4.2.3.2.43) that is the separation of suspended solids from a liquid inlet Stream (see 4.2.3.3.16) by the action of liquid vortices within one or more hydrocyclones. A hydrocyclone throttles an incoming Stream to achieve separation.

The data associated with Uo_hydrocyclone are the following:

— diameter;

— diameter_maximum;

— inlet_nozzle_diameter;

— length;

— number_of_parallel_hydrocyclones;

— overflow_nozzle_diameter;

— pressure_drop_maximum;

— separation_efficiency;

— underflow_nozzle_diameter;

— vortex_finder_diameter;

— vortex_finder_length.

4.2.3.2.40.1 diameter

A diameter specifies the diameter of the entrance section of the hydrocyclone performing the separation.

4.2.3.2.40.2 diameter_maximum

A diameter_maximum specifies the maximum diameter of the entrance section allowed in a sizing calculation for the hydrocyclone.

4.2.3.2.40.3 inlet_nozzle_diameter

An inlet_nozzle_diameter specifies the diameter of the inlet Nozzle (see 4.2.4.2.5) for the hydrocyclone.

4.2.3.2.40.4 length

A length specifies the overall length associated with the hydrocyclone.

4.2.3.2.40.5 number_of_parallel_hydrocyclones

A number_of_parallel_hydrocyclones specifies the number of parallel hydrocyclones in the hydrocyclone.

4.2.3.2.40.6 overflow_nozzle_diameter

An overflow_nozzle_diameter specifies the diameter of the overflow Nozzle (see 4.2.4.2.5) for the hydrocyclone.

4.2.3.2.40.7 pressure_drop_maximum

A pressure_drop_maximum specifies the maximum difference between the inlet and outlet pressures of the Uo_hydrocyclone.

4.2.3.2.40.8 separation_efficiency

A separation_efficiency specifies the ratio of the amount of solids removed from the inlet to the amount of solids in the inlet for the Uo_hydrocyclone.

4.2.3.2.40.9 underflow_nozzle_diameter

An underflow_nozzle_diameter specifies the diameter of the underflow Nozzle (see 4.2.4.2.5) for the hydrocyclone.

4.2.3.2.40.10 vortex_finder_diameter

A vortex_finder_diameter specifies the diameter of the vortex finder in the hydrocyclone.

4.2.3.2.40.11 vortex_finder_length

A vortex_finder_length specifies the length of the vortex finder in the hydrocyclone.

4.2.3.2.41 Uo_jet_ejector

A Uo_jet_ejector is a type of Process_unit_operation (see 4.2.3.2.5) that is the use of the kinetic energy of one fluid to pump another fluid.

4.2.3.2.42 Uo_liquid_liquid_flash

A Uo_liquid_liquid_flash is a type of Uo_multi_phase_flash (see 4.2.3.2.47) where the inlet Stream (see 4.2.3.3.16) splits into two equilibrium liquid outlet Streams.

4.2.3.2.43 Uo_liquid_solid_separation

A Uo_liquid_solid_separation is a type of Process_unit_operation (see 4.2.3.2.5) that is the separation of solids from a liquid Stream (see 4.2.3.3.16) or the transfer of entrained liquids from a solid Stream to a liquid or vapour Stream. A Uo_liquid_solid_separation may be one of the following: a Uo_centrifuge (see 4.2.3.2.13), a Uo_countercurrent_solids_decant (see 4.2.3.2.18), a Uo_crystallization (see 4.2.3.2.20), a Uo_dissolve (see 4.2.3.2.22), a Uo_hydrocyclone (see 4.2.3.2.40), a Uo_rotary_filter (see 4.2.3.2.59), a Uo_solids_decant_stage (see 4.2.3.2.66), or a Uo_solids_drying (see 4.2.3.2.67).

4.2.3.2.44 Uo_liquid_vapour_flash

A Uo_liquid_vapour_flash is a type of Uo_multi_phase_flash (see 4.2.3.2.47) where the inlet Stream (see 4.2.3.3.16) splits into a vapour Stream and a single liquid Stream.

4.2.3.2.45 Uo_melt

A Uo_melt is a type of Process_unit_operation (see 4.2.3.2.5) that is the melting of a solid to transform it into the liquid Phase (see 4.2.2.2.15) and freeze a liquid to transform it into the solid phase.

4.2.3.2.46 Uo_mix

A Uo_mix is the mixing of multiple input Streams (see 4.2.3.3.16) into one output Stream.

The data associated with Uo_mix are the following:

— pressure_drop;

— pressure_out.

4.2.3.2.46.1 pressure_drop

A pressure_drop specifies the difference between the inlet and outlet pressures for a Uo_mix.

4.2.3.2.46.2 pressure_out

A pressure_out specifies the outlet pressure associated with the unit operation, of the Uo_mix.

4.2.3.2.47 Uo_multi_phase_flash

A Uo_multi_phase_flash is a type of Uo_flash (see 4.2.3.2.34) that has more than two equilibrium liquid outlet Streams (see 4.2.3.3.16) or involves equilibrium solids. A Uo_multi_phase_flash may be one of the following: a Uo_liquid_liquid_flash (see 4.2.3.2.42), a Uo_liquid_vapour_flash (see 4.2.3.2.44), or a Uo_separator_three_phase_flash (see 4.2.3.2.62).

The data associated with a Uo_multi_phase_flash are the following:

— diameter;

— entrained_fraction;

— entrainment_fraction;

— entrainment_from;

— entrainment_rate;

— entrainment_to;

— height_above_grade;

— length.

4.2.3.2.47.1 diameter

A diameter specifies the diameter of the separation drum where the Uo_multi_phase_flash occurs.

4.2.3.2.47.2 entrained_fraction

An entrained_fraction specifies the ratio of the amount of an outlet Stream (see 4.2.3.3.16) that is entrained in another outlet Stream to the total amount of the first outlet Stream that would be present with no entrainment.

4.2.3.2.47.3 entrainment_fraction

An entrainment_fraction specifies the ratio of the amount of entrained material to the amount of entraining material in the outlet Stream (see 4.2.3.3.16).

4.2.3.2.47.4 entrainment_from

An entrainment_from specifies the outlet Stream (see 4.2.3.3.16) that is the source of the entrained material.

4.2.3.2.47.5 entrainment_rate

An entrainment_rate specifies the flow rate of the entrained material in the entraining outlet Stream (see 4.2.3.3.16).

4.2.3.2.47.6 entrainment_to

An entrainment_to specifies the outlet Stream (see 4.2.3.3.16) that is entraining the entrained material.

4.2.3.2.47.7 height_above_grade

A height_above_grade specifies the height above some datum of the liquid outlet for the separation drum where the Uo_multi_phase_flash occurs.

4.2.3.2.47.8 length

A length specifies the length of the separation drum where the multi_phase_flash occurs.

4.2.3.2.48 Uo_phase_change

A Uo_phase_change is a category of Process_unit_operation (see 4.2.3.2.5) that is a process that changes the Phase (see 4.2.2.2.15) of a Material_stream (see 4.2.3.3.7) or a Chemical_component (see 4.2.2.2.4) in a Material_stream.

EXAMPLE 34 - For example, Chemical_component A in a Material_stream is changed from a solid to liquid.

The data associated with Uo_phase_change are the following:

— duty.

A duty specifies the quantity of heat put into or taken out of the unit.

4.2.3.2.49 Uo_pipeline

A Uo_pipeline is a type of Process_unit_operation (see 4.2.3.2.5) that is a process performed by a pipeline. It is typically a multi-phase flow through a hollow pipe or an annular space.

The data associated with Uo_pipeline are the following:

— diameter.

A diameter specifies the actual or nominal diameter of the pipe segments in the pipeline.

4.2.3.2.50 Uo_pipeline_node

A Uo_pipeline_node is a type of Process_unit_operation (see 4.2.3.2.5) that is a location of a point along a Uo_pipeline (see 4.2.3.2.49). A Uo_pipeline_node forms the end of one or more Uo_pipeline_segments (see 4.2.3.2.51).

The data associated with Uo_pipeline_node are the following:

— ambient_temperature;

— duty;

— number;

— pressure;

— temperature;

— x_position;

— y_position;

— z_position.

4.2.3.2.50.1 ambient_temperature

An ambient_temperature specifies the ambient temperature at the node.

4.2.3.2.50.2 duty

A duty specifies the overall duty for the Uo_pipeline_node.

4.2.3.2.50.3 number

A number specifies the number for the Uo_pipeline_node that is unique within the Uo_pipeline (see 4.2.3.2.49) associated with it.

4.2.3.2.50.4 pressure

A pressure specifies the pressure at the Uo_pipeline_node.

4.2.3.2.50.5 temperature

A temperature specifies the temperature of the Uo_pipeline_node.

4.2.3.2.50.6 x_position

A x_position specifies the x_position of the Uo_pipeline_node.

NOTE - The origin is arbitrary, but consistent for all nodes belonging to a Uo_pipeline.

4.2.3.2.50.7 y_position

A y_position specifies the y_position of the Uo_pipeline_node.

NOTE - The origin is arbitrary, but consistent for all nodes belonging to a Uo_pipeline.

4.2.3.2.50.8 z_position

A z_position specifies the z_position of the Uo_pipeline_node.

NOTE - The origin is arbitrary, but consistent for all nodes belonging to a Uo_pipeline.

4.2.3.2.51 Uo_pipeline_segment

A Uo_pipeline_segment is a type of Process_unit_operation (see 4.2.3.2.5) that is a non-branching transfer of Material (see 4.2.2.4.9) between two Uo_pipeline_nodes (see 4.2.3.2.50) in a Uo_pipeline (see 4.2.3.2.49).

NOTE - A Uo_pipeline_segment may represent the flow of fluid in a hollow or annular pipe. The pipe may be a straight segment or have a number of bends, but cannot have any tees.

The data associated with Uo_pipeline_segment are the following:

— inner_diameter_of_outer_pipe;

— outer_diameter_of_inner_pipe;

— overall_heat_transfer_coefficient;

— pipe_efficiency_factor;

— pipe_roughness;

— pressure_drop;

— segment_number.

4.2.3.2.51.1 inner_diameter_of_outer_pipe

An inner_diameter_of_outer_pipe specifies the inner diameter of the outer pipe for the Uo_pipeline_-segment.

4.2.3.2.51.2 outer_diameter_of_inner_pipe

An outer_diameter_of_inner_pipe specifies the outer diameter of inner pipe for the Uo_pipeline_-segment.

4.2.3.2.51.3 overall_heat_transfer_coefficient

An overall_heat_transfer_coefficient specifies the overall Heat_transfer_coefficient (see 4.2.3.2.4) for the Uo_pipeline_segment.

4.2.3.2.51.4 pipe_efficiency_factor

A pipe_efficiency_factor specifies an efficiency factor for the Uo_pipeline_segment.

4.2.3.2.51.5 pipe_roughness

A pipe_roughness specifies the pipe roughness for the Uo_pipeline_segment.

4.2.3.2.51.6 pressure_drop

A pressure_drop specifies the pressure difference between the inlet and outlet of the Uo_pipeline_-segment.

4.2.3.2.51.7 segment_number

A segment_number specifies the segment number of the Uo_pipeline_segment that is unique within the Uo_pipeline (see 4.2.3.2.49).

4.2.3.2.52 Uo_plug_flow_reactor

A Uo_plug_flow_reactor is a type of Uo_reactor (see 4.2.3.2.57) performed by a plug flow reactor. A plug flow reactor is an ideal reactor where reactants and products pass through the reactor in an axial flow path with no back mixing. It calculates the extent of each reaction from kinetic equations.

The data associated with Uo_plug_flow_reactor are the following:

— coolant_flow_direction;

— diameter;

— length;

— overall_heat_transfer_coefficient.

4.2.3.2.52.1 coolant_flow_direction

A coolant_flow_direction specifies an enumerated attribute giving the coolant flow direction for the plug flow reactor. The value of the coolant_flow_direction attribute shall be one of the following:

— cocurrent;

— countercurrent.

4.2.3.2.52.1.1 cocurrent**:** an indication that the reactor coolant flow is cocurrent with the reactants.

4.2.3.2.52.1.2 countercurrent**:** an indication that the reactor coolant flow is countercurrent to the reactants.

4.2.3.2.52.2 diameter

A diameter specifies the diameter of the plug flow reactor.

4.2.3.2.52.3 length

A length specifies the length of the plug flow reactor.

4.2.3.2.52.4 overall_heat_transfer_coefficient

An overall_heat_transfer_coefficient specifies the overall Heat_transfer_coefficient (see 4.2.3.2.4) for the heat transfer to or from the walls of the plug flow reactor.

4.2.3.2.53 Uo_positive_displacement_compressor

A Uo_positive_displacement_compressor is a type of Uo_compressor (see 4.2.3.2.16) that represents a compressor with a mechanism that prevents gas that has been displaced from the compressor from re-entering through the compressor outlet and gas that has entered the compressor from exiting through the

compressor inlet. It is a Positive_displacement_compressor (see 4.2.4.5.20) unit operation. It can produce high compression ratios with small controlled flow rates.

4.2.3.2.54 Uo_positive_displacement_compressor_stage

A Uo_positive_displacement_compressor_stage is a type of Uo_compressor_stage (see 4.2.3.2.17) that is a Positive_displacement_compressor (see 4.2.4.5.20) stage unit operation. The stage has a mechanism that prevents gas the has been displaced from the stage from re-entering through the stage outlet and gas that has entered the stage from exiting through the stage inlet.

The data associated with Uo_positive_displacement_compressor_stage are the following:

— clearance_fraction;

— displacement;

— polytropic_efficiency;

— stage_number.

4.2.3.2.54.1 clearance_fraction

A clearance_fraction specifies the clearance fraction of the stage.

4.2.3.2.54.2 displacement

A displacement specifies the total displacement of the stage.

4.2.3.2.54.3 polytropic_efficiency

A polytropic_efficiency specifies the polytropic efficiency of the Uo_positive_displacement_-compressor_stage associated with the unit operation.

4.2.3.2.54.4 stage_number

A stage_number specifies the stage number associated with the Uo_positive_displacement_compressor_-stage.

4.2.3.2.55 Uo_pressure_change

A Uo_pressure_change is a type of Process_unit_operation (see 4.2.3.2.5) that is a process that changes the pressure of a Stream (see 4.2.3.3.16). It consumes energy to increase pressure or recovers energy from pressure letdown. Each Uo_pressure_change may be one of the following: a Uo_compressor (see 4.2.3.2.16), a Uo_compressor_stage (see 4.2.3.2.17), a Uo_expander (see 4.2.3.2.28), or a Uo_pump (see 4.2.3.2.56).

The data associated with Uo_pressure_change are the following:

— brake_horsepower;

— differential_pressure;

— driver_power_quantity;

— driver_power_type;

— inlet_pressure;

— inlet_temperature;

— mechanical_efficiency;

— outlet_pressure;

— outlet_temperature;

— pressure_ratio.

4.2.3.2.55.1 brake_horsepower

A brake_horsepower specifies the power supplied by the driver to the Uo_pressure_change.

NOTE - In the case of a Uo_expander (see 4.2.3.2.28), brake_horsepower is the power supplied by the unit operation.

4.2.3.2.55.2 differential_pressure

A differential_pressure specifies the change in pressure between the inlet and the outlet of the Uo_-pressure_change.

4.2.3.2.55.3 driver_power_quantity

A driver_power_quantity specifies the power required by the driver of the Uo_pressure_change.

4.2.3.2.55.4 driver_power_type

A driver_power_type specifies an enumerated attribute giving the driver power type for the Uo_-pressure_change. The value of the driver_power_type attribute shall be one of the following:

— electricity;

— fuel_gas;

— steam.

4.2.3.2.55.4.1 electricity**:** an indication that the driver is electric.

4.2.3.2.55.4.2 fuel_gas**:** an indication that the driver is fuel or gas driven.

4.2.3.2.55.4.3 steam**:** an indication that the driver is steam driven.

4.2.3.2.55.5 inlet_pressure

An inlet_pressure specifies the inlet pressure of the Uo_pressure_change.

4.2.3.2.55.6 inlet_temperature

An inlet_temperature specifies the inlet temperature of the Uo_pressure_change.

4.2.3.2.55.7 mechanical_efficiency

A mechanical_efficiency specifies the mechanical efficiency of the Uo_pressure_change.

4.2.3.2.55.8 outlet_pressure

An outlet_pressure specifies the outlet pressure of the Uo_pressure_change.

4.2.3.2.55.9 outlet_temperature

An outlet_temperature specifies the outlet temperature of the Uo_pressure_change.

4.2.3.2.55.10 pressure_ratio

A pressure_ratio specifies the ratio of the outlet pressure to the inlet pressure for the Uo_pressure_-change.

4.2.3.2.56 Uo_pump

A Uo_pump is a type of Uo_pressure_change (see 4.2.3.2.55) where the process is performed by a Pump (see 4.2.4.5.21). Pumps provide motive force for liquids.

The data associated with Uo_pump are the following:

— design_flowrate;

— design_head;

— design_speed;

— net_positive_suction_head;

— radial_frequency;

— type;

— volumetric_flow_rate.

4.2.3.2.56.1 design_flowrate

A design_flowrate specifies the volumetric flowrate for the Pump (see 4.2.4.5.21) at the design_speed.

4.2.3.2.56.2 design_head

A design_head specifies the head developed for the Pump (see 4.2.4.5.21) at the design_speed.

4.2.3.2.56.3 design_speed

A design_speed specifies the design rotational speed (i.e., radial_frequency) of the Pump (see 4.2.4.5.21).

4.2.3.2.56.4 net_positive_suction_head

A net_positive_suction_head specifies the net positive suction head (NPSH) for the Pump (see 4.2.4.5.21).

NOTE - Typically, the pump manufacturer specifies the minimum value of NPSH that must exist at the pump suction.

4.2.3.2.56.5 radial_frequency

A radial_frequency specifies the radial frequency of the Pump (see 4.2.4.5.21).

4.2.3.2.56.6 type

A type specifies the type of equipment that the Uo_pump represents.

4.2.3.2.56.7 volumetric_flow_rate

A volumetric_flow_rate specifies the volumetric flow rate at the inlet conditions for the Uo_pump.

4.2.3.2.57 Uo_reactor

A Uo_reactor is a type of Process_unit_operation (see 4.2.3.2.5) that is where the containment of one or more chemical reactions occur. Each Uo_reactor may be one of the following: a Uo_completely_-stirred_reactor (see 4.2.3.2.14), a Uo_extent_specified_reactor (see 4.2.3.2.29), a Uo_plug_flow_reactor (see 4.2.3.2.52), or a Uo_specified_yield_reactor (see 4.2.3.2.68).

NOTE - This is an abstract superclass of specialized types of reactors.

The data associated with Uo_reactor are the following:

— duty;

— outlet_pressure;

— outlet_temperature;

— outlet_vapour_fraction;

— pressure_drop.

4.2.3.2.57.1 duty

A duty specifies the heat supplied to or removed from the Uo_reactor.

4.2.3.2.57.2 outlet_pressure

An outlet_pressure specifies the outlet pressure of the Uo_reactor.

4.2.3.2.57.3 outlet_temperature

An outlet_temperature specifies the outlet temperature of the Uo_reactor.

4.2.3.2.57.4 outlet_vapour_fraction

An outlet_vapour_fraction specifies the vapour fraction of the outlet of the Uo_reactor.

4.2.3.2.57.5 pressure_drop

A pressure_drop specifies the difference between the inlet and outlet pressures in the Uo_reactor.

4.2.3.2.58 Uo_restrict

A Uo_restrict is a type of Uo_pressure_change (see 4.2.3.2.55) that is the pressure drop caused by fluid passing through a restriction, typically by the action of a restriction orifice inside of a pipe.

The data associated with Uo_restrict are the following:

— large_diameter;

— restriction_diameter.

4.2.3.2.58.1 large_diameter

A large_diameter specifies the diameter of the flow channel.

4.2.3.2.58.2 restriction_diameter

A restriction_diameter specifies the diameter of the restriction.

4.2.3.2.59 Uo_rotary_filter

A Uo_rotary_filter is a type of Uo_liquid_solid_separation (see 4.2.3.2.43) that is the process performed by a rotary filter. A rotary filter applies a pressure differential across a filter to remove solids from liquids.

The data associated with Uo_rotary_filter are the following:

— cake_compressibility_factor;

— cake_particle_diameter;

— cake_particle_sphericity;

— cake_percent_solid;

— cake_porosity;

— cake_specific_resistance;

— cake_thickness;

— diameter;

— filtration_angle;

— frequency;

— width.

4.2.3.2.59.1 cake_compressibility_factor

A cake_compressibility_factor specifies the compressibility factor for the cake of the rotary filter.

4.2.3.2.59.2 cake_particle_diameter

A cake_particle_diameter specifies the average diameter of particles in the filter cake in the rotary filter.

4.2.3.2.59.3 cake_particle_sphericity

A cake_particle_sphericity specifies the sphericity of the solids associated in the rotary filter.

4.2.3.2.59.4 cake_percent_solid

A cake_percent_solid specifies the percentage of solids in the inlet of the rotary filter.

4.2.3.2.59.5 cake_porosity

A cake_porosity specifies the porosity of the cake in the rotary filter.

4.2.3.2.59.6 cake_specific_resistance

A cake_specific_resistance specifies the specific resistance of the rotary filter.

4.2.3.2.59.7 cake_thickness

A cake_thickness specifies the filter cake thickness of the rotary filter.

4.2.3.2.59.8 diameter

A diameter specifies the diameter of the rotary filter.

4.2.3.2.59.9 filtration_angle

A filtration_angle specifies the angle of tilt for the rotary filter.

4.2.3.2.59.10 frequency

A frequency specifies the frequency for the rotary filter.

4.2.3.2.59.11 width

A width specifies the filter width of the rotary filter.

4.2.3.2.60 Uo_screen

A Uo_screen is a type of Uo_solid_solid_separation (see 4.2.3.2.65) that is the segregation of solids by the use of a screen. A screen separates a Mixture (see 4.2.2.2.12) of solids on the basis of their size.

The data associated with Uo_screen are the following:

— opening_size;

— operating_level;

— operating_mode;

— separation_efficiency;

— separation_strength.

4.2.3.2.60.1 opening_size

An opening_size specifies the screen opening size.

4.2.3.2.60.2 operating_level

An operating_level specifies an enumerated attribute indicating that the screen is operating as an upper or a lower screen for the Uo_screen. The value of the operating_level attribute shall be one of the following:

— lower;

— upper.

4.2.3.2.60.2.1 lower**:** an indication the Uo_screen is an lower screen.

4.2.3.2.60.2.2 upper**:** an indication the Uo_screen is an upper screen.

4.2.3.2.60.3 operating_mode

An operating_mode specifies an enumerated attribute indicating whether the screen operates as a wet or a dry screen. The value of the operating_mode attribute shall be one of the following:

— dry_screen;

— wet_screen.

4.2.3.2.60.3.1 dry_screen**:** an indication the screen operates dry.

4.2.3.2.60.3.2 wet_screen**:** an indication the screen operates wet.

4.2.3.2.60.4 separation_efficiency

A separation_efficiency specifies the separation efficiency of the Uo_screen.

4.2.3.2.60.5 separation_strength

A separation_strength specifies the portion of the feed flow that is overflow versus the portion that passes through the screen.

> NOTE - The separation_strength is a function of the size of the screen opening, the particle diameter, and the selection function for the screen. A selection function is defined for each stage of the Uo_screen as the fraction of feed particles in that particular stage size range that passes to the overflow.

4.2.3.2.61 Uo_separation

A Uo_separation is a category of Process_unit_operation (see 4.2.3.2.5) that is the physical separation of Chemical_components (see 4.2.2.2.4) in a feed Material_stream (see 4.2.3.3.7) into two or more outlet Material_streams.

4.2.3.2.62 Uo_separator_three_phase_flash

A Uo_separator_three_phase_flash is a type of Uo_multi_phase_flash (see 4.2.3.2.47) that is a calculation of the thermal conditions for a flash containing three outlet Streams (see 4.2.3.3.16). An inlet Stream to the flash is separated into three outlet Streams. The outlet Streams consist of a vapour and two liquid streams.

The data associated with Uo_separator_three_phase_flash are the following:

— weir_height;

— weir_length.

4.2.3.2.62.1 weir_height

A weir_height specifies the height of the weir that separates the division of the two liquid Phases (see 4.2.2.2.15) in the flash unit.

4.2.3.2.62.2 weir_length

A weir_length specifies the distance the weir is located from one end of the flash unit.

4.2.3.2.63 Uo_shell_and_tube_heat_exchanger

A Uo_shell_and_tube_heat_exchanger is a type of Process_unit_operation (see 4.2.3.2.5) that provides the capability to exchange heat between two Material_streams (see 4.2.3.3.7). One Material_stream flows through a tube bundle that is contained within a shell where the other Material_stream flows.

4.2.3.2.64 Uo_single_phase_flash

A Uo_single_phase_flash is a type of Uo_flash (see 4.2.3.2.34) that is a calculation of the thermal conditions for a single-phase Stream (see 4.2.3.3.16).

The data associated with Uo_single_phase_flash are the following:

— node_volume.

A node_volume specifies the total volume associated with the Uo_single_phase_flash.

4.2.3.2.65 Uo_solid_solid_separation

A Uo_solid_solid_separation is a category of Process_unit_operation (see 4.2.3.2.5) that is separation of solid particles from solid particles or a solid aggregate. Each Uo_solid_solid_separation may be one of the following: a Uo_crush (see 4.2.3.2.19) or a Uo_screen (see 4.2.3.2.60).

4.2.3.2.66 Uo_solids_decant_stage

A Uo_solids_decant_stage is a type of Uo_liquid_solid_separation (see 4.2.3.2.43) that is the contacting of a solid Stream (see 4.2.3.3.16) and a liquid Stream followed by the separation of the leached solid and effluent liquid by settling and decanting.

The data associated with Uo_solids_decant_stage are the following:

— decanter_stage_number;

— decanter_stage_outlet_pressure;

— decanter_stage_pressure_drop;

— flow_ratio_overflow_to_underflow;

— solids_concentration_overflow_to_underflow.

4.2.3.2.66.1 decanter_stage_number

A decanter_stage_number specifies the stage number for the Uo_solids_decant_stage in a Uo_-countercurrent_solids_decant (see 4.2.3.2.18).

4.2.3.2.66.2 decanter_stage_outlet_pressure

A decanter_stage_outlet_pressure specifies the outlet pressure for the Uo_solids_decant_stage.

4.2.3.2.66.3 decanter_stage_pressure_drop

A decanter_stage_pressure_drop specifies the difference between the inlet pressure and outlet pressure of the Uo_solids_decant_stage.

4.2.3.2.66.4 flow_ratio_overflow_to_underflow

A flow_ratio_overflow_to_underflow specifies the ratio of over flow to under flow of the Uo_solids_-decant_stage.

4.2.3.2.66.5 solids_concentration_overflow_to_underflow

A solids_concentration_overflow_to_underflow specifies the ratio of the solids concentration in the over flow to under flow for the Uo_solids_decant_stage.

4.2.3.2.67 Uo_solids_drying

A Uo_solids_drying is a type of Process_unit_operation (see 4.2.3.2.5) that is the removal of moisture or an entrained liquid from a solids Stream (see 4.2.3.3.16). Heat input or pressure drop is used to remove the overhead Stream (see 4.2.3.3.16) from the residual solids in the bottoms Stream.

The data associated with Uo_solids_drying are the following:

— duty;

— entrained_fraction;

— overhead_to_feed_mass_ratio;

— overhead_to_feed_mole_ratio;

— pressure;

— pressure_drop;

— temperature.

4.2.3.2.67.1 duty

A duty specifies the heat supplied to the Uo_solids_drying.

4.2.3.2.67.2 entrained_fraction

An entrained_fraction specifies the mass fraction of the amount of solids leaving the Uo_solids_drying in overhead vapour stream to the total amount of solids leaving the dryer.

4.2.3.2.67.3 overhead_to_feed_mass_ratio

An overhead_to_feed_mass_ratio specifies the ratio of the mass of the overhead to feed for the Uo_-solids_drying.

4.2.3.2.67.4 overhead_to_feed_mole_ratio

An overhead_to_feed_mole_ratio specifies the ratio of the mole flows of the overhead to the feed for the Uo_solids_drying.

4.2.3.2.67.5 pressure

A pressure specifies the pressure of the Uo_solids_drying.

4.2.3.2.67.6 pressure_drop

A pressure_drop specifies the difference between the inlet and outlet of the Uo_solids_drying.

4.2.3.2.67.7 temperature

A temperature specifies the temperature of the Uo_solids_drying.

4.2.3.2.68 Uo_specified_yield_reactor

A Uo_specified_yield_reactor is a type of Uo_reactor (see 4.2.3.2.57) whose performance is specified solely by the desired amount of one or more Chemical_components (see 4.2.2.2.4) in one or more Phases (see 4.2.2.2.15) of the reactor outlet.

4.2.3.2.69 Uo_split

A Uo_split is a type of Process_unit_operation (see 4.2.3.2.5) that is the separation of one or more inlet Streams (see 4.2.3.3.16) into two or more outlet Streams. Each Uo_split may be one of the following: a Uo_stream_split (see 4.2.3.2.70) or a Uo_substance_split (see 4.2.3.2.71).

NOTE - No specification of the process or equipment that might achieve this separation is supplied.

The data associated with Uo_split are the following:

— differential_pressure;

— pressure.

4.2.3.2.69.1 differential_pressure

A differential_pressure specifies the difference between the inlet pressure and the outlet pressure for the Uo_split.

4.2.3.2.69.2 pressure

A pressure specifies the outlet pressure for the Uo_split.

4.2.3.2.70 Uo_stream_split

A Uo_stream_split is a type of Uo_split (see 4.2.3.2.69) whose performance is specified by setting the desired flows or fractions of one or more outlet Streams (see 4.2.3.3.16) based on the total flow of one or more inlet Streams.

4.2.3.2.71 Uo_substance_split

A Uo_substance_split is a type of Uo_split (see 4.2.3.2.69) whose performance is specified by setting the desired flows or fractions of individual Substances (see 4.2.2.2.20) in one or more outlet Streams (see 4.2.3.3.16) based on the amount of those Substances present in one or more inlet Streams.

4.2.3.2.72 Uo_valve

A Uo_valve is a type of Uo_pressure_change (see 4.2.3.2.55) that is the pressure drop imposed by an adjustable device that restricts or redirects the flow path in a process line.

The data associated with Uo_valve are the following:

— action;

— control_type;

— fail;

— valve_flow_coefficient;

— valve_style;

— valve_type.

4.2.3.2.72.1 action

An action specifies an enumerated attribute that specifies whether the valve performing the Uo_valve opens or closes with an increase in a control signal to the valve. The value of the action attribute shall be one of the following:

— close;

— open.

4.2.3.2.72.1.1 close**:** an indication the valve closes with an increasing control signal.

4.2.3.2.72.1.2 open**:** an indication the valve opens with an increasing control signal.

4.2.3.2.72.2 control_type

A control_type specifies the type of control signal or mechanism that is used to operate the valve.

4.2.3.2.72.3 fail

A fail specifies an enumerated attribute that specifies how the valve behaves on loss of control signal or power. The value of the fail attribute shall be one of the following:

— fail_close;

— fail_fixed;

— fail_open.

4.2.3.2.72.3.1 fail_close**:** an indication the valve shall close on the loss of its control signal.

4.2.3.2.72.3.2 fail_fixed**:** an indication the valve shall remain fixed in its last position on the loss of its control signal.

4.2.3.2.72.3.3 fail_open**:** an indication the valve shall open on the loss of its control signal.

4.2.3.2.72.4 valve_flow_coefficient

A valve_flow_coefficient specifies the coefficient of flow for the valve in its fully open position.

4.2.3.2.72.5 valve_style

A valve_style specifies the particular style of valve for a given manufacturer.

4.2.3.2.72.6 valve_type

A valve_type identifies the valve manufacturer.

> NOTE - The value_type attribute determines the flow equation to be used. Typical valve manufacturers include: Masoneilan, Mokveld, Fisher, Introl, Valtek, and CCI Drag.

4.2.3.2.73 Uo_vapourize

A Uo_vapourize is a type of Process_unit_operation (see 4.2.3.2.5) that is the vapourization of part or all of a liquid Material_stream (see 4.2.3.3.7) by introducing heat.

4.2.3.2.74 Uo_venturi_scrubber

A Uo_venturi_scrubber is a type of Uo_gas_solid_separation (see 4.2.3.2.36) that is the process performed by a venturi scrubber. A venturi scrubber uses a liquid to scrub solid particles from a gas.

The data associated with Uo_venturi_scrubber are the following:

— gas_velocity_maximum;

— gas_velocity_minimum;

— liquid_throat_velocity;

— liquid_to_gas_volume_ratio_maximum;

— liquid_to_gas_volume_ratio_minimum;

— throat_diameter;

— throat_diameter_maximum;

— throat_diameter_minimum;

— throat_length.

4.2.3.2.74.1 gas_velocity_maximum

A gas_velocity_maximum specifies the maximum gas velocity for the venturi scrubber.

4.2.3.2.74.2 gas_velocity_minimum

A gas_velocity_minimum specifies the minimum gas velocity for the venturi scrubber.

4.2.3.2.74.3 liquid_throat_velocity

A liquid_throat_velocity specifies the liquid velocity in the throat of the venturi scrubber.

4.2.3.2.74.4 liquid_to_gas_volume_ratio_maximum

A liquid_to_gas_volume_ratio_maximum specifies the maximum volume ratio of liquid flow to gas flow of the venturi scrubber.

4.2.3.2.74.5 liquid_to_gas_volume_ratio_minimum

A liquid_to_gas_volume_ratio_minimum specifies the minimum volume ratio of liquid flow to gas flow of the venturi scrubber.

4.2.3.2.74.6 throat_diameter

A throat_diameter specifies the diameter of the throat associated with the venturi scrubber.

4.2.3.2.74.7 throat_diameter_maximum

A throat_diameter_maximum specifies the maximum diameter of the throat associated with the venturi scrubber.

4.2.3.2.74.8 throat_diameter_minimum

A throat_diameter_minimum specifies the minimum diameter of the throat associated with the venturi scrubber.

4.2.3.2.74.9 throat_length

A throat_length specifies the length of the throat of the venturi scrubber.

4.2.3.3 stream_data

Refer to 4.1.15 for a description of what this UoF specifies. The ARM diagrams related to this UoF are provided as figures G.43 through G.45 in annex G of this part to ISO 10303.

4.2.3.3.1 Distillation_stage_phase

A Distillation_stage_phase is a type of Internal_stream_phase (see 4.2.3.3.5) that exists on a Uo_-distillation_stage (see 4.2.3.2.24) representing either the liquid or the vapour flows that are in contact on the Uo_distillation_stage.

4.2.3.3.2 Energy_stream

An Energy_stream is a type of Stream (see 4.2.3.3.16) that is the flow of some sort of energy. Each Energy_stream may be one of the following: a Thermal_stream (see 4.2.3.3.17) or a Work_stream (see 4.2.3.3.20).

The data associated with Energy_stream are the following:

— energy_flow_rate.

An energy_flow_rate specifies the rate that energy is carried by the Stream (see 4.2.3.3.16).

4.2.3.3.3 Heat_exchanger_internal_phase

A Heat_exchanger_internal_phase is a type of Internal_stream_phase (see 4.2.3.3.5) that exists at some point along the flow path within a Uo_heat_exchanger (see 4.2.3.2.37).

4.2.3.3.4 Information_stream

An Information_stream is a type of Stream (see 4.2.3.3.16) that represents a flow of information.

EXAMPLE 35 - Control measurement signals, control adjustment signals, and control event signals such as interlock relay open/close event.

The data associated with Information_stream are the following:

— type.

A type specifies a text string indicating the mechanism for transporting the information associated with the Information_stream.

EXAMPLE 36 - Pneumatic, analog electronic, and digital electronic.

4.2.3.3.5 Internal_stream_phase

An Internal_stream_phase is a type of Specific_phase (see 4.2.3.3.15) that represents the internal flow of a single phase within a Process_unit_operation (see 4.2.3.2.5). An Internal_stream_phase exists

independent of any Stream (see 4.2.3.3.16). Each Internal_stream_phase may be one of the following: a Distillation_stage_phase (see 4.2.3.3.1) or a Heat_exchanger_internal_phase (see 4.2.3.3.3).

The data associated with Internal_stream_phase are the following:

— mass_flow_rate;

— mole_flow_rate;

— standard_volume_flow_rate.

4.2.3.3.5.1 mass_flow_rate

A mass_flow_rate specifies how much is flowing in the Internal_stream_phase on a mass per unit time basis.

4.2.3.3.5.2 mole_flow_rate

A mole_flow_rate specifies how much is flowing in the Internal_stream_phase on a mole per unit time basis.

4.2.3.3.5.3 standard_volume_flow_rate

A standard_volume_flow_rate specifies how much is flowing in the Internal_stream_phase at standard conditions.

4.2.3.3.6 Material_amount_phase

A Material_amount_phase is a type of Specific_phase (see 4.2.3.3.15) that is a single Phase (see 4.2.2.2.15) or a group of Phases that is treated as a single Phase and is associated with a Material_amount (see 4.2.2.4.10).

The data associated with Material_amount_phase are the following:

— mass;

— mass_fraction;

— mole_fraction;

— moles;

— volume;

— volume_fraction.

4.2.3.3.6.1 mass

A mass specifies the amount of mass in the Material_amount_phase.

4.2.3.3.6.2 mass_fraction

A mass_fraction specifies the ratio of the mass in the Material_amount_phase to the mass in the Material_amount (see 4.2.2.4.10).

4.2.3.3.6.3 mole_fraction

A mole_fraction specifies the ratio between the number of moles in the Material_amount_phase and the number of moles in the Material_amount (see 4.2.2.4.10).

4.2.3.3.6.4 moles

A moles specifies the number of moles present in a Material_amount_phase.

4.2.3.3.6.5 volume

A volume specifies the volume occupied by the Material_amount_phase.

4.2.3.3.6.6 volume_fraction

A volume_fraction specifies the ratio of the volume of the Material_amount_phase to the volume of the Material_amount (see 4.2.2.4.10).

4.2.3.3.7 Material_stream

A Material_stream is a type of Stream (see 4.2.3.3.16) that describes the flow of matter.

The data associated with Material_stream are the following:

— mass_flow_rate;

— mole_flow_rate;

— standard_volume_flow_rate.

4.2.3.3.7.1 mass_flow_rate

A mass_flow_rate specifies how much is flowing in the Material_stream on a mass per unit time basis.

4.2.3.3.7.2 mole_flow_rate

A mole_flow_rate specifies how much is flowing in the Material_stream on a mole per unit time basis.

4.2.3.3.7.3 standard_volume_flow_rate

A standard_volume_flow_rate specifies how much is flowing in the Material_stream at standard conditions.

4.2.3.3.8 Material_stream_phase

A Material_stream_phase is an arbitrary subdivision of a Material_stream (see 4.2.3.3.7).

> NOTE - These subdivisions are often on the basis of a Specific_phase (see 4.2.3.3.15). However, other subdivisions are possible, such as a total liquid Phase (see 4.2.2.2.15) consisting of all existing liquid Phases.

The data associated with Material_stream_phase are the following:

— mass_flow_rate;

— mass_fraction;

— mole_flow_rate;

— mole_fraction;

— standard_volume_flow_rate;

— volume_fraction.

4.2.3.3.8.1 mass_flow_rate

A mass_flow_rate specifies how much is flowing in the Material_stream_phase on a mass per unit time basis.

4.2.3.3.8.2 mass_fraction

A mass_fraction specifies the ratio between the mass flow rate in the Material_stream_phase to that in the Material_stream (see 4.2.3.3.7).

4.2.3.3.8.3 mole_flow_rate

A mole_flow_rate specifies how much is flowing in the Material_stream_phase on a mole per unit time basis.

4.2.3.3.8.4 mole_fraction

A mole_fraction specifies the ratio between the mole flow rate in the Material_stream_phase to that in the Material_stream (see 4.2.3.3.7).

4.2.3.3.8.5 standard_volume_flow_rate

A standard_volume_flow_rate specifies how much is flowing in the Material_stream_phase at standard conditions.

4.2.3.3.8.6 volume_fraction

A volume_fraction specifies the ratio between the volumetric flow rate in the Material_stream_phase to that in the Material_stream (see 4.2.3.3.7).

4.2.3.3.9 Particle_fraction

A Particle_fraction is the fraction of solid particles that occur within a range defined by two Particle_-sizes (see 4.2.3.3.10). A Particle_size_distribution_values (see 4.2.3.3.12) specifies which particles are considered in determining the fraction.

The data associated with Particle_fraction are the following:

— cumulative_mass_fraction;

— mass_fraction.

4.2.3.3.9.1 cumulative_mass_fraction

A cumulative_mass_fraction specifies the ratio of all particles smaller than the upper bound defined by a corresponding Particle_size (see 4.2.3.3.10) to the total mass of particles.

4.2.3.3.9.2 mass_fraction

A mass_fraction specifies the ratio of the mass of the particles that fall between two corresponding Particle_sizes (see 4.2.3.3.10) to the total mass of particles.

4.2.3.3.10 Particle_size

A Particle_size is an absolute size or a screen size that specifies the bounds on an interval for a Particle_-size_distribution (see 4.2.3.3.11).

The data associated with Particle_size are the following:

— size_value.

A size_value specifies the absolute size or screen size that segregates particles.

4.2.3.3.11 Particle_size_distribution

A Particle_size_distribution is the classification of the solid particles of a Substance (see 4.2.2.2.20) or particles of an aggregate of multiple Substances by segregation, by size intervals, or by physical screening. The size intervals for a Particle_size_distribution are supplied by one or more Particle_sizes

(see 4.2.3.3.10). The smallest size interval has a lower bound of 0 while the largest size interval contains all particles larger than the largest Particle_size.

4.2.3.3.12 Particle_size_distribution_values

A Particle_size_distribution_values is the values of the particle intervals for a Particle_size_distribution (see 4.2.3.3.11) in a Material_stream (see 4.2.3.3.7) or Material_amount (see 4.2.2.4.10). A Particle_-size_distribution_values may apply to the particles in the entire Material_stream or Material_amount or may be limited to particles that from a specific solid Phase (see 4.2.2.2.15). A Particle_size_-distribution_values consists of a number of Particle_fractions (see 4.2.3.3.9). The intervals for the Particle_fractions are specified by the Particle_size_distribution.

4.2.3.3.13 Phase_region

A Phase_region is a portion of the property and composition space of a Mixture (see 4.2.2.2.12) that applies to a single physical or logical Phase (see 4.2.2.2.15). For a physical Phase_region, the Mixture properties inside that region apply to a single physical Phase and is bounded by the phase envelope for that Phase. For a logical Phase_region, the Mixture properties are composite or average values for one or more Phases, the properties may be purely hypothetical for part or all of a logical Phase_region. A point within a Phase_region may be given by a Specific_phase (see 4.2.3.3.15).

The data associated with Phase_region are the following:

— description;

— phase_name;

— physical_or_logical.

4.2.3.3.13.1 description

A description specifies a textual explanation or summary of key aspects about the Phase_region.

4.2.3.3.13.2 phase_name

A phase_name specifies a textual label for the Phase (see 4.2.2.2.15) or composite that the Phase_region encompasses.

4.2.3.3.13.3 physical_or_logical

A physical_or_logical specifies the type of the region that the Phase_region encompasses.

4.2.3.3.14 Phases_in_equilibrium

A Phases_in_equilibrium is an association of two or more Specific_phases (see 4.2.3.3.15) indicating that they are in equilibrium with each other.

4.2.3.3.15 Specific_phase

A Specific_phase is a single logical or physical phase of a Mixture (see 4.2.2.2.12) at a given condition. A physical Specific_phase is a homogeneous part of a Mixture whose physical state is given by a Phase (see 4.2.2.2.15). A logical Specific_phase is a heterogeneous part of a Mixture that is lumped together to ease calculations for or descriptions of the Mixture. A Specific_phase may be one of the following: an Internal_stream_phase (see 4.2.3.3.5), a Material_amount_phase (see 4.2.3.3.6), or a Material_-stream_phase (see 4.2.3.3.8).

The data associated with Specific_phase are the following:

— description;

— equilibrium_phase;

— phase_name;

— physical_or_logical.

4.2.3.3.15.1 description

A description specifies a textual explanation or summary of key aspects about the Specific_phase.

4.2.3.3.15.2 equilibrium_phase

An equilibrium_phase specifies that the Specific_phase is at some phase equilibrium condition.

4.2.3.3.15.3 phase_name

A phase_name specifies a textual label that identifies the Specific_phase.

4.2.3.3.15.4 physical_or_logical

A physical_or_logical specifies the type of the Specific_phase.

4.2.3.3.16 Stream

A Stream is the Material (see 4.2.2.4.9), energy, or information that flows between unit operations in a simulation. Each Stream may be one of the following: an Energy_stream (see 4.2.3.3.2), a Material_-stream (see 4.2.3.3.7), or a Utility_stream (see 4.2.3.3.19).

The data associated with Stream are the following:

— stream_name.

A stream_name specifies a textual label identifying the Stream in a simulation run.

4.2.3.3.17 Thermal_stream

A Thermal_stream is an Energy_stream (see 4.2.3.3.2) that is the flow of heat.

The data associated with Thermal_stream are the following:

— temperature_level.

A temperature_level specifies the effective temperature level for the Stream (see 4.2.3.3.16).

4.2.3.3.18 Utility_service_stream_demand

A Utility_service_stream_demand is a requirement by a Utility_material_service (see 4.2.1.1.29) for either a continuous or peak flow by a Stream (see 4.2.3.3.16).

The data associated with Utility_service_stream_demand are the following:

— demand_type.

A demand_type specifies whether the type of demand is continuous or peak.

4.2.3.3.19 Utility_stream

An Utility_stream is a type of Stream (see 4.2.3.3.16) that describes an energy source or sink available to the Process_unit_operation (see 4.2.3.2.5).

NOTE - Utility_stream represents common utility services such as cooling water, steam, and air.

The data associated with Utility_stream are the following:

— utility_flow;

— utility_name.

4.2.3.3.19.1 utility_flow

An utility_flow specifies either the flow rate or the consumption of the Utility_stream.

4.2.3.3.19.2 utility_name

An utility_name specifies a textual label for what the utility service is in the Utility_stream.

4.2.3.3.20 Work_stream

A Work_stream is a type of Energy_stream (see 4.2.3.3.2) that is the flow of work.

4.2.3.4 process_simulation_data

Refer to 4.1.13 for a description of what this UoF specifies. The ARM diagrams related to this UoF are provided as figures G.37 through G.38 in annex G of this part to ISO 10303.

4.2.3.4.1 Algorithm_type_parameter

An Algorithm_type_parameter is a value for one parameter for the major algorithm, specified by the value of Process_simulation.algorithm_name (see 4.2.3.4.5).

The data associated with Algorithm_type_parameter are the following:

— parameter_name;

— parameter_value.

4.2.3.4.1.1 parameter_name

A parameter_name specifies a textual label for the algorithm parameter whose value is being supplied.

4.2.3.4.1.2 parameter_value

A parameter_value specifies the value for the algorithm parameter specified by parameter_name.

4.2.3.4.2 Balance

A Balance is a check on the results of a simulation to ensure that those results obey the laws of conservation of mass, species, or energy. A Balance sums or calculates the outputs of a given type, for example, total mass flows, the inputs of that type, and computes the difference.

The data associated with Balance are the following:

— discrepancy;

— error_flag;

— type.

4.2.3.4.2.1 discrepancy

A discrepancy specifies the imbalance computed by the Balance.

4.2.3.4.2.2 error_flag

An error_flag specifies an enumerated attribute that indicates whether the evaluation of a Balance produced a result that the computed balance is in excess of the tolerance allowed for that type of balance. If the tolerance is exceeded the Balance is in error. The value of the error_flag attribute shall be one of the following:

— error;

— no_error.

4.2.3.4.2.2.1 error: an indication of an error message in the Balance computation in the simulation.

4.2.3.4.2.2.2 no_error**:** an indication of no error messages in the Balance computation in the simulation.

4.2.3.4.2.3 type

A type specifies an enumerated attribute that indicates what type of quantities the Balance is checking for conservation. The value of the type attribute shall be one of the following:

— energy_balance;

— mass_balance;

— mole_balance.

4.2.3.4.2.3.1 energy_balance**:** an indication that the Balance is evaluating the balance of energy flows across the simulation.

4.2.3.4.2.3.2 mass_balance**:** an indication that the Balance is evaluating the balance of mass flows across the simulation.

4.2.3.4.2.3.3 mole_balance**:** an indication that the Balance is evaluating the balance of mole flows across the simulation.

4.2.3.4.3 Convergence_block_property_value_usage

A Convergence_block_property_value_usage is the use of a Process_design_property_value (see 4.2.1.1.14) by a Stream_convergence_block (see 4.2.3.4.30) indicating that the property is a converging variable or an ignored variable in the calculation.

The data associated with Convergence_block_property_value_usage are the following:

— converging_or_ignored.

A converging_or_ignored specifies whether Process_design_property_value is a converging or an ignored variable.

> NOTE - The variable value may be present and may be significant in the simulation. The ignored flag only specifies that the convergence algorithm will explicitly exclude that variable from the convergence criteria evaluation. This allows a convergence specification to either explicitly specify every variable to consider, to consider the module's default set of variables, or to consider the module's default set excluding specific variables.

4.2.3.4.4 Externally_defined_simulation_algorithm

An Externally_defined_simulation_algorithm is an algorithm used in a simulation that has a source external to this part of ISO 10303.

The data associated with Externally_defined_simulation_algorithm are the following:

— name;

— source.

4.2.3.4.4.1 name

A name specifies a textual label for the simulation algorithm.

4.2.3.4.4.2 source

A source specifies a reference for where the simulation algorithm is defined.

4.2.3.4.5 Process_simulation

A Process_simulation is a mathematical model of one or more interconnected unit operations or Streams (see 4.2.3.3.16) or the algorithms used to solve that model. Each Process_simulation may be one of the following: a Simulation_block (see 4.2.3.4.8).

NOTE - A Process_simulation may be constructed of other Process_simulations.

The data associated with Process_simulation are the following:

— algorithm_name;

— algorithm_type;

— module_name;

— module_owner;

— name;

— simulation_error_flag;

— version.

4.2.3.4.5.1 algorithm_name

An algorithm_name specifies the textual label for the algorithm used to solve the simulation or to calculate the unit operation model.

4.2.3.4.5.2 algorithm_type

An algorithm_type specifies the general type of algorithm used by the Process_simulation. The value of algorithm_type shall be one of the following:

— broyden;

— complex;

— continuation;

— direct;

— newton;

— model;

— other;

— secant;

— sqp;

— wegstein.

4.2.3.4.5.2.1 broyden**:** an indication that the algorithm is a convergence algorithm based on Broyden's method.

4.2.3.4.5.2.2 complex**:** an indication that the algorithm is a optimization algorithm with inequality constraints based on the complex method.

4.2.3.4.5.2.3 continuation**:** an indication that the algorithm is a equation set solution based on a continuation variable method.

4.2.3.4.5.2.4 direct**:** an indication that the algorithm is a convergence or equation set solution based on a direct substitution method.

4.2.3.4.5.2.5 newton**:** an indication that the algorithm is a convergence or equation set solution based on the Newton method.

4.2.3.4.5.2.6 model**:** an indication that the algorithm is the calculation of an unit operation model.

4.2.3.4.5.2.7 other**:** an indication that some other algorithm is used by the Process_simulation.

4.2.3.4.5.2.8 secant**:** an indication that the algorithm is a convergence algorithm based on the secant method.

4.2.3.4.5.2.9 sqp**:** an indication that the algorithm is an optimization algorithm based on sequential quadratic programming.

4.2.3.4.5.2.10 wegstein**:** an indication that the algorithm is a convergence algorithm based on Wegstein's method.

4.2.3.4.5.3 module_name

A module_name specifies the vendor specific label of the software module that is used to implement the Process_simulation.

4.2.3.4.5.4 module_owner

A module_owner specifies who produced the Simulation_block (see 4.2.3.4.8) or calculation module within the simulator.

4.2.3.4.5.5 name

A name specifies a user defined textual label that identifies a Process_simulation.

4.2.3.4.5.6 simulation_error_flag

A simulation_error_flag specifies whether the computer execution of the Process_simulation yielded any error conditions.

4.2.3.4.5.7 version

A version specifies the vendor specific version number of the software module implementing the Process_simulation.

4.2.3.4.6 Process_simulation_relationship

A Process_simulation_relationship is an association between two Process_simulation (see 4.2.3.4.5) objects. Each Process_simulation_relationship may be a Simulation_section_relationship (see 4.2.3.4.28).

4.2.3.4.7 Simulated_process_definition

A Simulated_process_definition is the role of the Process_definition (see 4.2.3.1.5) in the associated Process_simulation (see 4.2.3.4.5).

The data associated with Simulated_process_definition are the following:

— usage_type.

A usage_type specifies how the Process_definition is used by the Process_simulation.

> EXAMPLE 37 - A single Process_definition is used as an input specification for one or more Process_-simulations and each of those Process_simulations produces a separate Process_definition as its calculated result.

4.2.3.4.8 Simulation_block

A Simulation_block is a type of Process_simulation (see 4.2.3.4.5) that is a block of calculations that are a single step in the calculation order of a sequential-modular Process_simulation or provide a related set of equations and variables in an equation based Process_simulation. Each Simulation_block may be one of the following: a Stream_convergence_block (see 4.2.3.4.30), a Simulation_unit_operation (see 4.2.3.4.29), or a Variable_convergence_block (see 4.2.3.4.35).

The data associated with Simulation_block are the following:

— description;

— type.

4.2.3.4.8.1 description

A description specifies a textual explanation or summary of key aspects about the Simulation_block.

4.2.3.4.8.2 type

A type specifies whether the Simulation_block is a Stream_convergence_block (see 4.2.3.4.30), a Simulation_unit_operation (see 4.2.3.4.29), a Variable_convergence_block (see 4.2.3.4.35), or some other type of Simulation_block.

4.2.3.4.9 Simulation_centrifuge

A Simulation_centrifuge is a type of Simulation_unit_operation (see 4.2.3.4.29) that simulates a Uo_-centrifuge (see 4.2.3.2.13) unit operation.

The data associated with Simulation_centrifuge are the following:

— diameter_list;

— speed_list.

4.2.3.4.9.1 diameter_list

A diameter_list specifies a listing of allowable diameters used for design.

4.2.3.4.9.2 speed_list

A speed_list specifies a listing of allowable rotational speeds used for design.

4.2.3.4.10 Simulation_compressor

A Simulation_compressor is a type of Simulation_unit_operation (see 4.2.3.4.29) that simulates a Uo_-compressor (see 4.2.3.2.16) unit operation. Each Simulation_compressor may be: a Simulation_-polytropic_compressor (see 4.2.3.4.25) or a Simulation_polytropic_compressor_stage (see 4.2.3.4.26).

The data associated with Simulation_compressor are the following:

— calculation_method;

— cooler_differential_pressure;

— cooler_temperature.

4.2.3.4.10.1 calculation_method

A calculation_method specifies what to calculate and what model is used to perform the calculation.

4.2.3.4.10.2 cooler_differential_pressure

A cooler_differential_pressure specifies the pressure drop across the compressor after cooler.

4.2.3.4.10.3 cooler_temperature

A cooler_temperature specifies the desired outlet temperature for the compressor after cooler.

4.2.3.4.11 Simulation_countercurrent_solids_decanter

A Simulation_countercurrent_solids_decanter is a type of Simulation_unit_operation (see 4.2.3.4.29) that simulates a Uo_countercurrent_solids_decant (see 4.2.3.2.18) unit operation.

The data associated with Simulation_countercurrent_solids_decanter are the following:

— stages_maximum;

— stages_minimum.

4.2.3.4.11.1 stages_maximum

A stages_maximum specifies the maximum number of stages that the simulator may use in the Simulation_countercurrent_solids_decanter.

4.2.3.4.11.2 stages_minimum

A stages_minimum specifies the minimum number of stages that the simulator may use in the Simulation_countercurrent_solids_decanter.

4.2.3.4.12 Simulation_crystallizer

A Simulation_crystallizer is a type of Simulation_unit_operation (see 4.2.3.4.29) that simulates a Uo_-crystallization (see 4.2.3.2.20) unit operation.

NOTE - Crystallization is used in industrial processes for the manufacturing of organics, inorganics, fertilizers, biochemicals, and polymers.

The data associated with Simulation_crystallizer are the following:

— equation_coefficient;

— equation_exponent;

— equation_identifier;

— shape_factor.

4.2.3.4.12.1 equation_coefficient

An equation_coefficient specifies the linear parameter in the model for solid-liquid equilibrium used by the Simulation_crystallizer.

4.2.3.4.12.2 equation_exponent

An equation_exponent specifies the exponential parameter in the model for solid-liquid equilibrium used by the Simulation_crystallizer.

4.2.3.4.12.3 equation_identifier

An equation_identifier specifies kinetic expressions that define the growth and nucleation expressions.

4.2.3.4.12.4 shape_factor

A shape_factor specifies the crystal shape factor.

> NOTE - This factor is used to define the approximate shape of the crystal. Values range from 1.0. indicating a cubic crystal, to a factor of pi/6, indicating a spherical shaped crystal.

4.2.3.4.13 Simulation_dissolver

A Simulation_dissolver is a type of Simulation_unit_operation (see 4.2.3.4.29) that simulates a Uo_-dissolve (see 4.2.3.2.22) unit operation.

> NOTE - Mass transfer controlled dissolution is a unit operation used in both organic and inorganic processes. The most common is the stirred tank dissolver, where the liquid is assumed to be well mixed. The primary objective of the dissolver is to transform crystals in solution from the solid to the liquid phase.

The data associated with Simulation_dissolver are the following:

— mass_transfer_coefficients;

— mass_transfer_expression.

4.2.3.4.13.1 mass_transfer_coefficients

A mass_transfer_coefficients specifies the parameters used in the mass_transfer_expression.

4.2.3.4.13.2 mass_transfer_expression

A mass_transfer_expression specifies the mass transfer rate in solution.

4.2.3.4.14 Simulation_distillation

A Simulation_distillation is a type of Simulation_unit_operation (see 4.2.3.4.29) that simulates a Uo_-distillation (see 4.2.3.2.23) unit operation.

The data associated with Simulation_distillation are the following:

— feed_stage_number_optimum;

— initial_estimation_method;

— initial_reflux;

— initial_reflux_ratio;

— number_of_stages_minimum;

— reflux_ratio_multiplier.

4.2.3.4.14.1 feed_stage_number_optimum

A feed_stage_number_optimum specifies the optimal stage for supplying the feed to the distillation column.

4.2.3.4.14.2 initial_estimation_method

An initial_estimation_method specifies what method is used to provide initial values for the column profiles.

4.2.3.4.14.3 initial_reflux

An initial_reflux specifies the initial value for the reflux rate to the column.

4.2.3.4.14.4 initial_reflux_ratio

An initial_reflux_ratio specifies the initial value of the reflux ratio for the distillation column.

4.2.3.4.14.5 number_of_stages_minimum

A number_of_stages_minimum specifies the minimum number of stages for the Uo_distillation.

NOTE - This number is used in the shortcut model to define a factor that the minimum number of stages is multiplied by to determine the actual number of stages.

4.2.3.4.14.6 reflux_ratio_multiplier

A reflux_ratio_multiplier specifies a factor that the minimum reflux ratio is multiplied by to determine the actual reflux ratio.

4.2.3.4.15 Simulation_distillation_stage

A Simulation_distillation_stage is a type of Simulation_unit_operation (see 4.2.3.4.29) that simulates a Uo_distillation_stage (see 4.2.3.2.24) in a Simulation_distillation (see 4.2.3.4.14).

The data associated with Simulation_distillation_stage are the following:

— initial_stage_pressure;

— initial_stage_temperature.

4.2.3.4.15.1 initial_stage_pressure

An initial_stage_pressure specifies the initial value for the pressure for that stage in the Simulation_-distillation (see 4.2.3.4.14).

4.2.3.4.15.2 initial_stage_temperature

An initial_stage_temperature specifies the initial value for the temperature for that stage in the Simulation_distillation (see 4.2.3.4.14).

4.2.3.4.16 Simulation_electrostatic_precipitator

A Simulation_electrostatic_precipitator is a type of Process_simulation (see 4.2.3.4.5) that simulates a Uo_electrostatic_precipitator (see 4.2.3.2.27) unit operation.

The data associated with Simulation_electrostatic_precipitator are the following:

— gas_velocity_profile_standard_deviation.

A gas_velocity_profile_standard_deviation specifies the standard deviation for the measurements of points in the velocity profile associated with the Simulation_electrostatic_precipitator in the simulation.

4.2.3.4.17 Simulation_fabric_filter

A Simulation_fabric_filter is a type of Process_simulation (see 4.2.3.4.5) that simulates a Uo_fabric_-filter (see 4.2.3.2.31) unit operation.

The data associated with Simulation_fabric_filter are the following:

— calculation_mode.

A calculation_mode specifies an enumerated attribute giving the type of calculation to perform for the Simulation_fabric_filter. The value of the calculation_mode attribute shall be one of the following:

— calculate_pressure_drop;

— calculate_time.

4.2.3.4.17.0.1 calculate_pressure_drop**:** an indication that a pressure drop calculation is to be done.

4.2.3.4.17.0.2 calculate_time**:** an indication that cycle time calculation is to be done.

4.2.3.4.18 Simulation_flash

A Simulation_flash is a type of Simulation_unit_operation (see 4.2.3.4.29) that simulates a Uo_flash (see 4.2.3.2.34) unit operation.

> NOTE - It may occur when a Stream (see 4.2.3.3.16) is throttled across a valve with the resulting pressure drop causing vapourization.

The data associated with Simulation_flash are the following:

— pressure_estimate;

— temperature_estimate;

— three_phase_calculation.

4.2.3.4.18.1 pressure_estimate

A pressure_estimate specifies an initial value for the pressure of the Simulation_flash.

4.2.3.4.18.2 temperature_estimate

A temperature_estimate specifies an initial value for the temperature of the Simulation_flash.

4.2.3.4.18.3 three_phase_calculation

A three_phase_calculation specifies an enumerated attribute that indicates the method or model used by the Simulation_flash to calculate the distribution of Chemical_components (see 4.2.2.2.4) across the

vapour Phase (see 4.2.2.2.15) and two liquid Phases, if a second liquid Phase is present. The value of the three_phase_calculation attribute shall be one of the following:

— gibbs;

— equilibrium;

— none;

— other;

— rigorous;

— unspecified;

— water_decanted.

4.2.3.4.18.3.1 gibbs**:** an indication that a minimized Gibbs free energy three phase calculation is done.

4.2.3.4.18.3.2 equilibrium**:** an indication that an equilibrium three phase calculation is done.

4.2.3.4.18.3.3 none**:** an indication that no three phase calculation is done.

4.2.3.4.18.3.4 other**:** an indication that another method is used for three phase calculation other than rigorous, Gibbs, equilibrium, or water_decanted.

4.2.3.4.18.3.5 rigorous**:** an indication that a rigorous three phase calculation is done.

4.2.3.4.18.3.6 unspecified**:** an indication that the three phase calculation is not specified.

4.2.3.4.18.3.7 water_decanted**:** an indication that a water free basis three phase calculation is done.

4.2.3.4.19 Simulation_gas_solid_separator

A Simulation_gas_solid_separator is a type of Process_simulation (see 4.2.3.4.5) that simulates a Uo_-gas_solid_separation (see 4.2.3.2.36) unit operation.

The data associated with Simulation_gas_solid_separator are the following:

— calculation_option.

A calculation_option specifies an enumerated attribute that indicates whether the Simulation_gas_solid_-separator is to simulate the performance of a gas solid separator based on geometry parameters supplied as input or whether the Simulation_gas_solid_separator is to size the separator based on performance constraints. The value of the calculation_option attribute shall be one of the following:

— design;

— simulation.

4.2.3.4.19.0.1 design**:** an indication of calculation_option, describing the option for the Simulation_gas_-solid_separator.

4.2.3.4.19.0.2 simulation**:** an indication of calculation_option, describing the option for the Simulation_-gas_solid_separator.

4.2.3.4.20 Simulation_heat_exchanger

A Simulation_heat_exchanger is a Simulation_unit_operation (see 4.2.3.4.29) that simulates a Uo_heat_-exchanger (see 4.2.3.2.37) unit operation.

The data associated with Simulation_heat_exchanger are the following:

— uamax.

An uamax specifies the maximum value for the overall Heat_transfer_coefficient (see 4.2.3.2.4) that may be assigned to the Simulation_heat_exchanger.

4.2.3.4.21 Simulation_hydrocyclone

A Simulation_hydrocyclone is a type of Process_simulation (see 4.2.3.4.5) that simulates a Uo_-hydrocyclone (see 4.2.3.2.40) unit operation.

The data associated with Simulation_hydrocyclone are the following:

— particle_velocity_equation_coefficient;

— particle_velocity_equation_exponent.

4.2.3.4.21.1 particle_velocity_equation_coefficient

A particle_velocity_equation_coefficient specifies the constant for the particle velocity equation for the Simulation_hydrocyclone in the simulation.

4.2.3.4.21.2 particle_velocity_equation_exponent

A particle_velocity_equation_exponent specifies the exponent for the particle velocity equation for the Simulation_hydrocyclone in the simulation.

4.2.3.4.22 Simulation_liquid_solid_separator

A Simulation_liquid_solid_separator is a type of Process_simulation (see 4.2.3.4.5) that simulates a Uo_-liquid_solid_separation (see 4.2.3.2.43) unit operation.

The data associated with Simulation_liquid_solid_separator are the following:

— calculation_option.

A calculation_option specifies an enumerated attribute that indicates whether the unit operation is to be simulated or a design equation is used. The value of the calculation_option attribute shall be one of the following:

— design;

— simulate.

4.2.3.4.22.0.1 design**:** an indication that the unit operation is a design calculation only.

4.2.3.4.22.0.2 simulate**:** an indication that the unit operation is to be simulated.

4.2.3.4.23 Simulation_pipeline

A Simulation_pipeline is a type of Simulation_unit_operation (see 4.2.3.4.29) that simulates a Uo_-pipeline (see 4.2.3.2.49) unit operation.

The data associated with Simulation_pipeline are the following:

— calculation_direction;

— maximum_differential_pressure;

— maximum_velocity;

— minimum_radius;

— numerical_integration_key;

— pipe_sizes;

— thermal_simulation_key.

4.2.3.4.23.1 calculation_direction

A calculation_direction specifies an enumerated attribute that indicates whether the Stream (see 4.2.3.3.16) conditions are to be calculated for the exit end of the Simulation_pipeline are based on Stream conditions at the inlet or whether the Stream conditions are to be calculated for the inlet end of the Simulation_pipeline based on conditions at the exit end. The value of the calculation_direction attribute shall be one of the following:

— backward;

— forward.

4.2.3.4.23.1.1 backward**:** an indication that the calculation direction is backwards for the Simulation_-pipeline.

4.2.3.4.23.1.2 forward**:** an indication that the calculation direction is forward for Simulation_pipeline.

4.2.3.4.23.2 maximum_differential_pressure

A maximum_differential_pressure specifies the maximum limit of differential pressure across the Simulation_pipeline.

4.2.3.4.23.3 maximum_velocity

A maximum_velocity specifies the maximum limit for fluid velocity anywhere within the Simulation_-pipeline.

4.2.3.4.23.4 minimum_radius

A minimum_radius specifies the minimum bend radius that is allowed in the pipeline.

4.2.3.4.23.5 numerical_integration_key

A numerical_integration_key specifies an enumerated attribute giving the type of integration used by the Simulation_pipeline. The value of the numerical_integration_key attribute shall be one of the following:

— closed_form_method;

— numerical_integration.

4.2.3.4.23.5.1 closed_form_method**:** an indication that a closed form integration is used.

4.2.3.4.23.5.2 numerical_integration**:** an indication that a numerical integration is used.

4.2.3.4.23.6 pipe_sizes

A pipe_sizes specifies a list of allowable pipe diameters that the Simulation_pipeline can use in designing the pipeline.

4.2.3.4.23.7 thermal_simulation_key

A thermal_simulation_key specifies an enumerated attribute giving the type of thermal separation to perform for the Simulation_pipeline. The value of the thermal_simulation_key attribute shall be one of the following:

— energy_balance;

— linear_temperature_profile.

4.2.3.4.23.7.1 energy_balance**:** an indication that an energy Balance (see 4.2.3.4.2) is performed.

4.2.3.4.23.7.2 linear_temperature_profile**:** an indication that the generation of a linear temperature profile is performed.

4.2.3.4.24 Simulation_pipeline_node

A Simulation_pipeline_node is a type of Simulation_unit_operation (see 4.2.3.4.29) that simulates a Uo_-pipeline_node (see 4.2.3.2.50) unit operation as a single point in a Simulation_pipeline (see 4.2.3.4.23).

The data associated with Simulation_pipeline_node are the following:

— erosion_velocity_calculation_constant.

An erosion_velocity_calculation_constant specifies the erosion velocity calculation constant for the node.

4.2.3.4.25 Simulation_polytropic_compressor

A Simulation_polytropic_compressor is a type of Simulation_compressor (see 4.2.3.4.10) that is the simulation of a multi-stage compressor whose stages are simulated unit operation in the simulation.

The data associated with Simulation_polytropic_compressor are the following:

— radial_frequency.

A radial_frequency specifies rotational speed of the compressor.

4.2.3.4.26 Simulation_polytropic_compressor_stage

A Simulation_polytropic_compressor_stage is a type of Simulation_compressor (see 4.2.3.4.10) that simulates a Uo_centrifugal_compressor_stage (see 4.2.3.2.12) by specifying its polytropic efficiency. Polytropic efficiency is used to calculate a polytropic coefficient to use in place of the heat capacity ratio, $C_p/C_{v,}$ in the equation for the polytropic, or irreversible, operation of a compressor or expander. Simulation_polytropic_compressor_stage is part of a Simulation_polytropic_compressor (see 4.2.3.4.25)..

The data associated with Simulation_polytropic_compressor_stage are the following:

— polytropic_efficiency;

— stage_number.

4.2.3.4.26.1 polytropic_efficiency

A polytropic_efficiency specifies the value for the polytropic efficiency associated assigned to the stage.

4.2.3.4.26.2 stage_number

A stage_number specifies the position of the Simulation_polytropic_compressor_stage within the Simulation_polytropic_compressor (see 4.2.3.4.25).

4.2.3.4.27 Simulation_rotary_filter

A Simulation_rotary_filter is a Simulation_unit_operation (see 4.2.3.4.29) that simulates a Uo_rotary_-filter (see 4.2.3.2.59) unit operation.

The data associated with Simulation_rotary_filter are the following:

— pressure_drop_maximum;

— width_diameter_ratio.

4.2.3.4.27.1 pressure_drop_maximum

A pressure_drop_maximum specifies the maximum difference between the inlet and outlet pressures of the Simulation_rotary_filter allowed in the design.

4.2.3.4.27.2 width_diameter_ratio

A width_diameter_ratio specifies the specification of the allowed width to diameter ratio for the Simulation_rotary_filter design.

4.2.3.4.28 Simulation_section_relationship

A Simulation_section_relationship is a type of Process_simulation_relationship (see 4.2.3.4.6) where one is the containing Process_simulation (see 4.2.3.4.5) and the other is a simulation section for the containing Process_simulation.

> NOTE - The relating simulation specifies the containing Process_simulation (see 4.2.3.4.5) and the related simulation specifies the simulation section.

The data associated with Simulation_section_relationship are the following:

— process_simulation_section_name.

A process_simulation_section_name specifies a textual label that identifies the Process_simulation (see 4.2.3.4.5) section within the containing Process_simulation.

4.2.3.4.29 Simulation_unit_operation

A Simulation_unit_operation is a type of Simulation_block (see 4.2.3.4.8) that is the simulation of a Process_unit_operation (see 4.2.3.2.5). A Simulation_unit_operation contains information about how a Process_unit_operation is to be simulated, but in general does not contain engineering information about the Process_unit_operation itself. There are, in general, corresponding Process_unit_operations for each Simulation_unit_operation. The corresponding Process_unit_operation and Simulation_unit_-operation, taken together, constitute what process simulators typically refer to as a unit operation block.

A Simulation_unit_operation may be one of the following: Simulation_compressor (see 4.2.3.4.10), Simulation_countercurrent_solids_decanter (see 4.2.3.4.11), Simulation_crystallizer (see 4.2.3.4.12), Simulation_dissolver (see 4.2.3.4.13), Simulation_distillation (see 4.2.3.4.14), Simulation_distillation_-

stage (see 4.2.3.4.15), Simulation_electrostatic_precipitator (see 4.2.3.4.16), Simulation_fabric_filter (see 4.2.3.4.17), Simulation_flash (see 4.2.3.4.18), Simulation_gas_solid_separator (see 4.2.3.4.19), Simulation_heat_exchanger (see 4.2.3.4.20), Simulation_hydrocyclone (see 4.2.3.4.21), Simulation_-liquid_solid_separator (see 4.2.3.4.22), Simulation_pipeline (see 4.2.3.4.23), Simulation_pipeline_node (see 4.2.3.4.24), Simulation_polytropic_compressor (see 4.2.3.4.25), Simulation_polytropic_-compressor_stage (see 4.2.3.4.26), or a Simulation_rotary_filter (see 4.2.3.4.27).

4.2.3.4.30 Stream_convergence_block

A Stream_convergence_block is a Simulation_block (see 4.2.3.4.8) that implements a convergence or optimization algorithm for a Process_simulation (see 4.2.3.4.5) that modifies the values of one or more tear Streams (see 4.2.3.3.16) or Simulation_blocks (see 4.2.3.4.8) to achieve convergence.

The data_associated with Stream_convergence_block are the following:

— acceleration_method;

— calculation_sequence_type;

— tolerance_method;

— tolerance_value;

— type.

4.2.3.4.30.1 acceleration_method

An acceleration_method specifies a method to accelerate or control the convergence step applied by the Process_simulation.algorithm_type (see 4.2.3.4.5).

4.2.3.4.30.2 calculation_sequence_type

A calculation_sequence_type specifies how the Process_simulation (see 4.2.3.4.5) orders block calculations inside the Stream_convergence_block and how it selects variables to converge on. The value of the calculation_sequence_type attribute shall be one of the following:

— algorithm_only;

— calculation_order;

— calculation_order_and_algorithm;

— complete_tear_stream;

— complete_tear_stream_and_algorithm;

— partial_tear_stream;

— partial_tear_stream_and_algorithm;

— system_default.

4.2.3.4.30.2.1 algorithm_only**:** an indication that only the convergence algorithm method and values are supplied.

4.2.3.4.30.2.2 calculation_order**:** an indication that the blocks inside the convergence loop are specified but that the algorithm choice is left to the module.

4.2.3.4.30.2.3 calculation_order_and_algorithm**:** an indication that the blocks inside the convergence loop are specified and the convergence algorithm method and values are supplied.

4.2.3.4.30.2.4 complete_tear_stream**:** an indication that all tear streams for the block are specified but that the algorithm choice is left to the module.

4.2.3.4.30.2.5 complete_tear_stream_and_algorithm**:** an indication that all tear streams for the block are specified and the convergence algorithm method and values are supplied.

4.2.3.4.30.2.6 partial_tear_stream**:** an indication that one or more tear streams are specified but that the algorithm choice is left to the module. If insufficient tear streams are specified the module will chose the remainder.

4.2.3.4.30.2.7 partial_tear_stream_and_algorithm**:** an indication that one or more tear streams are specified and the convergence algorithm method and values are supplied. If insufficient tear streams are specified the module will chose the remainder.

4.2.3.4.30.2.8 system_default**:** an indication that the module chooses which variable to converge on, which algorithm to use, and the calculation sequence.

4.2.3.4.30.3 tolerance_method

A tolerance_method specifies the how the error that the tolerance is compared with is calculated.

4.2.3.4.30.4 tolerance_value

A tolerance_value specifies the criteria used by the convergence test to determine if a variable has converged.

4.2.3.4.30.5 type

A type specifies the convergence or optimization algorithm used by the Stream_convergence_block.

4.2.3.4.31 Thermophysical_property_method

A Thermophysical_property_method is a named set of related thermodynamic or transport property models used by a Process_simulation (see 4.2.3.4.5).

The data associated with Thermophysical_property_method are the following:

— method_description;

— method_name;

— method_phase.

4.2.3.4.31.1 method_description

A method_description specifies a textual explanation or summary of key aspects about the Thermophysical_property_method.

4.2.3.4.31.2 method_name

A method_name specifies a textual label that identifies the Thermophysical_property_method.

4.2.3.4.31.3 method_phase

A method_phase specifies that the Thermophysical_property_method applies only to a specific physical phase.

4.2.3.4.32 Thermophysical_property_method_option

A Thermophysical_property_method_option is a thermodynamic property option in the simulation.

The data associated with Thermophysical_property_method_option are the following:

— default;

— name;

— value.

4.2.3.4.32.1 default

A default specifies whether or not the Thermophysical_property_method_option is a default option.

4.2.3.4.32.2 name

A name specifies a textual label assigned to the Thermophysical_property_method_option in the simulation.

4.2.3.4.32.3 value

A value specifies the value of the Thermophysical_property_method_option in the simulation.

4.2.3.4.33 Trace_component_specification

A Trace_component_specification is the criteria that a Stream_convergence_block (see 4.2.3.4.30) may use in order to determine which components are present only in trace amounts and should be ignored in the convergence testing.

The data associated with Trace_component_specification are the following:

— applies_to;

— in_phases;

— minimum_fraction.

4.2.3.4.33.1 applies_to

An applies_to specifies whether the Trace_component_specification applies to all or only specified Substances (see 4.2.2.2.20) that may be present in the tear Stream (see 4.2.3.3.16) or Simulation_block (see 4.2.3.4.8) being converged. The value of the applies_to attribute shall be one of the following:

— all_components;

— specified_components.

4.2.3.4.33.1.1 all_components**:** an indication that the Trace_component_specification should be applied to all Substances (see 4.2.2.2.20) being converged.

4.2.3.4.33.1.2 specified_components**:** an indication that the Trace_component_specification is applied to one or more specified Substances (see 4.2.2.2.20).

4.2.3.4.33.2 in_phases

An in_phases specifies whether the Trace_component_specification applies to all or only specified Phases (see 4.2.2.2.15) that may be present in the tear Stream (see 4.2.3.3.16) or Simulation_block (see 4.2.3.4.8) being converged. The value of the in_phase attribute shall be one of the following:

— all_phases;

— specified_phases.

4.2.3.4.33.2.1 all_phases**:** an indication that the Trace_component_specification should be applied to all Phases (see 4.2.2.2.15) being converged.

4.2.3.4.33.2.2 specified_phases**:** an indication that the Trace_component_specification is applied to one or more specified Phases (see 4.2.2.2.15).

4.2.3.4.33.3 minimum_fraction

A minimum_fraction specifies the mole fraction below which a Substance (see 4.2.2.2.20) is considered to be a trace component and is ignored by the convergence test.

4.2.3.4.34 Variable_adjustment_specification

A Variable_adjustment_specification is the use of a Process_design_property_value (see 4.2.1.1.14) by a Variable_convergence_block (see 4.2.3.4.35) indicating that the property is a variable that may be varied in the Process_simulation (see 4.2.3.4.5) to achieve the desired objectives of the Variable_-convergence_block.

The data associated with Variable_adjustment_specification are the following:

— lower_limit;

— upper_limit.

4.2.3.4.34.1 lower_limit

A lower_limit specifies the bound below which the value of the variable may not be set by the Variable_-convergence_block (see 4.2.3.4.35).

4.2.3.4.34.2 upper_limit

A upper_limit specifies the bound above which the value of the variable may not be set by the Variable_-convergence_block (see 4.2.3.4.35).

4.2.3.4.35 Variable_convergence_block

A Variable_convergence_block is a Simulation_block (see 4.2.3.4.8) that varies the value of one or more Stream (see 4.2.3.3.16) variables or Process_unit_operation (see 4.2.3.2.5) variables specified by a Variable_adjustment_specification (see 4.2.3.4.34) to meet a desired objective for one or more other Stream or Process_unit_operation variables in the context of a Process_simulation (see 4.2.3.4.5).

4.2.3.4.36 Variable_convergence_specification

A Variable_convergence_specification is the specification of the criteria a Variable_convergence_block (see 4.2.3.4.35) uses to determine if a target variable specified by a Process_design_property_value (see 4.2.1.1.14) has converged.

The data associated with Variable_convergence_specification are the following:

— tolerance_method;

— tolerance_value.

4.2.3.4.36.1 tolerance_method

A tolerance_method specifies how the error that the tolerance is compared with is calculated.

4.2.3.4.36.2 tolerance_value

A tolerance_value specifies the criteria used by the convergence test to determine if a variable has converged.

4.2.3.5 process_flow_diagram

Refer to 4.1.12 for a description of what this UoF specifies. The ARM diagram related to this UoF is provided as figures G.36 in annex G of this part to ISO 10303.

4.2.3.5.1 PFD

A PFD is a process flow diagram. The PFD is comprised of a PFD_title_block (see 4.2.3.5.10) and a number of PFD_presentation_components (see 4.2.3.5.5). A PFD is a schematic representation containing the aggregation of the results of a process design activity. A PFD shows the arrangement of the equipment selected to carry out the processes, the stream connections, stream flow rates and compositions, and the operating conditions.

The data associated with PFD are the following:

— id;

— type;

— version.

A description specifies a textual explanation or summary of key aspects of the PFD.

4.2.3.5.1.1 id

An id specifies a unique identifier for the PFD.

4.2.3.5.1.2 type

A type specifies the various types of PFDs that can be depicted.

NOTE - This type could consist of a Simplified PFD (SFD), a Quantity Flow Diagram (QFD), a PFD, or finally a Process Flow and Control Diagram (PF&CD).

4.2.3.5.1.3 version

A version specifies the revision level of the PFD.

4.2.3.5.2 PFD_curve

A PFD_curve is the placement of a curve or curves on a PFD (see 4.2.3.5.1) to represent a portion or all of a PFD_element (see 4.2.3.5.3).

The data associated with PFD_curve are the following:

— defining_curve.

A defining_curve specifies a particular line such as a box, circle, ellipsoid, free form curve, or straight line that is used to draw the PFD_curve.

4.2.3.5.3 PFD_element

A PFD_element is the specific representation of a piece of Process_equipment (see 4.2.4.2.8), or a particular Stream (see 4.2.3.3.16), or a control element, or a Process_unit_operation (see 4.2.3.2.5) depicted on the PFD (see 4.2.3.5.1).

The data associated with PFD_element are the following:

— style.

A style specifies a combination of points, curves, and text that are assembled to represent an element.

4.2.3.5.4 PFD_point

A PFD_point is the placement of a point or points on a PFD (see 4.2.3.5.1) to represent a portion or all of a PFD_element (see 4.2.3.5.3).

The data associated with PFD_point are the following:

— point_coordinates.

A point_coordinates specifies the exact location on the PFD (see 4.2.3.5.1) in both X and Y coordinates for the PFD_point.

4.2.3.5.5 PFD_presentation_component

A PFD_presentation_component specifies how the depicted PFD (see 4.2.3.5.1) conforms to a certain type of PFD.

4.2.3.5.6 PFD_presentation_component_composition

A PFD_presentation_component_composition is the composition makeup for a particular view of the component.

The data associated with PFD_presentation_component_composition are the following:

— clipping.

A clipping specifies eliminating a portion of the drawing either inside the fenced or selected area and maintaining everything outside that area or outside the fenced or selected area and maintaining everything inside that area.

4.2.3.5.7 PFD_symbol_definition

A PFD_symbol_definition specifies a combination of one or more of PFD_points (see 4.2.3.5.4), PFD_-curves (see 4.2.3.5.2), PFD_text (see 4.2.3.5.9), and PFD_symbol_occurrences (see 4.2.3.5.8) to generate a symbol and place it on the PFD (see 4.2.3.5.1).

The data associated with PFD_symbol_definition are the following:

— description;

— identifier;

— name;

— source.

4.2.3.5.7.1 description

A description specifies a textual explanation or summary of a specific named symbol.

EXAMPLE 38 - The symbol named pump may be described as a centrifugal pump with an electrical driver.

4.2.3.5.7.2 identifier

An identifier specifies a unique identifier for the PFD_symbol_definition.

4.2.3.5.7.3 name

A name specifies a textual label given to a particular symbol.

4.2.3.5.7.4 source

A source specifies whether a symbol is available to the drawing from a standard cell library, from a specifically generated cell library, or from the drawing tool palette.

4.2.3.5.8 PFD_symbol_occurrence

A PFD_symbol_occurrence consists of the use of a previously drawn symbol that is available from a palette or cell library and can be placed on the PFD (see 4.2.3.5.1) as a complete symbol.

4.2.3.5.9 PFD_text

A PFD_text is the placement of alphanumeric text on a PFD (see 4.2.3.5.1) as part of the PFD_element (see 4.2.3.5.3) or as textual notes.

The data associated with PFD_text are the following:

— text_literal.

A text_literal specifies bringing together alphanumeric text on a PFD (see 4.2.3.5.1) as either notes on the depicted drawing, or as a description on or near the PFD_element (see 4.2.3.5.3), or as text on the PFD_title_block (see 4.2.3.5.10).

4.2.3.5.10 PFD_title_block

A PFD_title_block is the process flow diagram title block.

> NOTE - The title block is usually located in the lower right corner of the drawing and contains the project name, project receiver, and project owner.

The data associated with PFD_title_block are the following:

— approvals;

— contractor_info.

4.2.3.5.10.1 approvals

An approvals specifies who has approved the basic design as depicted on that particular PFD (see 4.2.3.5.1).

4.2.3.5.10.2 contractor_info

A contractor_info specifies what contractor, if any, has contributed to that particular PFD (see 4.2.3.5.1) and in what way they have made a contribution.

4.2.3.6 control_strategy

Refer to 4.1.2 for a description of what this UoF specifies. The ARM diagrams related to this UoF are provided as figures G.2 through G.3 in annex G of this part to ISO 10303.

4.2.3.6.1 Continuous_control_objective

A Continuous_control_objective is the goal that the Continuous_control_scheme (see 4.2.3.6.2) is designed to satisfy for the control of the process.

> NOTE - The Continuous_control_objective is often selected from a list of possible objectives within a particular enterprise.

EXAMPLE 39 - During steady-state operation, maintain Tank 101 level at a setpoint of 50%.

The data associated with Continuous_control_objective are the following:

— objective_description;

— objective_name;

— operating_state.

4.2.3.6.1.1 objective_description

An objective_description specifies an optional textual explanation or summary of the Continuous_-control_objective.

EXAMPLE 40 - Maintain Tank 101 level at 50 percent.

4.2.3.6.1.2 objective_name

An objective_name specifies the unique textual label for the Continuous_control_objective.

EXAMPLE 41 - Tank 101 level regulatory control.

4.2.3.6.1.3 operating_state

An operating_state specifies the operating state of the process.

EXAMPLE 42 - Startup, shutdown, standby, or steady-state.

4.2.3.6.2 Continuous_control_scheme

A Continuous_control_scheme defines the basic controls, instrument and information methods to permit a process to manufacture a desired product using control systems that continuously measure and adjust Streams (see 4.2.3.3.16) or Process_design_property_values (see 4.2.1.1.14).

The data associated with Continuous_control_scheme are:

— scheme_id;

— scheme_type.

4.2.3.6.2.1 scheme_id

A scheme_id specifies a unique identification for the Continuous_control_scheme.

4.2.3.6.2.2 scheme_type

A scheme_type specifies an enumerated attribute that identifies the general category of the Continuous_-control_scheme. The value of the scheme_type attribute shall be one of the following:

— recording_indication;

— regulatory_control.

4.2.3.6.2.2.1 recording_indication**:** an indication that measured variables are recorded on persistent media such as paper charts or digital computer magnetic disks or are indicated to humans. No control action is taken.

4.2.3.6.2.2.2 regulatory_control**:** an indication that the control is to maintain controlled variables at specified set point(s).

4.2.3.6.3 Control_adjustment

A Control_adjustment is a type of Process_definition (see 4.2.3.1.5) that continuously adjusts or manipulates a Stream (see 4.2.3.3.16) or Process_design_property_value (see 4.2.1.1.14) to carry out the results of a Control_loop (see 4.2.3.6.7) algorithm.

4.2.3.6.4 Control_event

A Control_event is a type of Process_definition (see 4.2.3.1.5) that manipulates a Stream (see 4.2.3.3.16) or Process_design_property_value (see 4.2.1.1.14) to carry out the event that results from applying a Control_logic (see 4.2.3.6.5).

4.2.3.6.5 Control_logic

A Control_logic is a control module that causes one or more Control_events (see 4.2.3.6.4) to occur based on a Control_logic_condition (see 4.2.3.6.6) to meet a Discrete_control_objective (see 4.2.3.6.8).

NOTE - Refer to ISA-S88-01 [1] for a description of a control module.

The data associated with Control_logic are the following:

— algorithm_name;

— algorithm_source;

— description;

— logic_id.

4.2.3.6.5.1 algorithm_name

An algorithm_name specifies the unique textual label given to the Control_logic.

EXAMPLE 43 - Fill Tank 101 or Tank 101 high level alarm.

4.2.3.6.5.2 algorithm_source

An algorithm_source specifies a textual description that indicates a reference for where the algorithm is defined.

EXAMPLE 44 - John Doe wrote a procedure on 1998-03-09.

4.2.3.6.5.3 description

A description specifies an optional additional textual explanation or summary of the Control_logic.

EXAMPLE 45 - Tank 101 high level setpoint alarm set to 90 percent to avoid tank overflow.

4.2.3.6.5.4 logic_id

A logic_id specifies a unique identifier for the Control_logic.

4.2.3.6.6 Control_logic_condition

A Control_logic_condition is a logical condition that indicates whether or not a Control_logic (see 4.2.3.6.5) will be executed. The condition may be either the result of a simple measurement of a Process_design_property_value (see 4.2.1.1.14), or it may be a logical combination of the results of measurements and the state of other control events. Each Control_logic_condition may be one of the following: a Logical_operation (see 4.2.3.6.10) or a Trigger (see 4.2.3.6.11).

EXAMPLE 46 - If Tank 101 level is greater than 80 percent then switch Tank 101 high level alarm to ON.

The data associated with Control_logic_condition is:

— name.

A name specifies a textual label for the Control_logic_condition within the context of the Continuous_-control_scheme (see 4.2.3.6.2). The value of the name attribute may be one of the following:

— close;

— cycle;

— high_alarm;

— high_interlock;

— low_alarm;

— low_interlock;

— open;

— press;

— press_and_hold;

— release;

— sequence;

— set_control_mode_to_automatic;

— set_control_mode_to_manual;

— set_control_mode_to_semi-automatic;

— set_switch;

— split_range_feedback;

— two_out_of_three_vote;

— two_out_of_two_vote;

— user_defined;

— wait;

— wait_until.

4.2.3.6.6.0.1 close: an indication of a control event initiated by an automated system or by the operator to close a specified valve or relay switch.

4.2.3.6.6.0.2 cycle**:** an indication that a set of control events is done in a sequence, that is then repeated until a specified condition is met.

4.2.3.6.6.0.3 high_alarm**:** an indication of an attention-getting auditory or visual cue to an operator to take action. The High Alarm event occurs when a controlled variable exceeds a specified limit condition.

4.2.3.6.6.0.4 high_interlock**:** an indication of an automatic control event, such as closing or opening a valve or relay switch in response to a controlled variable exceeding a specified limit condition.

4.2.3.6.6.0.5 low_alarm**:** an indication of an attention-getting auditory or visual cue to an operator to take action. The Low Alarm event occurs when a controlled variable is less than a specified limit condition.

4.2.3.6.6.0.6 low_interlock**:** an indication of an automatic control event, such as closing or opening a valve or relay switch in response to a controlled variable being less than a specified limit condition.

4.2.3.6.6.0.7 open**:** an indication of a control event initiated by an automated system or by the operator to open a specified valve or relay switch.

4.2.3.6.6.0.8 press**:** an indication of a control event initiated by the operator to press a switch or button.

4.2.3.6.6.0.9 press_and_hold**:** an indication of a control event initiated by the operator to press and hold a switch or button.

4.2.3.6.6.0.10 release**:** an indication of a control event initiated by the operator to release a switch or button.

4.2.3.6.6.0.11 sequence**:** an indication that a set of control events is done in a specified order.

4.2.3.6.6.0.12 set_control_mode_to_automatic**:** an indication of an event whereby a controller's operating mode is changed to automatic.

4.2.3.6.6.0.13 set_control_mode_to_manual**:** an indication of an event whereby a controller's operating mode is changed to manual.

4.2.3.6.6.0.14 set_control_mode_to_semi-automatic**:** an indication of an event whereby a controller's operating mode is changed to semi-automatic.

4.2.3.6.6.0.15 set_switch**:** an indication of a control event initiated by an automated system or by the operator to set a multiplexed switching device to a specified position.

4.2.3.6.6.0.16 two_out_of_three_vote**:** an indication of an interlock event that is dependent upon at least two out of three measurement variables exceeding a specified limit condition.

4.2.3.6.6.0.17 two_out_of_two_vote**:** an indication of an interlock event that is dependent upon two out of two measurement variables exceeding a specified limit condition.

4.2.3.6.6.0.18 user_defined**:** an indication that the name is not covered in the enumerated names.

NOTE - If used, then a description of the name shall be put in Control_logic.description (see 4.2.3.6.5).

4.2.3.6.6.0.19 wait**:** an indication of a control event associated with a timer or with an operator to wait for a specified period of time before taking the next action.

4.2.3.6.6.0.20 wait_until**:** an indication of a control event associated with an automated system or with an operator to wait until a specified logical condition is true prior to taking the next action.

4.2.3.6.7 Control_loop

A Control_loop is a control module where a measured variable and a set point are used by a control algorithm to carry out a continuous adjustment of a manipulated variable in order to meet a control objective associated with the controlled variable. Each of these variables are related to Process_design_-property_values (see 4.2.1.1.14).

NOTE - Refer to ISA-S88-01 [1] for a description of a control module.

The data associated with Control_loop are the following:

— algorithm_name;

— algorithm_source;

— description;

— loop_id.

4.2.3.6.7.1 algorithm_name

An algorithm_name specifies a textual label that identifies the algorithm associated with a particular Control_loop. The value of the algorithm_name attribute may be one of the following:

— cascade_feedback;

— constraint_feedback;

— feed_forward_control;

— indicate_display;

— manual_operation;

— multivariate_control;

— non_linear_feedback;

— on_off_feedback;

— p_feedback;

— pi_feedback;

— pid_feedback;

— record_event;

— record_trend;

— self_regulated_feedback;

— set_point_control;

— split_range_feedback;

— user_defined.

4.2.3.6.7.1.1 cascade_feedback**:** an indication of an arrangement of feedback control where the manipulated variable is the set point of another feedback loop.

EXAMPLE 47 - Temperature is measured and used to adjust the set point of a flow control feedback loop. The flow control loop responds to the flow set point change.

4.2.3.6.7.1.2 constraint_feedback**:** an indication of a feedback control loop to keep a controlled variable within a specified range. When the variable is inside the range, no control action is taken. When the controlled variable exceeds a limit (either high or low), then the control function is applied.

4.2.3.6.7.1.3 feed_forward_control**:** an indication that the measured variable is used to predict the value of the controlled variable using a predictive model and the control function is applied to correct anticipated errors.

NOTE - This method is usually used in conjunction with feedback control.

4.2.3.6.7.1.4 indicate_display**:** an indication that there is no control function except to indicate or display a measured variable to a human.

4.2.3.6.7.1.5 manual_operation**:** an indication that a human operator uses an indication of the measured variable to continuously adjust the manipulated variable to meet a control objective.

4.2.3.6.7.1.6 multivariate_control**:** an indication that several measured variables are used with a predictive model to adjust one or more manipulated variables to drive the model errors to zero.

4.2.3.6.7.1.7 non_linear_feedback**:** an indication of a form of PID or PI control where the proportionality coefficient is not linear (proportional) with error, but is raised to a power either less than or greater than one.

4.2.3.6.7.1.8 on_off_feedback**:** an indication that the control function is full On or full Off when the controlled variable deviates from the set point.

NOTE - A simple example of On-Off control is a home heating/air-conditioning thermostat.

4.2.3.6.7.1.9 p_feedback**:** an indication of proportional feedback control. A controlled variable is compared to a set point to compute an error. The computed control function is to adjust the manipulated variable proportionally to the error.

4.2.3.6.7.1.10 pi_feedback**:** an indication of proportional-integral feedback control. A controlled variable is compared to a set point to compute an error. The computed control function is to adjust the manipulated variable proportionally to the error and to the integral of the error.

4.2.3.6.7.1.11 pid_feedback**:** an indication of proportional-integral-derivative feedback control. A controlled variable is compared to a set point to compute an error. The computed control function is to adjust the manipulated variable proportionally to the error, to the integral of the error and to the derivative of the error.

4.2.3.6.7.1.12 record_event**:** an action to record the occurrence of an event into an event history log.

4.2.3.6.7.1.13 record_trend**:** an indication that the measured variable is recorded onto persistent media such as a chart or onto a digital system magnetic disk.

4.2.3.6.7.1.14 self_regulated_feedback**:** an indication of a form of feedback control where the measured variable is directly used to control the controlled variable.

NOTE - A common example is a back-pressure regulator.

4.2.3.6.7.1.15 set_point_control**:** an indication of the event whereby a controller's set point is changed.

4.2.3.6.7.1.16 split_range_feedback**:** an indication of a feedback control loop where different algorithms (or control constants) are used depending on the value of the controlled variable. If the controlled variable is within one range of values, one algorithm is used. If it is within a different range of values, then a different algorithm (or set of constants) is used.

4.2.3.6.7.1.17 user_defined**:** an indication that the control_algorithm is not covered in the enumerated algorithm names.

NOTE - If used, then a description of the name shall be put in Control_loop.description.

4.2.3.6.7.2 algorithm_source

An algorithm_source specifies an optional text string, that specifies a reference for where the algorithm is defined.

4.2.3.6.7.3 description

A description specifies a textual explanation or summary of key aspects of the Control_loop.

4.2.3.6.7.4 loop_id

A loop_id specifies a unique identifier for the Control_loop.

4.2.3.6.8 Discrete_control_objective

A Discrete_control_objective is the goal that the Discrete_control_scheme (see 4.2.3.6.9) is designed to satisfy for the control of the process.

NOTE - The Discrete_control_objective is often selected from a list of possible objectives within a particular enterprise.

EXAMPLE 48 - During steady-state operation, alert operator to out-of-normal conditions.

The data associated with Discrete_control_objective are the following:

— objective_description;

— objective_name;

— operating_state.

4.2.3.6.8.1 objective_description

An objective_description specifies an optional textual explanation or summary of the Discrete_control_-objective.

EXAMPLE 49 - If Tank 101 level exceeds 80 percent, then switch Tank 101 high level alarm to ON.

4.2.3.6.8.2 objective_name

An objective_name specifies the unique textual label for the Discrete_control_objective.

EXAMPLE 50 - Tank 101 high level alarm.

4.2.3.6.8.3 operating_state

An operating_state specifies the operating state of the process.

EXAMPLE 51 - Startup, shutdown, standby, or steady-state.

4.2.3.6.9 Discrete_control_scheme

A Discrete_control_scheme defines the basic controls, instrument and information methods to permit a process to manufacture a desired product using control logic and discrete control events.

The data associated with Discrete_control_scheme are:

— scheme_id;

— scheme_type.

4.2.3.6.9.1 scheme_id

A scheme_id specifies a unique identification for the Discrete_control_scheme.

4.2.3.6.9.2 scheme_type

A scheme_type specifies an enumerated attribute that identifies the general category of the Discrete_-control_scheme. The value of the scheme_type attribute shall be one of the following:

— alarms;

— interlocks;

— recording/indication;

— sequence_logic.

4.2.3.6.9.2.1 alarms: an indication that the control generates attention-getting auditory/visual cues to the operator when specified limit conditions are exceeded.

4.2.3.6.9.2.2 interlocks**:** an indication that the control generates automated control events, such as activate relays or open/close valves, when specified limit conditions are exceeded.

4.2.3.6.9.2.3 recording/indication**:** an indication that measured variables or control events are recorded on persistent media such as paper printouts or digital computer magnetic disks or are indicated to humans. No control action is taken.

4.2.3.6.9.2.4 sequence_logic: an indication that the control generates automated control events, such as activate relays or open/close valves, in a sequence, a cycle or when a logical condition has been satisfied.

4.2.3.6.10 Logical_operation

A Logical_operation is a type of Control_logic_condition (see 4.2.3.6.6) that is a boolean operation between two operands that results in a value of true or false.

> NOTE - This construct allows complex logical expressions to be described to support simple procedural controls that depend on logical conditions being satisfied, or are dependent upon other Control_logic_-conditions (see 4.2.3.6.6).
>
> EXAMPLE 52 - If Tank 101 Low Level Alarm is on AND Tank 101 Temperature exceeds 80 degrees C, then close Tank 101 steam jacket valve. The AND in the above control logic is a Logical_operation.

The data associated with Logical_operation are the following:

— logical_operator.

A logical_operator specifies the particular boolean operation that is being defined. The operator shall contain one of the following values: OR, AND, XOR.

4.2.3.6.11 Trigger

A Trigger is a Process_definition (see 4.2.3.1.5) that is a type of Control_logic_condition (see 4.2.3.6.6), the execution status of which contributes to the Control_logic (see 4.2.3.6.5) that governs the execution of a Control_adjustment (see 4.2.3.6.3), a Control_event (see 4.2.3.6.4), or an Event_sequence (see 4.2.3.1.4). The Trigger allows one event to trigger a different Control_event.

The data associated with Trigger are the following:

— status.

A status specifies the execution state of the Trigger using a boolean value.

EXAMPLE 53 - If Tank 101 Low Level Alarm is ON AND Tank 101 Temperature exceeds 80 degrees C, then close Tank 101 steam jacket valve. The Trigger in this example is Tank 101 Low Level Alarm is on. The status of the Low Level Alarm is TRUE (on).

4.2.4 Process equipment UoFs

The UoFs within the process equipment grouping contain the equipment required by the process to produce the desired product. These areas are related to activities defined in the AAM described in annex F. The equipment to be designed is defined in activity A22334. Other equipment is often added in detailed design. Which equipment will be designed in the process design and which in detailed design may vary in different projects and different companies. The equipment chosen for data modelling is the most common equipment with the most standardized design. This selection was made by representatives from major companies looking at prior projects. It does not guarantee that all equipment or even the most important equipment for some specific project has been modelled.

4.2.4.1 plant_item_data

Refer to 4.1.9 for a description of what this UoF specifies. The ARM diagrams related to this UoF are provided as figures G.28 through G.33 in annex G of this part to ISO 10303.

4.2.4.1.1 Alternating_current_port

An Alternating_current_port is a type of Electrical_power_port (see 4.2.4.1.14) for which the electrical power at the Equipment_port (see 4.2.4.1.16) is in the form of alternating current.

The data associated with Alternating_current_port are the following:

— number_of_phases;

— voltage_cycle_frequency.

4.2.4.1.1.1 number_of_phases

A number_of_phases specifies an enumerated attribute indicating the number of phases for the alternating current of the Alternating_current_port. The value of number_of_phases attribute shall be one of the following:

— single_phase;

— three_phase.

4.2.4.1.1.1.1 single_phase**:** an indication that the alternating current at an Alternating_current_port is specified as having a single phase.

4.2.4.1.1.1.2 three_phase**:** an indication that the alternating current at an Alternating_current_port is specified as having three phases.

4.2.4.1.1.2 voltage_cycle_frequency

A voltage_cycle_frequency specifies the frequency of the voltage cycles for the alternating current of an Alternating_current_port.

4.2.4.1.2 Baseplates_and_soleplates

A Baseplates_and_soleplates is rigid metal frames used to keep rotating equipment and the driver for that equipment mounted and aligned.

The data associated with Baseplates_and_soleplates are the following:

— baseplate_for_common;

— deck_plate;

— fluid_drip_handling;

— horizontal_adjustment_screws;

— other_configuration;

— plate_grouting_type;

— plate_support;

— plate_weight;

— soleplate_for_driver;

— soleplate_for_gear;

— soleplate_for_machine;

— stainless_shims_thickness;

— transfer_machine_only.

4.2.4.1.2.1 baseplate_for_common

A baseplate_for_common specifies whether the baseplate is common for the rotating equipment and the driver or divided among elements.

4.2.4.1.2.2 deck_plate

A deck_plate specifies the presence or absence of a plate placed on the baseplate for the safety of maintenance and operating personnel.

4.2.4.1.2.3 fluid_drip_handling

A fluid_drip_handling specifies the mechanism used to handle drips of oil or other fluids. The value of the fluid_drip_handling attribute shall be one of the following:

— drip_rim;

— open_drain.

4.2.4.1.2.3.1 drip_rim**:** an indication that fluid drips will be allowed to flow into a drip rim.

4.2.4.1.2.3.2 open_drain**:** an indication that fluid drips will be allowed to flow into an open drain.

4.2.4.1.2.4 horizontal_adjustment_screws

A horizontal_adjustment_screws specifies the presence or absence of horizontal adjusting screws for equipment.

4.2.4.1.2.5 other_configuration

An other_configuration specifies a baseplate configuration other than under the transfer machine only or under all elements of the rotating equipment and the driver.

4.2.4.1.2.6 plate_grouting_type

The plate_grouting_type specifies the type of grouting used for the baseplate. The value of the plate_-grouting_type attribute shall be one of the following:

— epoxy;

— modified_regular;

— regular.

4.2.4.1.2.6.1 epoxy**:** an indication that the type of baseplate grouting used is epoxy.

NOTE - Epoxy grout is used when vibration control is important.

4.2.4.1.2.6.2 modified_regular**:** an indication that the type of baseplate grouting used is a modified Portland cement.

NOTE - Modified Portland cement is used when maintenance of alignment is important.

4.2.4.1.2.6.3 regular**:** an indication that the type of baseplate grouting used is regular Portland cement used under normal conditions.

4.2.4.1.2.7 plate_support

A plate_support specifies an enumerated attribute that indicates the type of support used for the baseplates. The value of the plate_support attribute shall be one of the following:

— perimeter;

— point.

4.2.4.1.2.7.1 perimeter**:** an indication that the baseplate support is a perimeter type.

4.2.4.1.2.7.2 point**:** an indication that the baseplate support is point type.

4.2.4.1.2.8 plate_weight

A plate_weight specifies the total weight of the baseplate and soleplate combination.

4.2.4.1.2.9 soleplate_for_driver

A soleplate_for_driver specifies the presence or absence of a soleplate exclusively for the driver element.

4.2.4.1.2.10 soleplate_for_gear

A soleplate_for_gear specifies the presence or absence of a soleplate exclusively for the gear reducer element.

4.2.4.1.2.11 soleplate_for_machine

A soleplate_for_machine specifies the presence or absence of a soleplate exclusively for the transfer machine element.

4.2.4.1.2.12 stainless_shims_thickness

A stainless_shims_thickness specifies the allowable thickness of levelling shims for the mounting.

4.2.4.1.2.13 transfer_machine_only

A transfer_machine_only specifies the presence or absence of a baseplate exclusively for the transfer machine element.

4.2.4.1.3 Bearing

A Bearing is a machine element between a rotating Shaft (see 4.2.4.1.53) and a static housing or casing (integral housing) that reduces the coefficient of friction between the Shaft and its static supporting element namely, a Bearing_housing (see 4.2.4.1.4). Each Bearing may be one of the following: Radial_-bearing (see 4.2.4.1.49) or a Thrust_bearing (see 4.2.4.1.61).

The data associated with Bearing are the following:

— area;

— babbit_thickness;

— babbit_type;

— centre_pivot;

— loading_actual;

— loading_allowed;

— lubrication_type;

— offset_pivot;

— pad_material;

— type.

4.2.4.1.3.1 area

An area specifies the interfacial area or area of contact between the Shaft (see 4.2.4.1.53) and static Bearing.

4.2.4.1.3.2 babbit_thickness

A babbit_thickness specifies the thickness of the Bearing lining.

4.2.4.1.3.3 babbit_type

A babbitt_type specifies the type of Bearing babbit.

> NOTE - Babbitt is a soft metallic lining that provides for low friction between the Bearing surface and the rotating Shaft (see 4.2.4.1.53).

4.2.4.1.3.4 centre_pivot

A centre_pivot specifies that a centre pivot Bearing is used.

4.2.4.1.3.5 loading_actual

A loading_actual specifies the actual torque transmitted between Bearing and Shaft (see 4.2.4.1.53).

4.2.4.1.3.6 loading_allowed

A loading_allowed specifies the maximum torque allowed between the Bearing and Shaft (see 4.2.4.1.53).

4.2.4.1.3.7 lubrication_type

A lubrication_type specifies an enumerated attribute that indicates the type of lubrication. The value of the lubrication_type attribute shall be one of the following:

— API614;

— flood;

— grease;

— oil_mist;

— pressure;

— ring_oil.

4.2.4.1.3.7.1 API614**:** an indication that the lubrication_type is API (American Petroleum Institute) 614.

4.2.4.1.3.7.2 flood**:** an indication that the lubrication_type is flooded lubrication.

4.2.4.1.3.7.3 grease**:** an indication that the lubrication_type is a grease.

4.2.4.1.3.7.4 oil_mist**:** an indication that the lubrication_type is an oil misting system.

4.2.4.1.3.7.5 pressure**:** an indication that the lubrication_type is a pressurized lubricant.

4.2.4.1.3.7.6 ring_oil**:** an indication that the lubrication_type is an oil ring.

4.2.4.1.3.8 offset_pivot

An offset_pivot specifies that an offset pivot Bearing is used.

4.2.4.1.3.9 pad_material

A pad_material specifies the Material (see 4.2.2.4.9) supporting the Babbitt sleeve in the Bearing.

4.2.4.1.3.10 type

A type specifies the type of Bearing used.

4.2.4.1.4 Bearing_housing

A Bearing_housing is the enclosure around a Bearing (see 4.2.4.1.3) whose purpose is to keep dirt and water out and any lubricant in the Bearing.

The data associated with Bearing_housing are the following:

— housing_type.

A housing_type specifies how the Bearing_housing is incorporated in rotating machinery. The value of the housing_type attribute shall be one of the following:

— integral;

— separate.

4.2.4.1.4.0.1 integral**:** an indication that the Bearing_housing is integral to the machine it is for.

4.2.4.1.4.0.2 separate**:** an indication that the Bearing_housing is separate from the machine it is for.

4.2.4.1.5 Buttweld

A Buttweld is a type of Piping_connector (see 4.2.4.1.38) that indicates that pipe ends are butted together and then welded.

4.2.4.1.6 Centrifugal_compressor_tests

A Centrifugal_compressor_tests is a type of Rotating_equipment_tests (see 4.2.4.1.51) that specifies what tests are to be performed by a compressor manufacturer prior to delivery of the machine to the customer.

The data associated with Centrifugal_compressor_tests are the following:

— performance_test_air;

— performance_test_gas.

4.2.4.1.6.1 performance_test_air

A performance_test_air specifies that air will be used for the centrifugal compressor performance test.

4.2.4.1.6.2 performance_test_gas

A performance_test_gas specifies the gas to be used during the centrifugal compressor performance test.

4.2.4.1.7 Compression

A Compression is a type of end engagement for a Piping_connector (see 4.2.4.1.38) indicating that the connection is accomplished by mechanical deformation of the piping ends caused by exerting compressive force between two pieces of pipe.

4.2.4.1.8 Conditional_property_value

A Conditional_property_value is a type of Process_design_property_value (see 4.2.1.1.14).

NOTE - Support for the information described in a Conditional_property_value is not a requirement of applications that conform to this standard.

The data associated with Conditional_property_value are the following:

— limit_condition;

— value_context.

4.2.4.1.8.1 limit_condition

A limit_condition specifies the numerical value associated with the property.

4.2.4.1.8.2 value_context

A value_context specifies a setting in which the conditional value is applicable.

EXAMPLE 54 - The setting may be a season such as summer, so that a property value may be given for the maximum temperature in summer. Some other examples of the value_context are "normal", "annual", and "average".

4.2.4.1.9 Connected_equipment_port

A Connected_equipment_port is an Equipment_port (see 4.2.4.1.16) that is connected to another Equipment_port.

The data associated with Connected_equipment_port are the following:

— flow_state.

A flow_state specifies an enumerated attribute that indicates that the flow of a Connected_equipment_-port is in the intended direction, the opposite of the intended direction, or is not occurring. The value of the flow_state attribute shall be one of the following:

— normal;

— reverse;

— static.

4.2.4.1.9.0.1 normal**:** an indication that the flow in a Connected_equipment_port is in the intended direction as defined by the normal flow direction of the Equipment_port (see 4.2.4.1.16).

4.2.4.1.9.0.2 reverse**:** an indication that the flow in a Connected_equipment_port is in the reverse of the intended direction as defined by the normal flow direction of the Equipment_port (see 4.2.4.1.16).

4.2.4.1.9.0.3 static**:** an indication that flow in a Connected_equipment_port is not occurring.

4.2.4.1.10 Coupling

A Coupling is the Mechanical_component (see 4.2.4.1.29) that links the driver and pump or compressor in Material_transfer_equipment (see 4.2.4.5.19).

The data associated with Coupling are the following:

— idling_adapter_required;

— keying_or_fit;

— limited_end_float_required;

— lubrication;

— mount_driver_coupling_half;

— rating;

— rotation_viewed_from_driven_end;

— spacer_required.

4.2.4.1.10.1 idling_adapter_required

An idling_adapter_required specifies a mechanical feature of a Coupling that would allow either the pump/compressor or the driver to rotate independently.

4.2.4.1.10.2 keying_or_fit

A keying_or_fit specifies the type of attachment of the Coupling to a Shaft (see 4.2.4.1.53) (keying) or to its mating half (hydraulic). The value of the keying_or_fit attribute shall be one of the following:

— hydraulic;

— one;

— two.

4.2.4.1.10.2.1 hydraulic**:** an indication that the Coupling is attached using a hydraulic fit.

4.2.4.1.10.2.2 one**:** an indication that the Coupling is attached with a single key.

4.2.4.1.10.2.3 two**:** an indication that the Coupling is attached with a double key.

4.2.4.1.10.3 limited_end_float_required

A limited_end_float_required specifies that a floating end limiting device is required.

4.2.4.1.10.4 lubrication

A lubrication specifies the lubrication provided for the Coupling.

4.2.4.1.10.5 mount_driver_coupling_half

A mount_driver_coupling_half specifies who is to mount the driver half of the Coupling to mate with the driven half. The value of the mount_driver_coupling_half attribute shall be one of the following:

— machine_manufacturer;

— drive_manufacturer;

— purchaser.

4.2.4.1.10.5.1 machine_manufacturer**:** an indication that the machinery manufacturer will mount the driver side Coupling half.

4.2.4.1.10.5.2 drive_manufacturer**:** an indication that the drive manufacturer mounts the driver side Coupling half.

4.2.4.1.10.5.3 purchaser**:** an indication that the purchaser will mount the driver side Coupling half.

4.2.4.1.10.6 rating

A rating specifies the torque rating of the Coupling.

4.2.4.1.10.7 rotation_viewed_from_driven_end

A rotation_viewed_from_driven_end specifies an enumerated attribute that indicates the direction the Coupling rotates. The value of the rotation_viewed_from_driven_end attribute shall be one of the following:

— counter_clockwise;

— clockwise.

4.2.4.1.10.7.1 counter_clockwise**:** an indication that the Coupling rotates counter-clockwise when viewed from the driver side.

4.2.4.1.10.7.2 clockwise**:** an indication that the Coupling rotates clockwise when viewed from the driver side.

4.2.4.1.10.8 spacer_required

A spacer_required specifies that the Coupling requires a spacer.

4.2.4.1.11 Design_project

A Design_project is a task with a specifically defined purpose and scope.

The data associated with Design_project are the following:

— design_project_id;

— name;

— number;

— owner.

4.2.4.1.11.1 design_project_id

A design_project_id specifies a unique identifier for the Design_project.

4.2.4.1.11.2 name

A name specifies a textual label for the Design_project.

4.2.4.1.11.3 number

A number specifies a numeric designation for the Design_project.

4.2.4.1.11.4 owner

A owner specifies the name of the organization that owns the Design_project id, name, and number.

4.2.4.1.12 Design_project_assignment

A Design_project_assignment is an association between a Plant_item (see 4.2.4.1.39) and a Design_-project (see 4.2.4.1.11) whereby the design of specific Plant_items are performed in specific Design_-projects.

4.2.4.1.13 Direct_current_port

A Direct_current_port is a type of Electrical_power_port (see 4.2.4.1.14) where the electrical power is in the form of direct current.

4.2.4.1.14 Electrical_power_port

An Electrical_power_port is a type of Power_port (see 4.2.4.1.46) where the power is in the form of electrical energy. Each Electrical_power_port may be one of the following: an Alternating_current_port (see 4.2.4.1.1) or a Direct_current_port (see 4.2.4.1.13).

The data associated with Electrical_power_port are the following:

— line_voltage;

— normal_current;

— peak_current;

— rated_current;

— type.

4.2.4.1.14.1 line_voltage

A line_voltage specifies the specification for the voltage of the electrical energy of an Electrical_power_-port.

4.2.4.1.14.2 normal_current

A normal_current specifies the normal electrical current expected for the electrical energy of an Electrical_power_port.

4.2.4.1.14.3 peak_current

A peak_current specifies the peak electrical current expected for the electrical energy of an Electrical_-power_port.

4.2.4.1.14.4 rated_current

A rated_current specifies the manufacturer's rating for the maximum electrical current for the electrical energy of an Electrical_power_port.

4.2.4.1.14.5 type

A type specifies an indication that an Electrical_power_port is either a Direct_current_port (see 4.2.4.1.13) or an Alternating_current_port (see 4.2.4.1.1).

4.2.4.1.15 Energy_port

An Energy_port is a type of Equipment_port (see 4.2.4.1.16) through which energy is intended to flow without any Material_stream (see 4.2.3.3.7). Each Energy_port may be one of the following: a Heat_port (see 4.2.4.1.24) or a Power_port (see 4.2.4.1.46).

The data associated with Energy_port are the following:

— port_energy_category;

— type.

4.2.4.1.15.1 port_energy_category

A port_energy_category specifies an enumerated attribute that indicates the source or destination of the energy at an Energy_port. The value of the port_energy_category attribute shall be one of the following:

— ambient;

— process;

— product;

— utility;

— waste.

4.2.4.1.15.1.1 ambient**:** an indication that the energy at an Energy_port is obtained from or exhausted to the surroundings.

4.2.4.1.15.1.2 process**:** an indication that the energy at an Energy_port is created and consumed within the Plant (see 4.2.1.1.11).

4.2.4.1.15.1.3 product**:** an indication that the energy at an Energy_port is considered a salable product of the Plant (see 4.2.1.1.11).

4.2.4.1.15.1.4 utility**:** an indication that the energy at an Energy_port is created by an external utility supply system.

4.2.4.1.15.1.5 waste**:** an indication that the energy at an Energy_port is a waste and will require disposal.

4.2.4.1.15.2 type

A type specifies that an Energy_port is either a Power_port (see 4.2.4.1.46) or a Heat_port (see 4.2.4.1.24).

4.2.4.1.16 Equipment_port

An Equipment_port is a portion of a Plant_item (see 4.2.4.1.39) boundary through which Material (see 4.2.2.4.9), energy, or signals can flow. Each Equipment_port may be one of the following: an Energy_-port (see 4.2.4.1.15), a Material_port (see 4.2.4.1.28), or a Signal_port (see 4.2.4.1.55).

The data associated with Equipment_port are the following:

— equipment_port_name;

— normal_flow_direction;

— type.

4.2.4.1.16.1 equipment_port_name

An equipment_port_name specifies a textual label given to the Equipment_port.

4.2.4.1.16.2 normal_flow_direction

A normal_flow_direction specifies an enumerated attribute that indicates the normal direction of flow at an Equipment_port. The value of the normal_flow_direction attribute shall be one of the following:

— inlet;

— outlet;

— static.

4.2.4.1.16.2.1 inlet**:** an indication that the intended direction of flow is from outside of the Plant_item (see 4.2.4.1.39) boundary to inside.

4.2.4.1.16.2.2 outlet**:** an indication that the intended direction of flow is from inside of the Plant_item (see 4.2.4.1.39) boundary to outside.

4.2.4.1.16.2.3 static**:** an indication that no flow is expected at an Equipment_port.

4.2.4.1.16.3 type

A type specifies that an Equipment_port is either a Material_port (see 4.2.4.1.28), an Energy_port (see 4.2.4.1.15), or a Signal_port (see 4.2.4.1.55).

4.2.4.1.17 Equipment_port_connection

An Equipment_port_connection is exactly two Connected_equipment_ports (see 4.2.4.1.9) of the same type that share common portions.

4.2.4.1.18 Female_end

A Female_end is an end type of Piping_connector (see 4.2.4.1.38). A Female_end piping connector is used in conjunction with a Male_end (see 4.2.4.1.27) piping connector to form a pipe fitting connection.

4.2.4.1.19 Flanged

A Flanged is an end engagement type of a Piping_connector (see 4.2.4.1.38) that denotes that the end engagement is a flanged connection.

4.2.4.1.20 Flanged_end

A Flanged_end is a pipe flange.

The data associated with Flanged_end are the following:

— face_finish;

— flange_nominal_rating;

— flange_piping_schedule;

— flange_type.

4.2.4.1.20.1 face_finish

A face_finish specifies an enumerated attribute that describes the type of facing for the Flange. The value of the flange_finish attribute shall be one of the following:

— flat_face;

— raised_face;

— ring;

— unspecified.

4.2.4.1.20.1.1 flat_face**:** an indication that the face_finish is flat faced for the Flange.

4.2.4.1.20.1.2 raised_face**:** an indication that the face_finish is raised_face for the Flange.

4.2.4.1.20.1.3 ring**:** an indication that the face_finish is ring joint for the Flange.

4.2.4.1.20.1.4 unspecified**:** an indication that the face_finish is unspecified.

4.2.4.1.20.2 flange_nominal_rating

A flange_nominal_rating specifies the nominal pressure rating of the Flange.

4.2.4.1.20.3 flange_piping_schedule

A flange_piping_schedule specifies the piping schedule used for the flange. The piping schedule indication indicates the inner and outer diameter dimensions of the pipe end of the flange.

4.2.4.1.20.4 flange_type

A flange_type specifies an enumerated attribute of Flange that indicates the type of Flange. The value of the flange_type attribute shall be one of the following:

— slip_on;

— threaded;

— unspecified;

— welded.

4.2.4.1.20.4.1 slip_on**:** an indication that the type of Flange is a slip on flange.

4.2.4.1.20.4.2 threaded**:** an indication that the type of Flange is threaded.

4.2.4.1.20.4.3 unspecified**:** an indication that the type of Flange is unspecified.

4.2.4.1.20.4.4 welded**:** an indication that the type of Flange is a welded on flange.

4.2.4.1.21 Functional_volume

A Functional_volume is an internal portion of a Plant_item (see 4.2.4.1.39) that is holding or performing some process function.

NOTE - This internal portion may be a fixed volume, such as the volume below an overflow weir, or may vary with process conditions, such as the volume of decanted water in a separation drum.

— description.

A description specifies a textual explanation or summary of the key aspects of the Functional_volume.

4.2.4.1.22 Functional_volume_service_case

A Functional_volume_service_case is the state of a Functional_volume (see 4.2.4.1.21) in a Plant_item (see 4.2.4.1.39) performing a specific Process_service (see 4.2.3.1.10) under a single operating case.

4.2.4.1.23 Gasket

A Gasket is a packing made of deformable Material (see 4.2.2.4.9), usually in the form of a sheet or ring, used to make a pressure-tight joint between stationary parts.

The data associated with Gasket are the following:

— inside_diameter;

— nominal_diameter;

— outside_diameter;

— pipe_schedule;

— thickness;

— type.

4.2.4.1.23.1 inside_diameter

An inside_diameter specifies the diameter of the Gasket opening.

4.2.4.1.23.2 nominal_diameter

A nominal_diameter specifies the nominal diameter of the Gasket opening.

4.2.4.1.23.3 outside_diameter

An outside_diameter specifies the outside diameter of a Gasket.

4.2.4.1.23.4 pipe_schedule

A pipe_schedule specifies the pipe schedule of a Flanged_end (see 4.2.4.1.20) that the Gasket is made to fit.

4.2.4.1.23.5 thickness

A thickness specifies the thickness of a Gasket.

4.2.4.1.23.6 type

A type specifies an enumerated attribute of Gasket that specifies a type of Gasket. The value of the type attribute shall be one of the following:

— flat;

— full_face_spiral;

— full_faced_flat;

— o-ring;

— other;

— ring;

— spiral_wound;

— unspecified.

4.2.4.1.23.6.1 flat**:** an indication that the type is flat.

4.2.4.1.23.6.2 full_face_spiral**:** an indication that the type is full_face_spiral.

4.2.4.1.23.6.3 full_faced_flat**:** an indication that the type is full_faced_flat.

4.2.4.1.23.6.4 o-ring**:** an indication that the type is an o-ring.

4.2.4.1.23.6.5 other**:** an indication that the type is other.

4.2.4.1.23.6.6 ring**:** an indication that the type is a ring.

4.2.4.1.23.6.7 spiral_wound**:** an indication that the type is spiral_wound.

4.2.4.1.23.6.8 unspecified**:** an indication that the type is unspecified.

4.2.4.1.24 Heat_port

A Heat_port is a type of Energy_port (see 4.2.4.1.15) where the energy at the Equipment_port (see 4.2.4.1.16) is in the form of heat.

The data associated with Heat_port are the following:

— clean_heat_duty;

— fouled_heat_duty;

— normal_heat_duty.

4.2.4.1.24.1 clean_heat_duty

A clean_heat_duty specifies a specification for the maximum expected rate of heat transfer through a Heat_port.

4.2.4.1.24.2 fouled_heat_duty

A fouled_heat_duty specifies a specification for the minimum expected rate of heat transfer through a Heat_port.

4.2.4.1.24.3 normal_heat_duty

A normal_heat_duty specifies a specification for the normal rate of heat transfer expected through a Heat_port.

4.2.4.1.25 Inspection_and_tests

An Inspection_and_tests is inspections and tests performed on Plant_items (see 4.2.4.1.39) by a manufacturer prior to the delivery of the Plant_item to a customer.

The data associated with Inspection_and_tests are the following:

— board_certification_required;

— design_code;

— disassemble_reassemble_after_test;

— radiographs_required;

— shop_inspection;

— stress_relief_required;

— test_type.

4.2.4.1.25.1 board_certification_required

A board_certification_required specifies an enumerated attribute that indicates status with respect to board certification. The value of the board_certification_required attribute shall be one or more of the following:

— observed;

— required;

— witnessed.

4.2.4.1.25.1.1 observed**:** an indication that the required board certification has or has not been observed.

4.2.4.1.25.1.2 required**:** an indication that the required board certification is or is not required.

4.2.4.1.25.1.3 witnessed**:** an indication that the required board certification has or has not been witnessed.

4.2.4.1.25.2 design_code

A design_code specifies what design code is required.

EXAMPLE 55 - Design codes include ASTM and ASME.

4.2.4.1.25.3 disassemble_reassemble_after_test

A disassemble_reassemble_after_test specifies whether the Plant_item (see 4.2.4.1.39) should be disassembled, inspected, and reassembled after the test is complete.

4.2.4.1.25.4 radiographs_required

A radiographs_required specifies whether radiographs of the Plant_item (see 4.2.4.1.39) are required.

4.2.4.1.25.5 shop_inspection

A shop_inspection specifies whether an inspection of the Plant_item (see 4.2.4.1.39) at the manufacturer's shop is required.

4.2.4.1.25.6 stress_relief_required

A stress_relief_required specifies whether stress-relieving of the Plant_item (see 4.2.4.1.39) is required.

4.2.4.1.25.7 test_type

A test_type specifies the type(s) of tests that may be performed on the Plant_item (see 4.2.4.1.39). The value of the test_type attribute may be one or more of the following:

— full_operating_pressure_test;

— hydrostatic_test;

— hydrostatic_test_pressure;

— helium_leak_test;

— noise_level_test.

4.2.4.1.25.7.1 full_operating_pressure_test**:** an indication that the Plant_item (see 4.2.4.1.39) should be tested its full operating pressure.

4.2.4.1.25.7.2 hydrostatic_test**:** an indication that a hydrostatic test is to be performed on the Plant_item (see 4.2.4.1.39).

4.2.4.1.25.7.3 hydrostatic_test_pressure**:** an indication of the pressure that the hydrostatic test is to be performed at.

4.2.4.1.25.7.4 helium_leak_test**:** an indication that a leak test using helium is to be performed.

4.2.4.1.25.7.5 noise_level_test**:** an indication that a noise level test is to be performed.

4.2.4.1.26 Location_conditions

A Location_conditions is any special environmental conditions associated with a Plant_item (see 4.2.4.1.39) location.

The data associated with Location_conditions are the following:

— location_cover;

— location_electrical_area_class;

— location_unusual_conditions.

4.2.4.1.26.1 location_cover

A location_cover specifies whether the Plant_item (see 4.2.4.1.39) is located within an area that is covered.

4.2.4.1.26.2 location_electrical_area_class

A location_electrical_area_class specifies the electrical class of the area where the Plant_item (see 4.2.4.1.39) is located.

4.2.4.1.26.3 location_unusual_conditions

A location_unusual_conditions specifies any other unusual environmental conditions associated with a Plant_item (see 4.2.4.1.39) location.

4.2.4.1.27 Male_end

A Male_end is an end type of Piping_connector (see 4.2.4.1.38). A Male_end piping connector is used in conjunction with a Female_end (see 4.2.4.1.18) piping connector to form a pipe fitting connection.

The data associated with Male_end are the following:

— bevelled.

A bevelled specifies whether the Male_end has a bevelled or flat edge.

4.2.4.1.28 Material_port

A Material_port is a type of Equipment_port (see 4.2.4.1.16) through which Material (see 4.2.2.4.9) is intended to flow.

4.2.4.1.29 Mechanical_component

A Mechanical_component is an equipment item that is associated with the operation of rotating equipment. The Mechanical_component is a replaceable component of the rotating equipment and often is tracked by the plant for maintenance and spare parts. Each Mechanical_component may be one of the following: a Baseplates_and_soleplates (see 4.2.4.1.2), a Bearing (see 4.2.4.1.3), a Bearing_housing (see 4.2.4.1.4), a Cc_balance_piston (see 4.2.4.5.1), a Cc_casing (see 4.2.4.5.2), a Cc_diaphragm (see 4.2.4.5.4), a Cc_impeller (see 4.2.4.5.5), a Cc_labyrinth (see 4.2.4.5.6), a Cc_shaft_sleeve (see 4.2.4.5.9), a Coupling (see 4.2.4.1.10), a Mechanical_seal (see 4.2.4.1.31), a Pump_gland (see 4.2.4.5.24), or a Shaft (see 4.2.4.1.53).

The data associated with Mechanical_component are the following:

— manufacturer;

— model;

— serial_number;

— size;

— type;

— weight.

4.2.4.1.29.1 manufacturer

A manufacturer specifies the manufacturer of the Mechanical_component.

4.2.4.1.29.2 model

A model specifies the model designation assigned to the Mechanical_component by the manufacturer.

4.2.4.1.29.3 serial_number

A serial_number specifies the serial number assigned to the Mechanical_component.

4.2.4.1.29.4 size

A size specifies the external dimensions of the Mechanical_component.

> EXAMPLE 56 - A text string used to record the relevant dimensions for the specification and selection of mechanical equipment.

4.2.4.1.29.5 type

A type specifies the type of Mechanical_component.

4.2.4.1.29.6 weight

A weight specifies the weight of the Mechanical_component.

4.2.4.1.30 Mechanical_power_port

A Mechanical_power_port is a type of Power_port (see 4.2.4.1.46) where the power at the Equipment_-port (see 4.2.4.1.16) is in a mechanical form. Each Mechanical_power_port may be one of the following: a Reciprocating_power_port (see 4.2.4.1.50) or a Rotating_power_port (see 4.2.4.1.52).

The data associated with Mechanical_power_port are the following:

— type.

A type specifies that a Mechanical_power_port is either a Reciprocating_power_port (see 4.2.4.1.50) or a Rotating_power_port (see 4.2.4.1.52).

4.2.4.1.31 Mechanical_seal

A Mechanical_seal is a mechanical Shaft (see 4.2.4.1.53) seal.

The data associated with Mechanical_seal are the following:

— api_class_code;

— inner_oil_leakage;

— settling_out_pressure;

— system_type;

— type.

4.2.4.1.31.1 api_class_code

An api_class_code specifies the API class code for the seal.

4.2.4.1.31.2 inner_oil_leakage

An inner_oil_leakage specifies the rate of oil leakage on the inner seal.

4.2.4.1.31.3 settling_out_pressure

A settling_out_pressure specifies the settling out pressure for the seal.

4.2.4.1.31.4 system_type

A system_type specifies the seal system type.

4.2.4.1.31.5 type

A type specifies the seal type.

4.2.4.1.32 Noise_specification

A Noise_specification is the permissible noise levels when the compressor is operating under normal load conditions.

The data associated with Noise_specification are the following:

— acoustic_housing;

— applicable_to_machine;

— applicable_to_neighborhood.

4.2.4.1.32.1 acoustic_housing

An acoustic_housing specifies whether an acoustic enclosure will be required to meet environmental noise constraints.

4.2.4.1.32.2 applicable_to_machine

An applicable_to_machine specifies the noise level specification for personnel working at the compressor or in the immediate vicinity.

4.2.4.1.32.3 applicable_to_neighborhood

An applicable_to_neighborhood specifies the appropriate noise level for the compressor in the area surrounding the machine, such as the compressor room or the building.

4.2.4.1.33 Packaging

A Packaging is the packaging and shipping requirements.

The data associated with Packaging are the following:

— shipping_weight.

A shipping_weight specifies the shipping weight of the package.

4.2.4.1.34 Performance_curve

A Performance_curve is a representation of a curve or family of related curves of equipment or unit operation performance versus one or more operating conditions. Each Performance_curve may be one of the following: Performance_map (see 4.2.4.1.35) or Simple_performance_curve (see 4.2.3.4.7, 4.2.4.1.56).

The data associated with Performance_curve are the following:

— description;

— identifier.

4.2.4.1.34.1 description

A description specifies a textual explanation or summary of key aspects of the Performance_curve.

4.2.4.1.34.2 identifier

An identifier specifies a unique identifier for the Performance_curve.

4.2.4.1.35 Performance_map

A Performance_map is a type of Performance_curve (see 4.2.4.1.34) that provides for more than one independent variable by containing nested subordinate Performance_curves. Each value of the independent variable in the Performance_map is associated with one of a family of related, that is having the same independent and dependent variables defined, Performance_curves. Each of the dependent Performance_map_curves (see 4.2.4.1.36) shall have the same independent variable property name.

4.2.4.1.36 Performance_map_curve

A Performance_map_curve is one of the family of related Performance_curves (see 4.2.4.1.34) belonging to a Performance_map (see 4.2.4.1.35) for a specific value of the independent variable.

4.2.4.1.37 Performance_point

A Performance_point is one point of a Simple_performance_curve (see 4.2.3.4.7, 4.2.4.1.56). A Performance_point is the collection of dependent variable values associated with a specific value of exactly one independent variable.

4.2.4.1.38 Piping_connector

A Piping_connector is a type of Plant_item_connector (see 4.2.4.1.42) that describes the way in which two pieces of piping are connected. Each Piping_connector may be one of the following: a Buttweld (see 4.2.4.1.5), Compression (see 4.2.4.1.7), Flanged (see 4.2.4.1.19), Socket (see 4.2.4.1.57), or Threaded (see 4.2.4.1.60) connector.

The data associated with Piping_connector are the following:

— end_engagement_type;

— end_type;

— connector_piping_schedule;

— inner_diameter;

— nominal_diameter;

— outer_diameter;

— thickness.

4.2.4.1.38.1 end_engagement_type

An end_engagement_type specifies whether the Piping_connector is a Buttweld (see 4.2.4.1.5), Compression (see 4.2.4.1.7), Flanged (see 4.2.4.1.19), Socket (see 4.2.4.1.57), or Threaded (see 4.2.4.1.60) connector.

4.2.4.1.38.2 end_type

An end_type specifies whether the Piping_connector end type is a Female_end (see 4.2.4.1.18), Flanged_end (see 4.2.4.1.20), or a Male_end (see 4.2.4.1.27).

4.2.4.1.38.3 connector_piping_schedule

A connector_piping_schedule specifies the piping schedule used for the Piping_connector.

4.2.4.1.38.4 inner_diameter

An inner_diameter specifies the inside diameter of the pipe associated with the Piping_connector.

4.2.4.1.38.5 nominal_diameter

A nominal_diameter specifies the nominal diameter of the pipe associated with the Piping_connector.

4.2.4.1.38.6 outer_diameter

An outer_diameter specifies the outside diameter of the pipe associated with the Piping_connector.

4.2.4.1.38.7 thickness

A thickness specifies the wall thickness of the pipe associated with the Piping_connector.

4.2.4.1.39 Plant_item

A Plant_item is an application object made from formed Materials (see 4.2.2.4.9), perhaps an assembly of components, with moving parts, or deformable, that has a boundary with portions that are specifically intended to be permeable to the flow of Material, energy, or signals. Each Plant_item may be one of the following: a Bin_section (see 4.2.4.6.2), a Buffer_gas_system (see 4.2.4.2.1), a Cylindrical_pressure_-vessel_section (see 4.2.4.6.14), a Demister_pad (see 4.2.4.4.14), a Demister_pad_stack (see 4.2.4.4.15), an Exchanger_assembly (see 4.2.4.3.6), an Exchanger_bundle (see 4.2.4.3.7), a Gasket (see 4.2.4.1.23), a Mechanical_component (see 4.2.4.1.29), a Nozzle (see 4.2.4.2.5), a Nozzle_section (see 4.2.4.2.6), a Plant_item_connector (see 4.2.4.1.42), or a Process_equipment (see 4.2.4.2.8).

The data associated with Plant_item are the following:

— boundary;

— delivered_capital_cost;

— description;

— function;

— installed_capital_cost;

— manufacturer;

— maximum_weight_for_maintenance;

— name;

— operating_factor;

— plant_item_id;

— purchased_capital_cost;

— tag;

— type;

— weight.

4.2.4.1.39.1 boundary

A boundary specifies a description of the closed surface, portions of which can be imaginary or dynamic, that encloses the Plant_item.

4.2.4.1.39.2 delivered_capital_cost

A delivered_capital_cost specifies the capital cost of the Plant_item delivered to the Site (see 4.2.1.1.21).

4.2.4.1.39.3 description

A description specifies a textual explanation or summary of the Plant_item.

4.2.4.1.39.4 function

A function specifies a description of the intended function of the Plant_item unit.

4.2.4.1.39.5 installed_capital_cost

An installed_capital_cost specifies the capital cost of the Plant_item delivered and installed at the Site (see 4.2.1.1.21).

4.2.4.1.39.6 manufacturer

A manufacturer specifies the manufacturer or fabricator of the Plant_item.

4.2.4.1.39.7 maximum_weight_for_maintenance

A maximum_weight_for_maintenance specifies the maximum weight of the Plant_item to be used for planning maintenance.

4.2.4.1.39.8 name

A name specifies a textual label assigned to each Plant_item.

4.2.4.1.39.9 operating_factor

An operating_factor specifies the fraction of time that the Plant_item is expected to be in operational service.

4.2.4.1.39.10 plant_item_id

A plant_item_id specifies a unique identifier for the Plant_item.

4.2.4.1.39.11 purchased_capital_cost

A purchased_capital_cost specifies the capital cost of the Plant_item purchased at the location of manufacture or fabrication.

4.2.4.1.39.12 tag

A tag specifies an identifier affixed to the Plant_item.

NOTE - The uniqueness of the identifier is a matter of corporation policy.

4.2.4.1.39.13 type

A type specifies that the category of Plant_item is generally assigned according to the Plant_item function.

4.2.4.1.39.14 weight

A weight specifies the weight of the Plant_item.

4.2.4.1.40 Plant_item_assembly_relationship

A Plant_item_assembly_relationship is a type of Plant_item_group_relationship (see 4.2.4.1.43). The assembly relationship reflects the fact that a particular Plant_item (see 4.2.4.1.39) (the whole) is composed of an assembly of other Plant_items (the parts).

4.2.4.1.41 Plant_item_collection_relationship

A Plant_item_collection_relationship is a type of Plant_item_group_relationship (see 4.2.4.1.43). The collection relationship indicates that the Plant_item (see 4.2.4.1.39) is a member of a collection of similar Plant_items.

NOTE - Collections of similar Plant_items are described in catalogues and spare parts inventory lists.

4.2.4.1.42 Plant_item_connector

A Plant_item_connector is a feature of a Plant_item (see 4.2.4.1.39) that is designed to connect to a connector on another Plant_item. Each Plant_item_connector may be one of the following: a Piping_-connector (see 4.2.4.1.38).

The data associated with Plant_item_connector are the following:

— connector_description;

— connector_name;

— function_type.

4.2.4.1.42.1 connector_description

A connector_description specifies a textual explanation or summary of key aspects of the Plant_item_-connector.

4.2.4.1.42.2 connector_name

A connector_name specifies a textual label given to the Plant_item_connector.

4.2.4.1.42.3 function_type

A function_type specifies the type of Plant_item_connector.

4.2.4.1.43 Plant_item_group_relationship

A Plant_item_group_relationship is a method for logically linking or grouping two or more Plant_items (see 4.2.4.1.39). Each Plant_item_group_relationship may be one of the following: a Plant_item_-assembly_relationship (see 4.2.4.1.40) or a Plant_item_collection_relationship (see 4.2.4.1.41).

The data associated with Plant_item_group_relationship are the following:

— location_and_orientation.

A location_and_orientation specifies the relative position and orientation of the Plant_item (see 4.2.4.1.39) relative to the another Plant_item.

4.2.4.1.44 Plant_item_location

A Plant_item_location is the position of the Plant_item (see 4.2.4.1.39) relative to a Plant (see 4.2.1.1.11) or a Site (see 4.2.1.1.21). Each Plant_item_location is either a Location_in_plant (see 4.2.1.1.8) or a Location_in_site (see 4.2.1.1.9).

The data associated with Plant_item_location are the following:

— location_and_orientation;

— location_id.

4.2.4.1.44.1 location_and_orientation

A location_and_orientation specifies the relative position and orientation of the Plant_item (see 4.2.4.1.39) to the Plant (see 4.2.1.1.11) or a Site (see 4.2.1.1.21).

4.2.4.1.44.2 location_id

A location_id specifies a unique identifier for the Plant_item_location.

4.2.4.1.45 Port_service_case

A Port_service_case is the data associated with a Equipment_port (see 4.2.4.1.16) being used for a Process_service (see 4.2.3.1.10) under some operating case or criteria.

4.2.4.1.46 Power_port

A Power_port is a type of Energy_port (see 4.2.4.1.15) where the energy at the Equipment_port (see 4.2.4.1.16) is in the form of power. Each Power_port may be one of the following: an Electrical_power_-port (see 4.2.4.1.14) or a Mechanical_power_port (see 4.2.4.1.30).

The data associated with Power_port are the following:

— normal_power;

— peak_power;

— rated_maximum_sustained_power;

— type.

4.2.4.1.46.1 normal_power

A normal_power specifies the specification for the normal power transmission expected through a Power_port.

4.2.4.1.46.2 peak_power

A peak_power specifies the specification for the maximum instantaneous power transmission expected through a Power_port.

4.2.4.1.46.3 rated_maximum_sustained_power

A rated_maximum_sustained_power specifies the maximum power that the Power_port is rated to be capable of transmitting on a sustained basis.

4.2.4.1.46.4 type

A type specifies that a Power_port is either a Mechanical_power_port (see 4.2.4.1.30) or an Electrical_-power_port (see 4.2.4.1.14).

4.2.4.1.47 Process_design_case

A Process_design_case is a case used in the design of the Plant_item (see 4.2.4.1.39) that is an aggregate of cases on the attributes of Plant_item, perhaps other than the Plant_item of the design case, the attributes of Plant_item aggregates, the attributes of the Plant (see 4.2.1.1.11), the attributes of the Site (see 4.2.1.1.21), the attributes of Equipment_ports (see 4.2.4.1.16), the attributes of Material (see 4.2.2.4.9) flowing through the Material_ports (see 4.2.4.1.28), and the attributes of Material within the Plant_item.

The data associated with Process_design_case are the following:

— agitation_condition_category;

— description;

— flow_condition_category;

— heat_transfer_condition_category;

— level_condition_category;

— plant_item_design_condition_name;

— pressure_condition_category;

— temperature_condition_category.

4.2.4.1.47.1 agitation_condition_category

An agitation_condition_category specifies an enumerated attribute that indicates the agitation condition category of the Process_design_case. The value of the agitation_condition_category attribute shall be one of the following:

— none;

— normal;

— other;

— perfect_mixing;

— plug_flow;

— rated.

4.2.4.1.47.1.1 none**:** an indication that there is no agitation condition for the Process_design_case.

4.2.4.1.47.1.2 normal**:** an indication that the agitation condition for the Process_design_case is normal.

4.2.4.1.47.1.3 other**:** an indication that the agitation condition for the Process_design_case is peculiar and is described further in the description.

4.2.4.1.47.1.4 perfect_mixing**:** an indication that the agitation condition for the Process_design_case is perfectly mixed.

4.2.4.1.47.1.5 plug_flow**:** an indication that the agitation condition for the Process_design_case is plug flow.

4.2.4.1.47.1.6 rated**:** an indication that the agitation condition for the Process_design_case is as rated.

4.2.4.1.47.2 description

A description specifies a textual explanation or summary of the agitation condition for the Process_-design_case.

4.2.4.1.47.3 flow_condition_category

A flow_condition_category specifies an enumerated attribute that indicates the flow condition category of a Process_design_case. The value of the flow_condition_category attribute shall be one of the following:

— maximum;

— minimum;

— none;

— normal;

— other;

— rated.

4.2.4.1.47.3.1 maximum**:** an indication that the flow condition for the Process_design_case is a maximum.

4.2.4.1.47.3.2 minimum**:** an indication that the flow condition for the Process_design_case is a minimum.

4.2.4.1.47.3.3 none**:** an indication that there is no flow condition for Process_design_case.

4.2.4.1.47.3.4 normal**:** an indication that the flow condition for the Process_design_case is normal.

4.2.4.1.47.3.5 other**:** an indication that the flow condition for the Process_design_case is peculiar and is described further in the description.

4.2.4.1.47.3.6 rated**:** an indication that the flow condition for the Process_design_case is as rated.

4.2.4.1.47.4 heat_transfer_condition_category

A heat_transfer_condition_category specifies an enumerated attribute that indicates the heat transfer condition category of a Process_design_case. The value of the heat_transfer_condition_category attribute shall be one of the following:

— clean;

— fouled;

— none;

— normal;

— other;

— rated.

4.2.4.1.47.4.1 clean**:** an indication that the heat transfer condition for the Process_design_case is for a clean surface.

4.2.4.1.47.4.2 fouled**:** an indication that the heat transfer condition for the Process_design_case is for a fouled surface.

4.2.4.1.47.4.3 none**:** an indication that there is no heat transfer condition for the Process_design_case.

4.2.4.1.47.4.4 normal**:** an indication that the heat transfer condition for the Process_design_case is normal.

4.2.4.1.47.4.5 other**:** an indication that the heat transfer condition for the Process_design_case is peculiar and is described further in the description.

4.2.4.1.47.4.6 rated**:** an indication that the heat transfer condition for the Process_design_case is as rated.

4.2.4.1.47.5 level_condition_category

A level_condition_category specifies an enumerated attribute that indicates the level condition category of a Process_design_case. The value of the level_condition_category attribute shall be one of the following:

— maximum;

— minimum;

— none;

— normal;

— other;

— rated.

4.2.4.1.47.5.1 maximum**:** an indication that the level condition for the Process_design_case is a maximum.

4.2.4.1.47.5.2 minimum**:** an indication that the level condition for the Process_design_case is a minimum.

4.2.4.1.47.5.3 none**:** an indication that there is no level condition for the Process_design_case.

4.2.4.1.47.5.4 normal**:** an indication that the level condition for the Process_design_case is normal.

4.2.4.1.47.5.5 other**:** an indication that the level condition for the Process_design_case is peculiar and is described further in the description.

4.2.4.1.47.5.6 rated**:** an indication that the level condition for the Process_design_case is as rated.

4.2.4.1.47.6 plant_item_design_condition_name

A plant_item_design_condition_name specifies a textual label assigned to the Process_design_case.

NOTE - Each Process_design_case name must be unique for a Plant_item (see 4.2.4.1.39).

4.2.4.1.47.7 pressure_condition_category

A pressure_condition_category specifies an enumerated attribute that indicates the pressure condition category of the Process_design_case. The value of the pressure_condition_category attribute shall be one of the following:

— maximum;

— minimum;

— none;

— normal;

— other;

— rated.

4.2.4.1.47.7.1 maximum**:** an indication that the pressure condition for the Process_design_case is a maximum.

4.2.4.1.47.7.2 minimum**:** an indication that the pressure condition for the Process_design_case is a minimum.

4.2.4.1.47.7.3 none**:** an indication that there is no pressure condition for the Process_design_case.

4.2.4.1.47.7.4 normal**:** an indication that the pressure condition for the Process_design_case is normal.

4.2.4.1.47.7.5 other**:** an indication that the pressure condition for the Process_design_case is peculiar and is described further in the description.

4.2.4.1.47.7.6 rated**:** an indication that the pressure condition for the Process_design_case is as rated.

4.2.4.1.47.8 temperature_condition_category

A temperature_condition_category specifies an enumerated attribute that indicates the temperature condition category of the Process_design_case. The value of the temperature_condition_category attribute shall be one of the following:

— maximum;

— minimum;

— none;

— normal;

— other;

— rated.

4.2.4.1.47.8.1 maximum**:** an indication that the temperature condition for the Process_design_case is a maximum.

4.2.4.1.47.8.2 minimum**:** an indication that the temperature condition for the Process_design_case is a minimum.

4.2.4.1.47.8.3 none**:** an indication that there is no temperature condition for the Process_design_case.

4.2.4.1.47.8.4 normal**:** an indication that the temperature condition for the Process_design_case is normal.

4.2.4.1.47.8.5 other**:** an indication that the temperature condition for the Process_design_case is peculiar and is described further in the description.

4.2.4.1.47.8.6 rated**:** an indication that the temperature condition for the Process_design_case is as rated.

4.2.4.1.48 Process_design_case_relationship

A Process_design_case_relationship is an association between two Process_design_cases (see 4.2.4.1.47).

The data associated with Process_design_case_relationship are the following:

— description;

— type.

4.2.4.1.48.1 description

A description specifies a textual explanation or summary of the manner in which two Process_design_-cases (see 4.2.4.1.47) are related.

4.2.4.1.48.2 type

A type specifies the general nature or category of a given Process_design_case_relationship.

4.2.4.1.49 Radial_bearing

A Radial_bearing is a type of Bearing (see 4.2.4.1.3) that is a machine element placed between the Shaft (see 4.2.4.1.53) and the casing to isolate the casing from the torque generated by the Shaft and to align the Shaft. A Radial_bearing is wrapped around the Shaft radial_bearing_span.

The data associated with Radial_bearing are the following:

— fluid_mach_number;

— span.

4.2.4.1.49.1 fluid_mach_number

A fluid_mach_number specifies the design maximum mach number the bearing is rated for.

4.2.4.1.49.2 span

A span specifies the width of the contact surface between the Shaft (see 4.2.4.1.53) and the Bearing (see 4.2.4.1.3).

4.2.4.1.50 Reciprocating_power_port

A Reciprocating_power_port is a type of Mechanical_power_port (see 4.2.4.1.30) where the mechanical power at the Equipment_port (see 4.2.4.1.16) is in the form of reciprocating pistons.

The data associated with Reciprocating_power_port are the following:

— normal_stroke_frequency;

— number_of_pistons;

— rated_maximum_stroke_frequency.

4.2.4.1.50.1 normal_stroke_frequency

A normal_stroke_frequency specifies the normal frequency of the piston cycles of a Reciprocating_-power_port.

4.2.4.1.50.2 number_of_pistons

A number_of_pistons specifies the number of pistons in the Reciprocating_power_port.

4.2.4.1.50.3 rated_maximum_stroke_frequency

A rated_maximum_stroke_frequency specifies the maximum rated frequency of the piston cycles for a Reciprocating_power_port.

4.2.4.1.51 Rotating_equipment_tests

A Rotating_equipment_tests is a type of Inspection_and_tests (see 4.2.4.1.25) that are performed on Plant_items (see 4.2.4.1.39) that are also rotating equipment.

> NOTE - These tests are carried out by a manufacturer prior to the delivery of the rotating equipment Plant_-item to a customer.

The data associated with Rotating_equipment_tests are the following:

— check_bearings_and_seals_after_test;

— fit_in_spare_rotor_test;

— lubrication_and_seal_job_test;

— lubrication_and_seal_shop_test;

— mechanical_run_test;

— mechanical_run_spare_rotor_test;

— residual_electrical_mechanical_runout_test;

— rotating_equipment_with_driver_test;

— rotating_equipment_without_driver_test;

— vibration_and_axial_probes_job_test;

— vibration_probes_job_test;

— vibration_probes_shop_test.

4.2.4.1.51.1 check_bearings_and_seals_after_test

A check_bearings_and_seals_after_test specifies whether the Plant_item (see 4.2.4.1.39) bearings and seals are to be inspected after completion of the test.

4.2.4.1.51.2 fit_in_spare_rotor_test

A fit_in_spare_rotor_test specifies whether a performance test is to be made using the spare rotor.

4.2.4.1.51.3 lubrication_and_seal_job_test

A lubrication_and_seal_job_test specifies whether the lubrication and seal system is to be tested after installation.

4.2.4.1.51.4 lubrication_and_seal_shop_test

A lubrication_and_seal_shop_test specifies whether the lubrication and seal system is tested at the shop.

4.2.4.1.51.5 mechanical_run_test

A mechanical_run_test specifies whether a mechanical run test is to be performed.

4.2.4.1.51.6 mechanical_run_spare_rotor_test

A mechanical_run_spare_rotor_test specifies whether a mechanical run test is to be performed using the spare rotor.

4.2.4.1.51.7 residual_electrical_mechanical_runout_test

A residual_electrical_mechanical_runout_test specifies whether a residual mechanical runout test is to be performed.

4.2.4.1.51.8 rotating_equipment_with_driver_test

A rotating_equipment_with_driver_test specifies whether the rotating equipment is to be tested with its driver.

4.2.4.1.51.9 rotating_equipment_without_driver_test

A rotating_equipment_without_driver_test specifies whether the rotating equipment is to be tested without its driver.

4.2.4.1.51.10 vibration_and_axial_probes_job_test

A vibration_and_axial_probes_job_test specifies whether vibration probes will be used on a performance test after installation.

4.2.4.1.51.11 vibration_probes_job_test

A vibration_probes_job_test specifies whether vibration probes will be used on the job performance test.

4.2.4.1.51.12 vibration_probes_shop_test

A vibration_probes_shop_test specifies whether vibration probes will be used on the shop performance test.

4.2.4.1.52 Rotating_power_port

A Rotating_power_port is a type of Mechanical_power_port (see 4.2.4.1.30) where the mechanical power at the Equipment_port (see 4.2.4.1.16) is in the form of a rotating Shaft (see 4.2.4.1.53).

The data associated with Rotating_power_port are the following:

— allowable_peak_to_peak_vibration;

— normal_revolution_frequency;

— normal_torque;

— rated_maximum_revolution_frequency;

— rated_maximum_torque;

— rotation_direction.

4.2.4.1.52.1 allowable_peak_to_peak_vibration

An allowable_peak_to_peak_vibration specifies the specification for the maximum allowable peak to peak vibration for the Shaft (see 4.2.4.1.53) of a Rotating_power_port.

4.2.4.1.52.2 normal_revolution_frequency

A normal_revolution_frequency specifies the specification for the normal frequency of the Shaft (see 4.2.4.1.53) revolutions for a Rotating_power_port.

4.2.4.1.52.3 normal_torque

A normal_torque specifies the specification for the normal torque applied to the rotating Shaft (see 4.2.4.1.53) of a Rotating_power_port.

4.2.4.1.52.4 rated_maximum_revolution_frequency

A rated_maximum_revolution_frequency specifies the specification for the maximum rated frequency of the Shaft (see 4.2.4.1.53) revolutions for a Rotating_power_port.

4.2.4.1.52.5 rated_maximum_torque

A rated_maximum_torque specifies the specification for the maximum rated torque for the rotating Shaft (see 4.2.4.1.53) of a Rotating_power_port.

4.2.4.1.52.6 rotation_direction

A rotation_direction specifies an enumerated attribute that indicates the allowable rotation direction of a Rotating_power_port. The value of the rotation_direction attribute shall be one of the following:

— both;

— clockwise;

— counterclockwise.

4.2.4.1.52.6.1 both**:** an indication that the allowable rotation direction for a Rotating_power_port is both clockwise and counterclockwise when facing the end of the rotating Shaft (see 4.2.4.1.53).

4.2.4.1.52.6.2 clockwise**:** an indication that the allowable rotation direction for a Rotating_power_port is clockwise when facing the end of the rotating Shaft (see 4.2.4.1.53).

4.2.4.1.52.6.3 counterclockwise**:** an indication that the allowable rotation direction for a Rotating_-power_port is counterclockwise when facing the end of the rotating Shaft (see 4.2.4.1.53).

4.2.4.1.53 Shaft

A Shaft is a rotating cylinder that connects a driver such as a motor, turbine. or expander to an associated rotating equipment such as a compressor or pump.

NOTE - A Shaft can connect a driver to several pieces of equipment at the same time. For example, a gas turbine driver connected to four compressors on a common Shaft.

The data associated with Shaft are the following:

— diameter_at_coupling_end;

— diameter_at_impellers.

4.2.4.1.53.1 diameter_at_coupling_end

A diameter_at_coupling_end specifies the geometry of the shaft at the coupling point. The value of the diameter_at_coupling_end attribute shall be one of the following:

— cylindrical;

— tapered.

4.2.4.1.53.1.1 cylindrical: an indication that the Shaft is not tapered at the Coupling (see 4.2.4.1.10) end.

4.2.4.1.53.1.2 tapered**:** an indication the Shaft is tapered at the Coupling (see 4.2.4.1.10) end.

4.2.4.1.53.2 diameter_at_impellers

A diameter_at_coupling_end_impellers specifies the diameter of the Shaft at the point where the Shaft is coupled to the impellers.

4.2.4.1.54 Shop_testing_requirement

A Shop_testing_requirement is a requirement for a mechanical or performance test performed in the manufacturer's or a third-party's testing facility as a part of the associated Inspection_and_tests (see 4.2.4.1.25) for a Plant_item (see 4.2.4.1.39).

The data associated with Shop_testing_requirement are the following:

— test_type;

— witness_requirements.

4.2.4.1.54.1 test_type

A test_type specifies the general nature or category of a given mechanical or performance shop test to perform.

4.2.4.1.54.2 witness_requirements

A witness_requirements specifies the degree of witnessing of the test required by the purchaser. The value of the witness_requirements attribute shall be one of the following:

— none;

— observed;

— witnessed.

4.2.4.1.54.2.1 none**:** an indication that there are no requirements for the purchaser to witness the shop test.

4.2.4.1.54.2.2 observed**:** an indication that the purchaser will observe the shop test.

4.2.4.1.54.2.3 witnessed**:** an indication that the purchaser will witness and sign-off on the shop test.

4.2.4.1.55 Signal_port

A Signal_port is a type of Equipment_port (see 4.2.4.1.16) through which a signal is intended to flow.

4.2.4.1.56 Simple_performance_curve

A Simple_performance_curve is a type a Performance_curve (see 4.2.4.1.34) that is a representation of the plot of one or more dependent variables versus a single independent variable. Each of the dependent variables shall have the same independent variable property name.

4.2.4.1.57 Socket

A Socket is a type of end engagement for a Piping_connector (see 4.2.4.1.38) that uses a socket as the connection mechanism.

4.2.4.1.58 Space_requirements

A Space_requirements is the spatial area occupied by a Plant_item (see 4.2.4.1.39) plus any space allowances for safety or maintenance considerations.

The data associated with Space_requirements are the following:

— area_required;

— item_description.

4.2.4.1.58.1 area_required

An area_required specifies the spatial area requirements allowing for the Plant_item (see 4.2.4.1.39) dimensions plus any additional dimensions required for maintenance or safety considerations.

4.2.4.1.58.2 item_description

An item_description specifies a textual explanation or summary of the Space_requirements elucidating additional details or rationale for the area requirement.

4.2.4.1.59 Spare_item_relationship

A Spare_item_relationship is the relationship between the spare item and the piece of the Plant (see 4.2.1.1.11) equipment the spare item is associated with.

> EXAMPLE 57 - For example, a spare pump may be placed in line and connected to the process, while a spare impeller would be placed in storage.

The data associated with Spare_item_relationship are the following:

— type.

A type specifies the general nature or category of a given Spare_item_relationship.

4.2.4.1.60 Threaded

A Threaded is a type of Piping_connector (see 4.2.4.1.38) where the two pipes are connected by screw-type threading.

The data associated with Threaded are the following:

— thread_type.

A thread_type specifies an enumerated attribute that specifies the type of Threading. The value of the thread_type attribute shall be one of the following:

— iso_tapered;

— normal_course;

— normal_fine;

— normal_pipe;

— unspecified.

4.2.4.1.60.0.1 iso_tapered**:** an indication that specifies the type of Threaded as ISO tapered thread.

4.2.4.1.60.0.2 normal_course**:** an indication that specifies the type of Threaded as normal coarse thread.

4.2.4.1.60.0.3 normal_fine**:** an indication that specifies the type of Threaded as normal fine thread.

4.2.4.1.60.0.4 normal_pipe**:** an indication that specifies the type of Threaded as normal pipe thread.

4.2.4.1.60.0.5 unspecified**:** an indication that specifies the type of Threaded as not specified.

4.2.4.1.61 Thrust_bearing

A Thrust_bearing is a type of Bearing (see 4.2.4.1.3) that is used to take up the axial force produced by a Shaft (see 4.2.4.1.53) driven machine. The Thrust_bearing acts as a pad at the end of the Shaft.

The data associated with Thrust_bearing are the following:

— balance_piston_compression_load;

— coupling_coefficient_friction;

— coupling_gear_pitch;

— coupling_slip_load;

— gas_loading;

— location.

4.2.4.1.61.1 balance_piston_compression_load

A balance_piston_compression_load specifies the load the balance piston takes up from the impellers.

4.2.4.1.61.2 coupling_coefficient_friction

A coupling_coefficient_friction specifies the coefficient of friction of the Thrust_bearing Coupling (see 4.2.4.1.10).

4.2.4.1.61.3 coupling_gear_pitch

A coupling_gear_pitch specifies the angle between the Thrust_bearing Coupling (see 4.2.4.1.10) and the gear.

4.2.4.1.61.4 coupling_slip_load

A coupling_slip_load specifies the load necessary to cause a slip in the position of the Thrust_bearing.

4.2.4.1.61.5 gas_loading

A gas_loading specifies the gas loading required to maintain normal Thrust_bearing operation with no slip.

4.2.4.1.61.6 location

A location specifies where on the Shaft (see 4.2.4.1.53) the Thrust_bearing is located.

4.2.4.2 major_process_equipment_data

Refer to 4.1.4 for a description of what this UoF specifies. The ARM diagrams related to this UoF are provided as figures G.8 through G.9 in annex G of this part to ISO 10303.

4.2.4.2.1 Buffer_gas_system

A Buffer_gas_system is an environmental control system that prevents leakage of noxious Substances (see 4.2.2.2.20) into the environment by forcing high pressure gas into the chemical process at interfaces between Bearings (see 4.2.4.1.3) and Shafts (see 4.2.4.1.53).

> NOTE - The gas is determined by its association with a Utility_stream (see 4.2.3.3.19) through Plant_item (see 4.2.4.1.39) and Equipment_port (see 4.2.4.1.16).

The data associated with Buffer_gas_system are the following:

— pressure_drop;

— required_for.

4.2.4.2.1.1 pressure_drop

A pressure_drop specifies the pressure drop through the passages irrigated by the Buffer_gas_system.

4.2.4.2.1.2 required_for

A required_for specifies an enumerated attribute for the operating scenario for when the Buffer_gas_-system is required. The value of the required_for attribute shall be one of the following:

— air_run_in;

— other;

— startup.

4.2.4.2.1.2.1 air_run_in**:** an indication that the Buffer_gas_system is needed only for air run of the compressor.

4.2.4.2.1.2.2 other**:** an indication that the Buffer_gas_system is needed during operations other than those covered by the other enumerations given.

4.2.4.2.1.2.3 startup**:** an indication that the Buffer_gas_system is needed only for start up.

4.2.4.2.2 Casing_nozzle

A Casing_nozzle is the interaction between a Nozzle (see 4.2.4.2.5) and a pump or compressor casing.

The data associated with Casing_nozzle are the following:

— allowable_force;

— allowable_moment;

— flange_velocity;

— position.

4.2.4.2.2.1 allowable_force

An allowable_force specifies the allowable force between a Nozzle (see 4.2.4.2.5) and a pump or compressor casing.

4.2.4.2.2.2 allowable_moment

An allowable_moment specifies the allowable moment between a Nozzle (see 4.2.4.2.5) and a pump or compressor casing.

4.2.4.2.2.3 flange_velocity

A flange_velocity specifies the velocity of the process fluid at the Nozzle (see 4.2.4.2.5) Flanged_end (see 4.2.4.1.20).

4.2.4.2.2.4 position

A position specifies the position of a Nozzle (see 4.2.4.2.5) on a pump or compressor casing. The value of the position attribute shall be one of the following:

— discharge;

— inlet;

— other.

4.2.4.2.2.4.1 discharge**:** an indication that the Nozzle (see 4.2.4.2.5) is a discharge nozzle.

4.2.4.2.2.4.2 inlet**:** an indication that the Nozzle (see 4.2.4.2.5) is an inlet nozzle to the casing.

4.2.4.2.2.4.3 other**:** an indication that the Nozzle (see 4.2.4.2.5) is not an inlet or outlet nozzle.

4.2.4.2.3 Elbow_nozzle_section

An Elbow_nozzle_section is a type of Nozzle_section (see 4.2.4.2.6) that contains a simple bend.

The data associated with Elbow_nozzle_section are the following:

— bend_radius;

— included_angle.

4.2.4.2.3.1 bend_radius

A radius specifies the inside bend radius of the Elbow_nozzle_section.

4.2.4.2.3.2 included_angle

An included_angle specifies the included angle for the bend of the Elbow_nozzle_section.

4.2.4.2.4 External_treatment

An External_treatment is a collection of attributes that describe types of external treatments that a section or vessel might receive.

The data associated with External_treatment are the following:

— heat_tracing_required;

— insulation_thickness;

— insulation_type;

— jacket_required;

— paint_specification.

4.2.4.2.4.1 heat_tracing_required

A heat_tracing_required specifies that heat tracing is required for the vessel.

4.2.4.2.4.2 insulation_thickness

An insulation_thickness specifies the thickness of the insulation used as an External_treatment.

4.2.4.2.4.3 insulation_type

An insulation_type specifies the type of insulation used as an External_treatment.

4.2.4.2.4.4 jacket_required

A jacket_required specifies that jacketing is required for the vessel.

4.2.4.2.4.5 paint_specification

A paint_specification specifies the specifications for a paint that is used as an External_treatment.

4.2.4.2.5 Nozzle

A Nozzle is a physical opening in certain Plant_items (see 4.2.4.1.39) through which Material (see 4.2.2.4.9) is intended to flow.

The data associated with Nozzle are the following:

— entrance_type;

— function;

— nominal_size;

— piping_schedule;

— pressure_rating;

— tag;

— temperature_rating;

— vortex_breaker;

— wall_thickness.

4.2.4.2.5.1 entrance_type

An entrance_type specifies an enumerated attribute of Nozzle that specifies the type of Nozzle entrance. The value of the entrance_type attribute shall be one of the following:

— axial;

— elbow;

— radial;

— tangential;

— unspecified.

4.2.4.2.5.1.1 axial**:** an indication that the type of Nozzle is specified as axial (see item 4 in figure 5).

4.2.4.2.5.1.2 elbow**:** an indication that the type of Nozzle specified is an elbow (see item 3 in figure 5).

4.2.4.2.5.1.3 radial**:** an indication that the type of Nozzle is specified as radial (see item 1 in figure 5).

4.2.4.2.5.1.4 tangential**:** an indication that the type of Nozzle is specified as tangential (see item 2 in figure 5).

4.2.4.2.5.1.5 unspecified**:** an indication that the type of Nozzle is not specified.

4.2.4.2.5.2 function

A function specifies an enumerated attribute that gives the function of the Nozzle. The value of the function attribute shall be one of the following:

— drain;

— inlet;

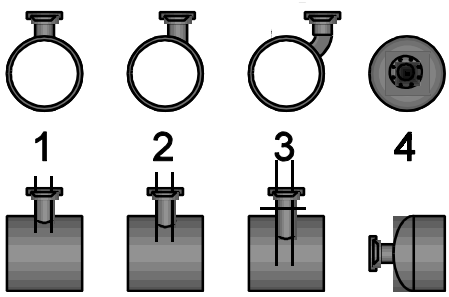


Figure 5 - Nozzle entrance type

— inspection_port;

— liquid_inlet;

— manhole;

— outlet;

— safety_valve;

— sparge;

— unspecified;

— vapour_outlet;

— vent.

4.2.4.2.5.2.1 drain**:** an indication that specifies the function of the Nozzle as a drain (no flow).

4.2.4.2.5.2.2 inlet**:** an indication that specifies the function of the Nozzle as inlet.

4.2.4.2.5.2.3 inspection_port**:** an indication that specifies the function of the Nozzle as an inspection port.

4.2.4.2.5.2.4 liquid_inlet**:** an indication that specifies the function of the Nozzle as a liquid inlet.

4.2.4.2.5.2.5 manhole**:** an indication that specifies the function of the Nozzle as manhole.

4.2.4.2.5.2.6 outlet**:** an indication that specifies the function of the Nozzle as outlet.

4.2.4.2.5.2.7 safety_valve**:** an indication that specifies the function of the Nozzle as a safety valve.

4.2.4.2.5.2.8 sparge**:** an indication that specifies the function of the Nozzle as a sparge.

4.2.4.2.5.2.9 unspecified**:** an indication that the function of the Nozzle is not specified.

4.2.4.2.5.2.10 vapour_outlet**:** an indication that specifies the function of the Nozzle as a vapour outlet.

4.2.4.2.5.2.11 vent**:** an indication that specifies the function of the Nozzle as a vent.

4.2.4.2.5.3 nominal_size

A nominal_size specifies the nominal size of a Nozzle.

4.2.4.2.5.4 piping_schedule

A piping_schedule specifies the pipe schedule of the Nozzle.

4.2.4.2.5.5 pressure_rating

A pressure_rating specifies the pressure rating of the Nozzle.

4.2.4.2.5.6 tag

A tag specifies a textual label for the Nozzle.

4.2.4.2.5.7 temperature_rating

A temperature_rating specifies the rated temperature of the Nozzle.

4.2.4.2.5.8 vortex_breaker

A vortex_breaker specifies that a vortex breaker is required for the Nozzle.

4.2.4.2.5.9 wall_thickness

A wall_thickness specifies the wall thickness of the Nozzle.

4.2.4.2.6 Nozzle_section

A Nozzle_section is a section of a Nozzle (see 4.2.4.2.5). Each Nozzle_section may be one of the following: an Elbow_nozzle_section (see 4.2.4.2.3), a Reducing_nozzle_section (see 4.2.4.2.11), or a Straight_nozzle_section (see 4.2.4.2.13).

The data associated with Nozzle_section are the following:

— inside_diameter;

— nominal_diameter;

— outside_diameter;

— piping_schedule;

— wall_thickness.

4.2.4.2.6.1 inside_diameter

An inside_diameter specifies the inside diameter of the Nozzle_section.

4.2.4.2.6.2 nominal_diameter

A nominal_diameter specifies the nominal diameter of the Nozzle_section.

4.2.4.2.6.3 outside_diameter

An outside_diameter specifies the outer diameter of the Nozzle_section.

4.2.4.2.6.4 piping_schedule

A piping_schedule specifies the pipe schedule of the Nozzle_section.

4.2.4.2.6.5 wall_thickness

A wall_thickness specifies the wall thickness of the Nozzle_section.

4.2.4.2.7 Nozzle_section_connection

A Nozzle_section_connection is the connection of two sections of the Nozzle (see 4.2.4.2.5).

The data associated with Nozzle_section_connection are the following:

— angular_offset;

— inside_radius;

— thickness;

— type.

4.2.4.2.7.1 angular_offset

An angular_offset specifies the angle between the plane of the next lowest ordered Elbow_nozzle_section (see 4.2.4.2.3) in the Nozzle (see 4.2.4.2.5) and the plane of the Elbow_nozzle_section being connected.

4.2.4.2.7.2 inside_radius

A inside_radius specifies the inside radius of the transition of the Nozzle_section_connection between two unequally sized Nozzle_sections (see 4.2.4.2.6).

4.2.4.2.7.3 thickness

A thickness specifies the wall thickness of the Nozzle_section_connection.

4.2.4.2.7.4 type

A type specifies an enumerated attribute of the Nozzle_section_connection describing the type of connection. The value of the type attribute shall be one of the following;

— flanged;

— open;

— threaded;

— unspecified;

— welded.

4.2.4.2.7.4.1 flanged**:** an indication that describes the connection type as flanged.

4.2.4.2.7.4.2 open**:** an indication that describes the connection type to be open. If the connection is open only one section may be associated with the Nozzle_section_connection.

4.2.4.2.7.4.3 threaded**:** an indication that describes the connection type as threaded.

4.2.4.2.7.4.4 unspecified**:** an indication that describes the connection type to be unspecified.

4.2.4.2.7.4.5 welded**:** an indication that describes the connection type as welded.

4.2.4.2.8 Process_equipment

A Process_equipment is a type of Plant_item (see 4.2.4.1.39) that is intended to be in direct contact with the Material (see 4.2.2.4.9) isolated from the surroundings by the Plant (see 4.2.1.1.11). Each Process_-equipment may be one of the following: a Heat_transfer_equipment (see 4.2.4.3.19), a Mass_transfer_-equipment (see 4.2.4.4.26), a Material_transfer_equipment (see 4.2.4.5.19), a Process_equipment_driver (see 4.2.4.2.9), a Process_vessel (see 4.2.4.6.22), a Reaction_system_equipment (see 4.2.4.2.10), or a Solids_processing_equipment (see 4.2.4.2.12).

The data associated with Process_equipment are the following:

— water_filled_weight;

— type.

4.2.4.2.8.1 water_filled_weight

A water_filled_weight specifies the weight of the Process_equipment when filled with water.

4.2.4.2.8.2 type

A type specifies that the Process_equipment is either a Material_transfer_equipment (see 4.2.4.5.19), control element, separation tower, piping system, Process_vessel (see 4.2.4.6.22), separation tower internal, chemical reactor, or Heat_transfer_equipment (see 4.2.4.3.19).

4.2.4.2.9 Process_equipment_driver

A Process_equipment_driver is a type of Process_equipment (see 4.2.4.2.8).

4.2.4.2.10 Reaction_system_equipment

A Reaction_system_equipment is a type of Process_equipment (see 4.2.4.2.8).

4.2.4.2.11 Reducing_nozzle_section

A Reducing_nozzle_section is a Nozzle_section (see 4.2.4.2.6) that is a straight length with a reducer.

The data associated with Reducing_nozzle_section are the following:

— angular_offset_of_small_circle;

— eccentric;

— inside_diameter2;

— nominal_diameter2;

— outside_diameter2.

4.2.4.2.11.1 angular_offset_of_small_circle

An angular_offset_of_small_circle specifies the angular offset associated with the small circle of the Reducing_nozzle_section.

4.2.4.2.11.2 eccentric

An eccentric specifies that the Reducing_nozzle_section has eccentric sides.

4.2.4.2.11.3 inside_diameter2

An inside_diameter_2 specifies the second inside diameter for the Reducing_nozzle_section. This is the side toward the highest numbered section of the Nozzle (see 4.2.4.2.5).

4.2.4.2.11.4 nominal_diameter2

A nominal_diameter_2 specifies the second nominal diameter for the Reducing_nozzle_section. This is the side toward the highest numbered section of the Nozzle (see 4.2.4.2.5).

4.2.4.2.11.5 outside_diameter2

An outside_diameter_2 specifies the second outside diameter for the Reducing_nozzle_section. This is the side toward the highest numbered section of the Nozzle (see 4.2.4.2.5).

4.2.4.2.12 Solids_processing_equipment

A Solids_processing_equipment is a type of Process_equipment (see 4.2.4.2.8) used to process solid Materials (see 4.2.2.4.9).

4.2.4.2.13 Straight_nozzle_section

A Straight_nozzle_section is a straight piece of Nozzle_section (see 4.2.4.2.6).

The data associated with Straight_nozzle_section are the following:

— length.

A length specifies the length of the Straight_nozzle_section.

4.2.4.3 heat_transfer_equipment_data

Refer to 4.1.3 for a description of what this UoF specifies. The ARM diagrams related to this UoF are provided as figures G.4 through G.7 in annex G of this part to ISO 10303.

4.2.4.3.1 Air_cooled_heat_exchanger_unit

An Air_cooled_heat_exchanger_unit is a composite of one or more air-cooled heat exchangers.

4.2.4.3.2 Cross_baffle

A Cross_baffle is a sheet of material in a heat exchanger placed in the bundle to alter the flow pattern of the shell side fluid flow.

The data associated with Cross_baffle are the following:

— cut_out_of_window;

— diameter;

— distance_from_tubesheet_face;

— elastic_modulus;

— orientation;

— outer_ring_width;

— percent_diameter_first_cut;

— percent_diameter_second_cut;

— percent_diameter_third_cut;

— thermal_conductivity;

— thickness;

— thickness_at_tube_hole;

— type.

4.2.4.3.2.1 cut_out_of_window

A cut_out_of_window specifies whether or not the baffle window is integral to the baffle. The value of the cut_out_of_window attribute shall be one of the following:

— no;

— unspecified;

— yes.

4.2.4.3.2.1.1 no**:** an indication that the baffle window is not integral to the baffle (see item 1 in figure 6).

4.2.4.3.2.1.2 unspecified**:** an indication that whether a baffle has a baffle window is not specified.

4.2.4.3.2.1.3 yes**:** an indication that the baffle window is integral to the baffle (see item 2 in figure 6).

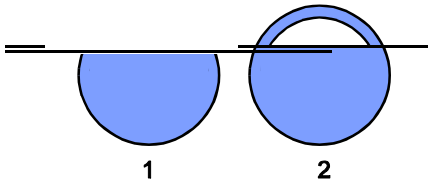


Figure 6 - Baffle window

4.2.4.3.2.2 diameter

A diameter specifies the outside diameter of the Cross_baffles.

4.2.4.3.2.3 distance_from_tubesheet_face

A distance_from_tubesheet_face specifies the distance from the centre of a single baffle to the front face of the front tubesheet.

4.2.4.3.2.4 elastic_modulus

An elastic_modulus specifies the modulus of elasticity for the baffle.

4.2.4.3.2.5 orientation

An orientation specifies an enumerated attribute giving the baffle cut orientation of a segmental type baffle. The value of the type attribute shall be one of the following:

— none;

— parallel;

— perpendicular;

— rotated;

— unspecified.

4.2.4.3.2.5.1 none**:** an indication that there is no baffle cut.

4.2.4.3.2.5.2 parallel**:** an indication that the baffle cut orientation is parallel (normally vertical) to the shell side inlet nozzle axis.

4.2.4.3.2.5.3 perpendicular**:** an indication that the baffle cut orientation is perpendicular (normally horizontal) to the shell side inlet nozzle axis.

4.2.4.3.2.5.4 rotated**:** an indication that the baffle cut orientation is rotated 45 degrees with respect to the shell side inlet nozzle axis.

4.2.4.3.2.5.5 unspecified**:** an indication that the baffle cut orientation is not specified.

4.2.4.3.2.6 outer_ring_width

An outer_ring_width specifies the width of the outer ring.

4.2.4.3.2.7 percent_diameter_first_cut

A percent_diameter_first_cut varies with the type of segmental baffle. For a single-segmental baffle, it is defined as the segment opening height expressed as a percentage of the shell inside diameter. For double-segmental and triple-segmental baffles, it is defined as the segment height of the innermost baffle window as a percent of the shell inside diameter.

4.2.4.3.2.8 percent_diameter_second_cut

A percent_diameter_second_cut varies with the type of segmental baffle. For a double-segmental baffle, it is defined as the segment height of the outermost baffle window as a percent of the shell inside diameter. For a triple-segmental baffle, it is defined as the segment height of the intermediate baffle window as a percent of the shell inside diameter.

4.2.4.3.2.9 percent_diameter_third_cut

A percent_diameter_third_cut specifies the segment height of the outermost baffle window of a triple-segmental baffle as a percent of the shell inside diameter.

4.2.4.3.2.10 thermal_conductivity

A thermal_conductivity specifies the thermal conductivity of the baffle.

4.2.4.3.2.11 thickness

A thickness specifies the thickness of the Cross_baffles.

4.2.4.3.2.12 thickness_at_tube_hole

A thickness_at_tube_hole specifies the thickness of the Cross_baffles at the tube holes.

4.2.4.3.2.13 type

A type specifies an enumerated attribute giving the type of baffle in a heat exchanger. The value of the type attribute shall be one of the following:

— disk_and_donut;

— double_segmental;

— full_support;

— no_baffles;

— rod;

— single_segmental;

— strip;

— triple_segmental;

— unspecified.

4.2.4.3.2.13.1 disk_and_donut**:** an indication that the type of baffle is a disk and donut (see item 7 in figure 7).

4.2.4.3.2.13.2 double_segmental**:** an indication that the type of baffle is a double-segmental (see item 2 in figure 7).

4.2.4.3.2.13.3 full_support**:** an indication that the type of baffle is a full-support (see item 4 in figure 7).

4.2.4.3.2.13.4 no_baffles**:** an indication that there is no baffle.

4.2.4.3.2.13.5 rod**:** an indication that the type of baffle is a rod (see item 5 in figure 7).

4.2.4.3.2.13.6 single_segmental**:** an indication that the type of baffle is a single-segmental (see item 1 in figure 7).

4.2.4.3.2.13.7 strip**:** an indication that the type of baffle is a strip (see item 6 in figure 7).

4.2.4.3.2.13.8 triple_segmental**:** an indication that the type of baffle is a triple-segmental (see item 3 in figure 7).

4.2.4.3.2.13.9 unspecified**:** an indication that the type of baffle is not specified.

4.2.4.3.3 Detuning_plate

A Detuning_plate is a piece of plate that is attached to the bundle to change the vibration or acoustic resonance tendencies within the bundle.

The data associated with Detuning_plate are the following:

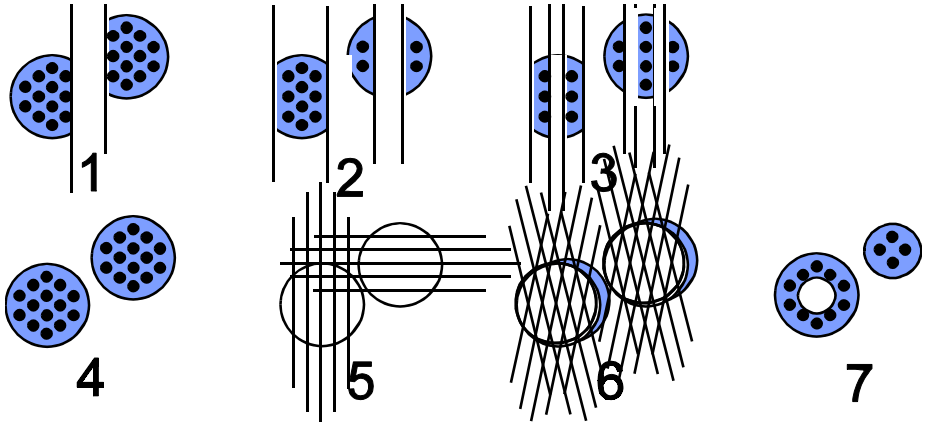


Figure 7 - Baffle type

— distance_from_shell_centre;

— length;

— thickness;

— width.

4.2.4.3.3.1 distance_from_shell_centre

A distance_from_shell_centre specifies the distance from the Detuning_plate to the centreline of the shell.

4.2.4.3.3.2 length

A length specifies the length of the Detuning_plate.

4.2.4.3.3.3 thickness

A thickness specifies the thickness of the Detuning_plate.

4.2.4.3.3.4 width

A width specifies the width of the Detuning_plate.

4.2.4.3.4 Distributor_belt

A Distributor_belt is a donut-shaped section constructed around the shell that aids the distribution of a fluid into the shell side of the heat exchanger and reduces the entrance velocity of the fluid.

The data associated with Distributor_belt are the following:

— inside_diameter;

— length;

— outside_diameter;

— radial_clearance;

— slot_area;

— type.

4.2.4.3.4.1 inside_diameter

An inside_diameter specifies the inside diameter of the Distributor_belt.

4.2.4.3.4.2 length

A length specifies the length of the Distributor_belt.

4.2.4.3.4.3 outside_diameter

An outside_diameter specifies the outside diameter of the Distributor_belt.

4.2.4.3.4.4 radial_clearance

A radial_clearance specifies the radial clearance between the Distributor_belt and the shell.

4.2.4.3.4.5 slot_area

A slot_area specifies the total area of the distribution slots in the Distributor_belt.

4.2.4.3.4.6 type

A type specifies the type of the Distributor_belt as a gap, slot, or unspecified.

4.2.4.3.5 End_partition_plate

An End_partition_plate is a piece of plate in the front or rear heads used to partition the heads for multiple tube passes.

The data associated with End_partition_plate are the following:

— distance_from_centre;

— length;

— orientation;

— thickness;

— width.

4.2.4.3.5.1 distance_from_centre

A distance_from_centre specifies the distance from the tubesheet centreline to the End_partition_plate.

4.2.4.3.5.2 length

A length specifies the length of the End_partition_plate.

4.2.4.3.5.3 orientation

An orientation specifies whether the orientation of the End_partition_plate is horizontal, vertical, or unspecified.

4.2.4.3.5.4 thickness

A thickness specifies the thickness of the End_partition_plate.

4.2.4.3.5.5 width

A width specifies the width of the End_partition_plate.

4.2.4.3.6 Exchanger_assembly

An Exchanger_assembly is the combination of one Exchanger_bundle (see 4.2.4.3.7), one Exchanger_-shell (see 4.2.4.3.12), zero or one Reboiler_piping (see 4.2.4.3.27), zero, one, or many Exchanger_ends (see 4.2.4.3.9), and zero, one, or many Exchanger_nozzles (see 4.2.4.3.10) into a unit to be used in a Shell_and_tube_heat_exchanger_unit (see 4.2.4.3.28).

The data associated with Exchanger_assembly are the following:

— dry_weight;

— wet_weight.

4.2.4.3.6.1 dry_weight

A dry_weight specifies the weight of the Exchanger_assembly when empty.

4.2.4.3.6.2 wet_weight

A wet_weight specifies the weight of the Exchanger_assembly when filled with water.

4.2.4.3.7 Exchanger_bundle

An Exchanger_bundle is the tube bundle of the heat exchanger that consists of tubes, baffles, supports, tie rods, and spacers.

The data associated with Exchanger_bundle are the following:

— baffle_inlet_spacing;

— baffle_outlet_spacing;

— baffle_to_shell_clearance;

— bundle_to_shell_clearance;

— bundle_weight;

— effective_area_in_ubends;

— floating_head_support_type;

— kettle_tuberows_removed_at_bottom;

— kettle_tuberows_removed_at_top;

— nominal_baffle_spacing;

— number_inlet_intermediate_supports;

— number_midspace_intermediate_supports;

— number_of_cross_baffles;

— number_of_seal_strip_pairs;

— number_of_tube_passes_shell;

— number_of_tubes_in_window;

— number_outlet_intermediate_supports;

— outer_tube_limit;

— percent_baffle_overlap;

— total_number_of_tubes;

— tube_to_baffle_clearance;

— tubes_in_windows.

4.2.4.3.7.1 baffle_inlet_spacing

A baffle_inlet_spacing specifies the distance between the tubesheet (or support plate) and the first baffle at the point where the shell side flow enters the heat exchanger.

4.2.4.3.7.2 baffle_outlet_spacing

A baffle_outlet_spacing specifies the distance the tubesheet (or support plate) and the last baffle at the point where the shell side flow exits the heat exchanger.

4.2.4.3.7.3 baffle_to_shell_clearance

A baffle_to_shell_clearance specifies the diametric distance between the baffle outside diameter and the shell inside diameter.

4.2.4.3.7.4 bundle_to_shell_clearance

A bundle_to_shell_clearance specifies the diametric distance between the outer tube limit and shell inside diameter.

4.2.4.3.7.5 bundle_weight

A bundle_weight specifies the weight of the heat exchanger bundle.

4.2.4.3.7.6 effective_area_in_ubends

An effective_area_in_ubends specifies the effective heat transfer surface area in the u-bends used for heat transfer.

4.2.4.3.7.7 floating_head_support_type

A floating_head_support_type specifies an enumerated attribute for the type of floating head support for the bundle of a heat exchanger with an S or T-type rear head. The value of the floating_head_support_-type attribute shall be one of the following:

— full_support_plate;

— none;

— support_with_opening;

— two_supports_with_vertical_cut_windows;

— unspecified.

4.2.4.3.7.7.1 full_support_plate**:** an indication that the floating head support is a full plate.

4.2.4.3.7.7.2 none**:** an indication that there is no floating head support.

4.2.4.3.7.7.3 support_with_opening**:** an indication that the support plates have a section cut from the support baffle.

4.2.4.3.7.7.4 two_supports_with_vertical_cut_windows**:** an indication that the support plates are constructed from two vertical-cut baffles with windows.

4.2.4.3.7.7.5 unspecified**:** an indication that the type of floating head support is not specified.

4.2.4.3.7.8 kettle_tuberows_removed_at_bottom

A kettle_tuberows_removed_at_bottom specifies the number of tube rows removed at the bottom of a full tube layout bundle in a kettle.

4.2.4.3.7.9 kettle_tuberows_removed_at_top

A kettle_tuberows_removed_at_top specifies the number of tube rows removed at the top of a full tube layout bundle in a kettle.

4.2.4.3.7.10 nominal_baffle_spacing

A nominal_baffle_spacing specifies the distance from the centre of one baffle to the centre of the next baffle.

4.2.4.3.7.11 number_inlet_intermediate_supports

A number_inlet_intermediate_supports specifies the number of intermediate supports for the bundle located between the tubesheet and the first baffle at the shell side inlet of the heat exchanger.

4.2.4.3.7.12 number_midspace_intermediate_supports

A number_midspace_intermediate_supports specifies the number of intermediate supports for the bundle between baffles of the heat exchanger.

4.2.4.3.7.13 number_of_cross_baffles

A number_of_cross_baffles specifies the number of Cross_baffles (see 4.2.4.3.2) in the heat exchanger.

4.2.4.3.7.14 number_of_seal_strip_pairs

A number_of_seal_strip_pairs specifies the number of seal strip pairs in the heat exchanger. A pair consists of two sealing strips, one on each side of the bundle.

4.2.4.3.7.15 number_of_tube_passes_shell

A number_of_tube_passes_shell specifies the number of times the tube side flow travels the length of the exchanger for a single shell and tube heat exchanger.

4.2.4.3.7.16 number_of_tubes_in_window

A number_of_tubes_in_window specifies the number of tubes in the baffle window of the heat exchanger.

NOTE - The baffle window is the open area of a single segmented baffle.

4.2.4.3.7.17 number_outlet_intermediate_supports

A number_outlet_intermediate_supports specifies the number of intermediate supports for the bundle located between the tubesheet and the last baffle at the shell side outlet of the heat exchanger.

4.2.4.3.7.18 outer_tube_limit

An outer_tube_limit specifies the diameter of a circle beyond which no tubes can be placed in the tubesheet.

4.2.4.3.7.19 percent_baffle_overlap

A percent_baffle_overlap specifies the percent of adjacent baffle overlap based on the shell inside diameter.

4.2.4.3.7.20 total_number_of_tubes

A total_number_of_tubes specifies the total number of tubes in the heat exchanger. For U-tube bundles, the total number of tubes would be the number of tube holes in the tubesheet.

4.2.4.3.7.21 tube_to_baffle_clearance

A tube_to_baffle_clearance specifies the diametric distance between the hole in the baffle for the tube and the tube outside diameter.

4.2.4.3.7.22 tubes_in_windows

A tubes_in_windows specifies whether tubes in the baffle window (open area) of a baffle for a heat exchanger are present, not present, or are not specified.

4.2.4.3.8 Exchanger_design_criteria

An Exchanger_design_criteria is the design criteria for the heat exchanger.

The data associated with Exchanger_design_criteria are the following:

— code_requirement;

— condensation_option;

— condensing_correlation;

— dimensional_standard;

— dry_wall_desuperheating;

— fraction_entrainment;

— hot_fluid_allocation;

— material_standard;

— maximum_heat_flux;

— maximum_shells_in_parallel;

— maximum_shells_in_series;

— minimum_excess_surface;

— minimum_lmtd_correction_factor;

— minimum_shells_in_parallel;

— minimum_shells_in_series;

— minimum_temperature_approach;

— mode_of_operation;

— nucleate_boiling;

— service_class;

— tema_class;

— vapourization_option.

4.2.4.3.8.1 code_requirement

A code_requirement specifies an enumerated attribute giving the code requirement of a heat exchanger design as AD Merkblätter (German), ASME (American Society of Mechanical Engineers), CODAP (Comprehensive Occupational Data Analysis Programs), other, or unspecified.

4.2.4.3.8.2 condensation_option

A condensation_option specifies an enumerated attribute indicating the type of condensation option as normal, knockback reflux, or unspecified.

4.2.4.3.8.3 condensing_correlation

A condensing_correlation specifies an enumerated attribute giving the type of condensing correlation as a mass transfer film model, modified proration model, or not specified.

4.2.4.3.8.4 dimensional_standard

A dimensional_standard specifies an enumerated attribute giving the type of dimensional standards as ANSI (American National Standards Institute), DIN (German Institute for Standardization), ISO, other, or unspecified.

4.2.4.3.8.5 dry_wall_desuperheating

A dry_wall_desuperheating specifies an indication of whether dry wall desuperheating is present, not present, or not specified.

4.2.4.3.8.6 fraction_entrainment

A fraction_entrainment specifies the weight fraction of entrained liquid allowed.

4.2.4.3.8.7 hot_fluid_allocation

A hot_fluid_allocation specifies an enumerated attribute that indicates the location of hot fluid. The value of the hot_fluid_allocation attribute shall be one of the following:

— shell;

— tube;

— unspecified.

4.2.4.3.8.7.1 shell**:** an indication that the hot fluid is in the shell side of the heat exchanger.

4.2.4.3.8.7.2 tube**:** an indication that the hot fluid is in the tube side of the heat exchanger.

4.2.4.3.8.7.3 unspecified**:** an indication that the hot fluid location is not specified.

4.2.4.3.8.8 material_standard

A material_standard specifies an enumerated attribute giving the type of material standards as AFNOR (French Association of Standardization), ASTM, DIN, other, or unspecified.

4.2.4.3.8.9 maximum_heat_flux

A maximum_heat_flux specifies the allowed maximum heat flux in the associated heat exchanger design.

4.2.4.3.8.10 maximum_shells_in_parallel

A maximum_shells_in_parallel specifies the maximum shells in parallel in the heat exchanger design.

4.2.4.3.8.11 maximum_shells_in_series

A maximum_shells_in_series specifies the maximum shells in series in the heat exchanger design.

4.2.4.3.8.12 minimum_excess_surface

A minimum_excess_surface specifies the minimum excess surface area allowed in the associated heat exchanger design.

4.2.4.3.8.13 minimum_lmtd_correction_factor

A minimum_lmtd_correction_factor specifies the minimum log mean temperature difference (LMTD) correction factor allowed in the associated heat exchanger design.

4.2.4.3.8.14 minimum_shells_in_parallel

A minimum_shells_in_parallel specifies the minimum shells in parallel in the heat exchanger design.

4.2.4.3.8.15 minimum_shells_in_series

A minimum_shells_in_series specifies the minimum shells in series in the heat exchanger design.

4.2.4.3.8.16 minimum_temperature_approach

A minimum_temperature_approach specifies the minimum temperature approach allowed in the associated heat exchanger design.

4.2.4.3.8.17 mode_of_operation

A mode_of_operation specifies an enumerated attribute indicating the mode of operation as design, rating, simulation, or unspecified.

4.2.4.3.8.18 nucleate_boiling

A nucleate_boiling specifies an indication of whether nucleate boiling is present, not present, or not specified.

4.2.4.3.8.19 service_class

A service_class specifies an enumerated attribute giving the type of service class as lethal, low temperature, normal, or unspecified.

4.2.4.3.8.20 tema_class

A tema_class specifies an enumerated attribute indicating the classification assigned to a particular type of heat exchangers by the Tubular Exchanger Manufacturer's Association (TEMA). The value of the tema_class attribute shall be one of the following:

— B;

— C;

— code_only;

— R;

— unspecified.

4.2.4.3.8.20.1 B**:** an indication that the heat exchanger is designed for chemical service.

4.2.4.3.8.20.2 C**:** an indication that the heat exchanger is designed for general service.

4.2.4.3.8.20.3 code_only**:** an indication that the heat exchanger is designed to a private code standard.

4.2.4.3.8.20.4 R**:** an indication that the heat exchanger is designed for refinery service.

4.2.4.3.8.20.5 unspecified**:** an indication that the heat exchanger service design is not specified.

4.2.4.3.8.21 vapourization_option

A vapourization_option specifies an enumerated attribute indicating the type of vapourization option as falling film, forced circulation, pool boiling, thermosiphon, or unspecified.

4.2.4.3.9 Exchanger_end

An Exchanger_end is the head and cover for one end of a heat exchanger.

The data associated with Exchanger_end are the following:

— body_flange_type;

— head_cover_inside_diameter;

— head_cover_outside_diameter;

— head_cover_thickness;

— head_cover_type;

— head_cylinder_inside_diameter;

— head_cylinder_outside_diameter;

— head_cylinder_thickness;

— head_type;

— location.

4.2.4.3.9.1 body_flange_type

A body_flange_type specifies an enumerated attribute giving the type of body flange on the heat exchanger end as integral straight hub, integral tapered hub, lap joint, none, ring, or unspecified.

4.2.4.3.9.2 head_cover_inside_diameter

A head_cover_inside_diameter specifies the inside diameter of the head cover.

4.2.4.3.9.3 head_cover_outside_diameter

A head_cover_outside_diameter specifies the outside diameter of the head cover.

4.2.4.3.9.4 head_cover_thickness

A head_cover_thickness specifies the thickness of the head cover.

4.2.4.3.9.5 head_cover_type

A head_cover_type specifies an enumerated attribute giving the type of head cover on the heat exchanger end as cone, dished, elbow, ellipsoidal, flat bolted, flat welded, hemispherical, torispherical, or unspecified.

4.2.4.3.9.6 head_cylinder_inside_diameter

A head_cylinder_inside_diameter specifies the inside diameter of the head cylinder.

4.2.4.3.9.7 head_cylinder_outside_diameter

A head_cylinder_outside_diameter specifies the outside diameter of the head cylinder.

4.2.4.3.9.8 head_cylinder_thickness

A head_cylinder_thickness specifies the thickness of the head cylinder.

4.2.4.3.9.9 head_type

A head_type specifies an enumerated attribute giving the type of head on the end of the heat exchanger. The value of the head_type attribute shall be one of the following:

— A;

— B;

— C;

— D;

— L;

— M;

— N;

— P;

— R;

— S;

— T;

— U;

— unspecified;

— W.

4.2.4.3.9.9.1 A**:** an indication that the head_type is a channel and removable cover.

4.2.4.3.9.9.2 B**:** an indication that the head_type is a bonnet bolted or integral with the tubesheet.

4.2.4.3.9.9.3 C**:** an indication that the head_type is a channel integral with the tubesheet and removable bundle.

4.2.4.3.9.9.4 D**:** an indication that the head_type is a high pressure enclosure.

4.2.4.3.9.9.5 L**:** an indication that the head_type is a fixed tubesheet with a removable channel and flat cover.

4.2.4.3.9.9.6 M**:** an indication that the head_type is a fixed tubesheet with a removable or integral bonnet.

4.2.4.3.9.9.7 N**:** an indication that the head_type is a channel integral with a tubesheet and non-removable bundle.

4.2.4.3.9.9.8 P**:** an indication that the head_type is an outside packed floating head.

4.2.4.3.9.9.9 R**:** an indication that the head_type is a fixed tubesheet with an integral channel and removable flat cover.

4.2.4.3.9.9.10 S**:** an indication that the head_type is a floating head with a backing device.

4.2.4.3.9.9.11 T**:** an indication that the head_type is a pull-through floating head.

4.2.4.3.9.9.12 U**:** an indication that the head_type is a U-tube bundle.

4.2.4.3.9.9.13 unspecified**:** an indication that the head_type is not specified.

4.2.4.3.9.9.14 W**:** an indication that the head_type is an externally sealed floating tubesheet.

4.2.4.3.9.10 location

A location specifies an enumerated attribute giving the location of the heat exchanger end as the front of heat exchanger, rear of heat exchanger, or unspecified.

4.2.4.3.10 Exchanger_nozzle

An Exchanger_nozzle is a physical opening for fluid to enter or exit the heat exchanger.

The data associated with Exchanger_nozzle are the following:

— angle;

— axial_location;

— distance_from_tubesheet;

— distribution_type;

— entrance_type;

— exchanger_side;

— flange_design;

— flange_facing;

— flange_rating;

— flange_type;

— function;

— height_under_nozzle;

— inside_diameter;

— nominal_diameter;

— outside_diameter.

4.2.4.3.10.1 angle

An angle specifies the orientation angle of the nozzle in clockwise.

4.2.4.3.10.2 axial_location

An axial_location specifies the axial location for the nozzle along the length of the heat exchanger.

4.2.4.3.10.3 distance_from_tubesheet

A distance_from_tubesheet specifies the distance from the centreline of the nozzle to the front face of the front tubesheet.

4.2.4.3.10.4 distribution_type

A distribution_type specifies an enumerated attribute giving the distribution type of each nozzle in a heat exchanger as distributor, impingement, none, plain, sparge, or unspecified.

4.2.4.3.10.5 entrance_type

An entrance_type specifies an enumerated attribute giving the type of entrance of each nozzle as axial, elbow, radial, tangential, or unspecified.

4.2.4.3.10.6 exchanger_side

An exchanger_side specifies an enumerated attribute giving the heat exchanger side of each nozzle as shell, tube, or unspecified.

4.2.4.3.10.7 flange_design

A flange_design specifies an enumerated attribute that indicates the type of flange design for each Exchanger_nozzle as either ANSI, DIN, ISO, optimized design, or unspecified.

4.2.4.3.10.8 flange_facing

A flange_facing specifies an enumerated attribute giving the type of flange facing for each nozzle as flat face, raised face, tongue and groove, or unspecified.

4.2.4.3.10.9 flange_rating

A flange_rating specifies the nozzle flange rating.

4.2.4.3.10.10 flange_type

A flange_type specifies an enumerated attribute giving the type of flange for each nozzle as lap weld, long weld neck, self-reinforce neck, slip-on, unspecified, or weld neck.

4.2.4.3.10.11 function

A function specifies an enumerated attribute giving the function of each nozzle as drain (no flow), inlet, inspection port, liquid inlet, manhole, outlet, safety valve, sparge, unspecified, vapour outlet, or vent (no flow).

4.2.4.3.10.12 height_under_nozzle

A height_under_nozzle specifies the distance between the shell inside diameters and the edge of the first tube row beneath the nozzle.

4.2.4.3.10.13 inside_diameter

An inside_diameter specifies the inside diameter of the nozzle.

4.2.4.3.10.14 nominal_diameter

A nominal_diameter specifies the nominal diameter of the nozzle.

4.2.4.3.10.15 outside_diameter

An outside_diameter specifies the outside diameter of the nozzle.

4.2.4.3.11 Exchanger_performance

An Exchanger_performance is the overall thermal performance of the heat exchanger.

The data associated with Exchanger_performance are the following:

— effective_area;

— effective_temperature_difference;

— heat_duty;

— lmtd_correction_factor;

— overall_heat_transfer_coefficient;

— total_area.

4.2.4.3.11.1 effective_area

An effective_area specifies the effective surface area of the heat exchanger.

4.2.4.3.11.2 effective_temperature_difference

An effective_temperature_difference specifies the effective temperature difference of the heat exchanger.

4.2.4.3.11.3 heat_duty

A heat_duty specifies the total duty (see 3.3) of the heat exchanger.

4.2.4.3.11.4 lmtd_correction_factor

A lmtd_correction_factor specifies the correction factor for the log mean temperature difference of the heat exchanger.

4.2.4.3.11.5 overall_heat_transfer_coefficient

An overall_heat_transfer_coefficient specifies the overall rate at which heat is transferred from the hot fluid on one side of the heat exchanger to the cold fluid on the other side.

4.2.4.3.11.6 total_area

A total_area specifies the total surface area of the heat exchanger.

4.2.4.3.12 Exchanger_shell

An Exchanger_shell is the shell of a shell-and-tube heat exchanger.

The data associated with Exchanger_shell are the following:

— body_flange_type;

— entrance_construction;

— exit_construction;

— inside_diameter;

— kettle_inside_diameter;

— kettle_outside_diameter;

— kettle_thickness;

— kettle_type;

— number_shell_passes;

— outside_diameter;

— shell_cover_type;

— tema_shell_type;

— thickness.

4.2.4.3.12.1 body_flange_type

A body_flange_type specifies an enumerated attribute giving the type of body flange on the shell. The value of the body_flange_type attribute shall be one of the following:

— integral_straight_hub;

— integral_tapered_hub;

— lap_joint;

— none;

— ring.

4.2.4.3.12.1.1 integral_straight_hub**:** an indication that the body_flange_type is a flange with a straight hub that is butt-welded to a cylinder or head.

4.2.4.3.12.1.2 integral_tapered_hub**:** an indication that the body_flange_type is a flange with a sloping hub that is butt-welded to a cylinder or head.

4.2.4.3.12.1.3 lap_joint**:** an indication that the body_flange_type is a loose flange normally made of carbon steel that is placed behind a lap joint ring made of alloy material that is integral with the cylinder.

4.2.4.3.12.1.4 none**:** an indication that there is no shell side body flange.

4.2.4.3.12.1.5 ring**:** an indication that the body_flange_type is a ring flange that is welded to a cylinder or head.

4.2.4.3.12.2 entrance_construction

An entrance_construction specifies the construction layout at the entrance of the shell as Distributor_belt (see 4.2.4.3.4) with full tube layout, full tube layout, nozzle dome with full tube layout, remove enough tubes to meet TEMA requirement of maximum fluid density times fluid velocity squared, remove tubes

so that the entrance area equals the inlet nozzle area, remove tubes within the nozzle projection, unspecified, or user defined.

4.2.4.3.12.3 exit_construction

An exit_construction specifies the construction layout at the exit of the shell as Distributor_belt (see 4.2.4.3.4) with full tube layout, full tube layout, nozzle dome with full tube layout, remove enough tubes to meet TEMA requirement of maximum fluid density times fluid velocity squared, remove tubes so that the exit area equals the outlet nozzle area, remove tubes within the nozzle projection, unspecified, or user defined.

4.2.4.3.12.4 inside_diameter

An inside_diameter specifies the inside diameter of the shell of the heat exchanger.

4.2.4.3.12.5 kettle_inside_diameter

A kettle_inside_diameter specifies the inside diameter of the kettle cylinder.

4.2.4.3.12.6 kettle_outside_diameter

A kettle_outside_diameter specifies the outside diameter of the kettle cylinder.

4.2.4.3.12.7 kettle_thickness

A kettle_thickness specifies the thickness of the kettle cylinder.

4.2.4.3.12.8 kettle_type

A kettle_type specifies an enumerated attribute that indicates the type of kettle shell as an enlarged shell with eccentric reducer(s), an enlarged shell with formed head(s), or unspecified.

4.2.4.3.12.9 number_shell_passes

A number_shell_passes specifies the number of times the shell side flow travels all or part of the shell in the longitudinal direction.

NOTE - The G-type shell has 2 passes; the H-type shell has 4 passes.

4.2.4.3.12.10 outside_diameter

An outside_diameter specifies the outside diameter of the shell of the heat exchanger.

4.2.4.3.12.11 shell_cover_type

A shell_cover_type specifies an enumerated attribute that gives the type of cover attached to the rear of the shell when there is no rear tubesheet or when the rear tubesheet does not provide containment of the shell side fluid as ellipsoidal, flat bolted, flat welded, torispherical, or unspecified.

4.2.4.3.12.12 tema_shell_type

A tema_shell_type specifies the designation given to a shell configuration according to TEMA (with additions). The value of the tema_shell_type attribute shall be one of the following:

— E;

— F;

— G;

— H;

— I;

— J;

— K;

— none;

— unspecified;

— V;

— X.

4.2.4.3.12.12.1 E**:** an indication that the tema_shell_type is a one shell pass (see item 2 in figure 8).

4.2.4.3.12.12.2 F**:** an indication that the tema_shell_type is a two passes with long baffle (see item 3 in figure 8).

4.2.4.3.12.12.3 G**:** an indication that the tema_shell_type is a split flow (see item 4 in figure 8).

4.2.4.3.12.12.4 H**:** an indication that the tema_shell_type is a double split flow (see item 5 in figure 8).

4.2.4.3.12.12.5 I**:** an indication that the tema_shell_type is a combining divided flow (see item 6 in figure 8).

4.2.4.3.12.12.6 J**:** an indication that the tema_shell_type is a dividing divided flow (see item 7 in figure 8).

4.2.4.3.12.12.7 K**:** an indication that the tema_shell_type is a kettle (see item 8 in figure 8).

4.2.4.3.12.12.8 none**:** an indication that there is no tema_shell_type.

4.2.4.3.12.12.9 unspecified**:** an indication that the tema_shell_type is not specified.

4.2.4.3.12.12.10 V**:** an indication that the tema_shell_type is a vapour belt (see item 10 in figure 8).

4.2.4.3.12.12.11 X**:** an indication that the tema_shell_type is a cross flow (see item 9 in figure 8).

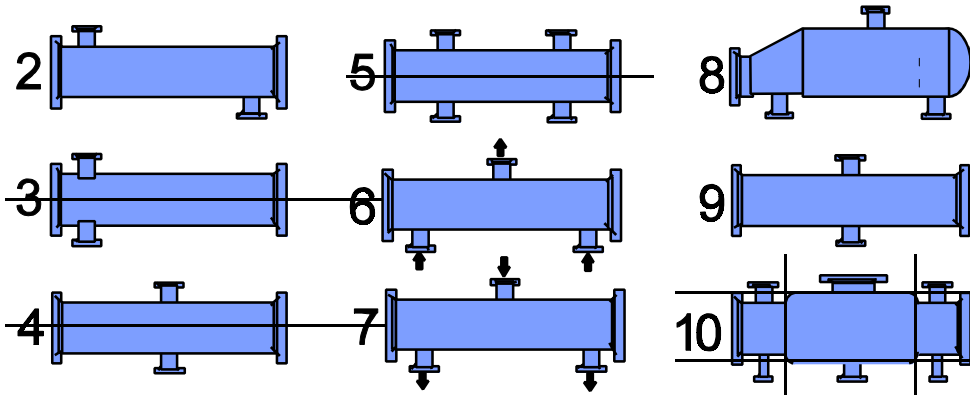


Figure 8 - TEMA shell type

4.2.4.3.12.13 thickness

A thickness specifies the thickness of the shell of the heat exchanger.

4.2.4.3.13 Exchanger_zone

An Exchanger_zone is an arbitrary section of a heat exchanger. Zones may be associated either with the shell side or the tube side of the heat exchanger.

The data associated with Exchanger_zone are the following:

— cold_bulk_film_coefficient;

— cold_bulk_temperature;

— cold_clean_pressure_drop;

— cold_controlling_regime;

— cold_dirty_pressure_drop;

— cold_effective_vapour_coefficient;

— cold_flow_regime_parameter;

— cold_liquid_prandtl_number;

— cold_liquid_reynolds_number;

— cold_pressure;

— cold_sensible_liquid_coefficient;

— cold_sensible_vapour_coefficient;

— cold_vapour_phase_resistance;

— cold_vapour_prandtl_number;

— cold_vapour_reynolds_number;

— cold_vapour_weight_fraction;

— cold_wall_temperature;

— condensate_film_coefficient;

— convective_boiling_coefficient;

— description;

— effective_area;

— film_boiling_coefficient;

— heat_duty;

— hot_bulk_film_coefficient;

— hot_bulk_temperature;

— hot_clean_pressure_drop;

— hot_controlling_regime;

— hot_dirty_pressure_drop;

— hot_effective_vapour_coefficient;

— hot_flow_regime_parameter;

— hot_liquid_prandtl_number;

— hot_liquid_reynolds_number;

— hot_pressure;

— hot_sensible_liquid_coefficient;

— hot_sensible_vapour_coefficient;

— hot_vapour_phase_resistance;

— hot_vapour_prandtl_number;

— hot_vapour_reynolds_number;

— hot_vapour_weight_fraction;

— hot_wall_temperature;

— local_heat_flux;

— local_overall_heat_transfer_coefficient;

— mean_temperature_difference;

— nucleate_boiling_coefficient;

— shellside_flow_fraction_a;

— shellside_flow_fraction_b;

— shellside_flow_fraction_c;

— shellside_flow_fraction_e;

— shellside_window_velocity;

— shellside_crossflow_velocity;

— tubeside_velocity;

— x_coordinate;

— y_coordinate;

— z_coordinate.

4.2.4.3.13.1 cold_bulk_film_coefficient

A cold_bulk_film_coefficient specifies the Heat_transfer_coefficient (see 4.2.3.2.4) of the bulk fluid in the cold side of the Exchanger_zone.

4.2.4.3.13.2 cold_bulk_temperature

A cold_bulk_temperature specifies the temperature of the cold side bulk fluid on the cold side in the Exchanger_zone.

4.2.4.3.13.3 cold_clean_pressure_drop

A cold_clean_pressure_drop specifies the pressure drop in the cold side of the Exchanger_zone when it is clean.

4.2.4.3.13.4 cold_controlling_regime

A cold_controlling_regime specifies the flow regime category for a given Exchanger_zone.

4.2.4.3.13.5 cold_dirty_pressure_drop

A cold_dirty_pressure_drop specifies the pressure drop in the cold side of the Exchanger_zone when it is dirty.

4.2.4.3.13.6 cold_effective_vapour_coefficient

A cold_effective_vapour_coefficient specifies the effective vapour coefficient on the cold side of the associated Exchanger_zone.

4.2.4.3.13.7 cold_flow_regime_parameter

A cold_flow_regime_parameter specifies a parameter associated with the flow regime in the cold Exchanger_zone.

4.2.4.3.13.8 cold_liquid_prandtl_number

A cold_liquid_prandtl_number specifies the Prandtl number for the cold Exchanger_zone. The Prandtl number is the ratio of the kinematic viscosity of the fluid to its thermal diffusivity.

4.2.4.3.13.9 cold_liquid_reynolds_number

A cold_liquid_reynolds_number specifies the Reynolds number for the cold Exchanger_zone. The Reynolds number is any number of dimensionless quantities that are proportional to the ratio of the inertial force to viscous force in a flow system.

4.2.4.3.13.10 cold_pressure

A cold_pressure specifies the pressure in the cold side of the Exchanger_zone.

4.2.4.3.13.11 cold_sensible_liquid_coefficient

A cold_sensible_liquid_coefficient specifies the sensible liquid coefficient in the cold side of the Exchanger_zone.

4.2.4.3.13.12 cold_sensible_vapour_coefficient

A cold_sensible_vapour_coefficient specifies the sensible vapour coefficient in the cold side of the Exchanger_zone.

4.2.4.3.13.13 cold_vapour_phase_resistance

A cold_vapour_phase_resistance specifies the vapour phase resistance on the cold side of the associated Exchanger_zone.

4.2.4.3.13.14 cold_vapour_prandtl_number

A cold_vapour_prandtl_number specifies the Prandtl number of the vapour on the cold side in the Exchanger_zone.

4.2.4.3.13.15 cold_vapour_reynolds_number

A cold_vapour_reynolds_number specifies the Reynolds number of the vapour on the cold side in the Exchanger_zone.

4.2.4.3.13.16 cold_vapour_weight_fraction

A cold_vapour_weight_fraction specifies the vapour weight fraction in the cold side of the Exchanger_-zone.

4.2.4.3.13.17 cold_wall_temperature

A cold_wall_temperature specifies the temperature on the cold side in the Exchanger_zone.

4.2.4.3.13.18 condensate_film_coefficient

A condensate_film_coefficient specifies the Heat_transfer_coefficient (see 4.2.3.2.4) for the condensate films in the associated Exchanger_zone.

4.2.4.3.13.19 convective_boiling_coefficient

A convective_boiling_coefficient specifies the convective boiling coefficient in the associated heat Exchanger_zone.

4.2.4.3.13.20 description

A description specifies a textual explanation or summary of the Exchanger_zone.

4.2.4.3.13.21 effective_area

An effective_area specifies the effective area of the associated Exchanger_zone.

4.2.4.3.13.22 film_boiling_coefficient

A film_boiling_coefficient specifies the film boiling coefficient in the associated heat Exchanger_zone.

4.2.4.3.13.23 heat_duty

A heat_duty specifies the duty (see 3.3) associated with the Exchanger_zone.

4.2.4.3.13.24 hot_bulk_film_coefficient

A hot_bulk_film_coefficient specifies the film coefficient of the bulk fluid on the hot side in the Exchanger_zone.

4.2.4.3.13.25 hot_bulk_temperature

A hot_bulk_temperature specifies the temperature of the hot side bulk fluid in the hot side of the Exchanger_zone.

4.2.4.3.13.26 hot_clean_pressure_drop

A hot_clean_pressure_drop specifies the pressure drop on the hot side in the Exchanger_zone when it is clean.

4.2.4.3.13.27 hot_controlling_regime

A hot_controlling_regime specifies the flow regime category for a given Exchanger_zone.

4.2.4.3.13.28 hot_dirty_pressure_drop

A hot_dirty_pressure_drop specifies the pressure drop on the hot side in the Exchanger_zone when it is dirty.

4.2.4.3.13.29 hot_effective_vapour_coefficient

A hot_effective_vapour_coefficient specifies the effective vapour coefficient on the hot side of the associated Exchanger_zone.

4.2.4.3.13.30 hot_flow_regime_parameter

A hot_flow_regime_parameter specifies a parameter associated with the flow regime in the hot Exchanger_zone.

4.2.4.3.13.31 hot_liquid_prandtl_number

A hot_liquid_prandtl_number specifies the Prandtl number of the liquid on the hot side in the Exchanger_zone. The Prandtl number is the ratio of the kinematic viscosity of the fluid to its thermal diffusivity.

4.2.4.3.13.32 hot_liquid_reynolds_number

A hot_liquid_reynolds_number specifies the Reynolds number of the liquid on the hot side in the Exchanger_zone. The Reynolds number is any number of dimensionless quantities that are proportional to the ratio of the inertial force to viscous force in a flow system.

4.2.4.3.13.33 hot_pressure

A hot_pressure specifies the pressure on the hot side in the Exchanger_zone.

4.2.4.3.13.34 hot_sensible_liquid_coefficient

A hot_sensible_liquid_coefficient specifies the sensible liquid coefficient on the hot side in the Exchanger_zone.

4.2.4.3.13.35 hot_sensible_vapour_coefficient

A hot_sensible_vapour_coefficient specifies the sensible vapour coefficient on the hot side in the Exchanger_zone.

4.2.4.3.13.36 hot_vapour_phase_resistance

A hot_vapour_phase_resistance specifies the vapour phase resistance for the hot side of the associated Exchanger_zone.

4.2.4.3.13.37 hot_vapour_prandtl_number

A hot_vapour_prandtl_number specifies the Prandtl number of the vapour on the hot side in the Exchanger_zone.

4.2.4.3.13.38 hot_vapour_reynolds_number

A hot_vapour_reynolds_number specifies the Reynolds number of the vapour on the hot side in the Exchanger_zone.

4.2.4.3.13.39 hot_vapour_weight_fraction

A hot_vapour_weight_fraction specifies the vapour weight fraction on the hot side in the Exchanger_-zone.

4.2.4.3.13.40 hot_wall_temperature

A hot_wall_temperature specifies the tube wall temperature on the hot side in the Exchanger_zone.

4.2.4.3.13.41 local_heat_flux

A local_heat_flux specifies the local heat flux in the associated Exchanger_zone.

4.2.4.3.13.42 local_overall_heat_transfer_coefficient

A local_overall_heat_transfer_coefficient specifies the overall Heat_transfer_coefficient (see 4.2.3.2.4) in the associated Exchanger_zone.

4.2.4.3.13.43 mean_temperature_difference

A mean_temperature_difference specifies the mean temperature difference across the associated Exchanger_zone.

4.2.4.3.13.44 nucleate_boiling_coefficient

A nucleate_boiling_coefficient specifies the nucleate boiling coefficient in the associated heat Exchanger_zone.

4.2.4.3.13.45 shellside_flow_fraction_a

A shellside_flow_fraction_a specifies the fractional flow through clearance between the baffle hole and tube outside diameter.

4.2.4.3.13.46 shellside_flow_fraction_b

A shellside_flow_fraction_b specifies the fractional flow across the bundle.

4.2.4.3.13.47 shellside_flow_fraction_c

A shellside_flow_fraction_c specifies the fractional flow through clearance between the shell inside diameter and bundle outer tube limit.

4.2.4.3.13.48 shellside_flow_fraction_e

A shellside_flow_fraction_e specifies the fraction flow through clearance between the shell inside diameter and baffle outside diameter.

4.2.4.3.13.49 shellside_window_velocity

A shellside_window_velocity specifies the velocity through the baffle window on shell side in the Exchanger_zone.

4.2.4.3.13.50 shellside_crossflow_velocity

A shellside_crossflow_velocity specifies the velocity of shell side crossflow in an Exchanger_zone.

4.2.4.3.13.51 tubeside_velocity

A tubeside_velocity specifies the velocity of tubeside flow in an Exchanger_zone.

4.2.4.3.13.52 x_coordinate

A x_coordinate specifies the x direction coordinate of a central point within a physical Exchanger_zone measured off the vertical centreline of the front tubesheet.

4.2.4.3.13.53 y_coordinate

A y_coordinate specifies the y direction coordinate of a central point within a physical Exchanger_zone measured off the horizontal centreline of the front tubesheet.

4.2.4.3.13.54 z_coordinate

A z_coordinate specifies the z direction coordinate of a central point within a physical Exchanger_zone measured from the outer face of the front tubesheet.

4.2.4.3.14 Expansion_joint

An Expansion_joint is a cylindrical device located in the shell cylinder for fixed tubesheet exchangers. It is designed to relieve the stress caused by the difference in expansion or contraction of the tube and shell materials due to temperature or pressure.

The data associated with Expansion_joint are the following:

— diameter;

— length;

— location;

— type.

4.2.4.3.14.1 diameter

A diameter specifies the outside diameter of the Expansion_joint.

4.2.4.3.14.2 length

A length specifies the length of the Expansion_joint parallel to the axis of the shell.

4.2.4.3.14.3 location

A location specifies the axial location of an Expansion_joint from the face of the front tubesheet to the centreline of the Expansion_joint.

4.2.4.3.14.4 type

A type specifies enumerated attribute that gives the type of Expansion_joint as flanged and flued, flanged only, none, reinforced bellows, unreinforced bellows, or unspecified.

4.2.4.3.15 External_circuit_component

An External_circuit_component is all inlet and outlet piping pertaining to a thermosiphon reboiler system.

The data associated with External_circuit_component are the following:

— bend_angle;

— bend_radius;

— circuit_location;

— circuit_position;

— component_code;

— component_height;

— component_inside_diameter;

— component_length;

— contraction_coefficient;

— extra_equivalent_length;

— head_flowrate;

— head_gained;

— orifice_downstream_diameter;

— piping_design_area_ratio;

— surface_roughness.

4.2.4.3.15.1 bend_angle

A bend_angle specifies the angle of the piping bend.

4.2.4.3.15.2 bend_radius

A bend_radius specifies the radius of the piping bend.

4.2.4.3.15.3 circuit_location

A circuit_location specifies an enumerated attribute identifying the circuit as inlet or outlet piping or unspecified.

4.2.4.3.15.4 circuit_position

A circuit_position specifies the order of the component within the external circuit.

4.2.4.3.15.5 component_code

A component_code specifies an enumerated attribute identifying the type of component as straight pipe (i.e main pipe), bend, sudden enlargement, sudden contraction, globe valve, gate valve, thin orifice, thick orifice, dummy fitting, header pipe, nozzle pipe, tee (flow is assumed to divide evenly between the branches of the tee), Inside face of the bottom tubesheet (for vertical units), Inside face of the top tubesheet (for vertical units), Bottom inside surface of the shell (for horizontal units), or Top inside surface of the shell (for horizontal units).

4.2.4.3.15.6 component_height

A component_height specifies the height of the component above the reference level (of inlet to component for inlet circuit, outlet of component for outlet circuit).

4.2.4.3.15.7 component_inside_diameter

A component_inside_diameter specifies the inside diameter of the component.

4.2.4.3.15.8 component_length

A component_length specifies the longitudinal length of the component.

4.2.4.3.15.9 contraction_coefficient

A contraction_coefficient specifies the Cd value to be used in the pressure loss calculation for the component.

4.2.4.3.15.10 extra_equivalent_length

An extra_equivalent_length specifies the extra equivalent piping length specified as a number of diameters.

NOTE - This allows for additional pressure losses, such as from partly open valves.

4.2.4.3.15.11 head_flowrate

A head_flowrate specifies the flowrate.

4.2.4.3.15.12 head_gained

A head_gained specifies the head gained at the given flowrate.

4.2.4.3.15.13 orifice_downstream_diameter

An orifice_downstream_diameter specifies the diameter downstream for the orifice.

4.2.4.3.15.14 piping_design_area_ratio

A piping_design_area_ratio is different for tube and shell side thermosiphons. For tube side thermosiphons, it is the ratio of the main pipe flow area divided by the total tube flow area. For shell side thermosiphons, it is the ratio of the main pipe diameter divided by the bundle diameter.

4.2.4.3.15.15 surface_roughness

A surface_roughness specifies the surface roughness factor for the component.

4.2.4.3.16 Flow_vibration_analysis

A Flow_vibration_analysis specifies an analysis done to determine the vibration tendency in the heat exchanger.

The data associated with Flow_vibration_analysis are the following:

— acoustic_damping_factor;

— acoustic_resonance_indicator;

— acoustic_turbulent_buffeting_ratio;

— acoustic_vortex_shedding_ratio;

— added_mass_factor;

— average_crossflow_velocity;

— axial_stress_loading;

— baffle_tip_cross_velocity;

— bundle_crossflow_velocity;

— bundle_shell_velocity;

— chen_number;

— critical_velocity;

— crossflow_amplitude;

— crossflow_momentum;

— instability_threshold_beta;

— length_for_natural_frequency;

— length_for_tema_maximum_span;

— location;

— log_decrement_for_damping;

— number_of_spans;

— parallel_flow_amplitude;

— shell_acoustic_frequency;

— tube_gap;

— tube_natural_frequency;

— tube_position;

— tube_turbulent_buffeting_ratio;

— tube_vortex_shedding_ratio;

— unsupported_span;

— vibration_indicator;

— window_parallel_velocity.

4.2.4.3.16.1 acoustic_damping_factor

An acoustic_damping_factor specifies the damping factor to adjust the acoustic frequency as a result of the characteristic of vapour or liquid phase.

4.2.4.3.16.2 acoustic_resonance_indicator

An acoustic_resonance_indicator specifies whether acoustic resonance of the heat exchanger is present, not present, or undetermined.

4.2.4.3.16.3 acoustic_turbulent_buffeting_ratio

An acoustic_turbulent_buffeting_ratio specifies the ratio of the shell acoustic frequency divided by the turbulent buffeting frequency.

4.2.4.3.16.4 acoustic_vortex_shedding_ratio

An acoustic_vortex_shedding_ratio specifies the ratio of the acoustic frequency divided by the vortex shedding frequency.

4.2.4.3.16.5 added_mass_factor

An added_mass_factor specifies the mass factor of the tubes. The mass factor is a function of the tube pattern and the ratio of tube pitch divided by the tube diameter.

4.2.4.3.16.6 average_crossflow_velocity

An average_crossflow_velocity specifies the average crossflow velocity in the heat exchanger in the heat exchanger vibration analysis.

4.2.4.3.16.7 axial_stress_loading

An axial_stress_loading specifies the axial forces that are imposed by the thermal expansion of tubes in relation to the shell.

4.2.4.3.16.8 baffle_tip_cross_velocity

A baffle_tip_cross_velocity specifies the local cross flow velocity at the baffle tips.

4.2.4.3.16.9 bundle_crossflow_velocity

A bundle_crossflow_velocity specifies the crossflow velocity through the bundle of a heat exchanger.

4.2.4.3.16.10 bundle_shell_velocity

A bundle_shell_velocity specifies the velocity in the direction parallel to the shell through the bundle.

4.2.4.3.16.11 chen_number

A chen_number specifies a factor indicating the probability of damage of the tubes.

4.2.4.3.16.12 critical_velocity

A critical_velocity specifies the velocity of fluid flow through a given heat exchanger above which fluid elastic coupling becomes unstable.

4.2.4.3.16.13 crossflow_amplitude

A crossflow_amplitude specifies the distance between maximum and minimum vibrations in the direction perpendicular to the fluid flow.

4.2.4.3.16.14 crossflow_momentum

A crossflow_momentum specifies the momentum of the flow in the crossflow direction.

4.2.4.3.16.15 instability_threshold_beta

An instability_threshold_beta specifies the beta factor for the critical velocity calculation.

4.2.4.3.16.16 length_for_natural_frequency

A length_for_natural_frequency specifies the length used to calculate the natural frequency of the tubes.

4.2.4.3.16.17 length_for_tema_maximum_span

A length_for_tema_maximum_span specifies the length of the maximum allowable span per TEMA classification type.

4.2.4.3.16.18 location

A location specifies the distance from the front tubesheet to the actual position where the vibration analysis is calculated.

4.2.4.3.16.19 log_decrement_for_damping

A log_decrement_for_damping specifies the logarithm of the difference in successive amplitude peaks.

4.2.4.3.16.20 number_of_spans

A number_of_spans specifies the number of spans in a heat exchanger.

4.2.4.3.16.21 parallel_flow_amplitude

A parallel_flow_amplitude specifies the distance between maximum and minimum vibrations in the direction parallel to the fluid flow.

4.2.4.3.16.22 shell_acoustic_frequency

A shell_acoustic_frequency specifies the natural frequency of the shell of the heat exchanger.

4.2.4.3.16.23 tube_gap

A tube_gap specifies the gap between the tubes in the bundle.

4.2.4.3.16.24 tube_natural_frequency

A tube_natural_frequency specifies the natural frequency of the tubes.

4.2.4.3.16.25 tube_position

A tube_position specifies an enumerated attribute giving the position of the tube associated with the vibration analysis of a heat exchanger as bottom row, row inside baffle overlap at bottom, row inside baffle overlap at top, top row, row outside baffle overlap, or undetermined.

4.2.4.3.16.26 tube_turbulent_buffeting_ratio

A tube_turbulent_buffeting_ratio specifies the ratio of the natural tube frequency divided by the turbulent buffeting frequency.

4.2.4.3.16.27 tube_vortex_shedding_ratio

A tube_vortex_shedding_ratio specifies the ratio of the natural tube frequency divided by the vortex shedding frequency.

4.2.4.3.16.28 unsupported_span

An unsupported_span specifies the length of the unsupported span.

4.2.4.3.16.29 vibration_indicator

A vibration_indicator specifies whether vibration of the heat exchanger is present, not present, or undetermined.

4.2.4.3.16.30 window_parallel_velocity

A window_parallel_velocity specifies the velocity parallel to the fluid flow in the windows of a heat exchanger.

4.2.4.3.17 Heat_release_curve

A Heat_release_curve specifies a curve representing the performance of the heat release for the Material_stream (see 4.2.3.3.7). The Heat_release_curve shall be associated with at least one of Tubeside_design (see 4.2.4.3.37) or Shellside_design (see 4.2.4.3.29).

The data associated with Heat_release_curve are the following:

— independent_variable;

— isobaric_curve;

— non_condensables;

— number_of_components;

— number_of_liquids;

— phase_change;

— single_component;

— super_critical.

4.2.4.3.17.1 independent_variable

An independent_variable specifies an enumerated attribute that indicates whether the basis for curve construction was equal duty, equal fraction of vapour, equal temperature, or unspecified.

4.2.4.3.17.2 isobaric_curve

An isobaric_curve specifies an enumerated attribute for determining the operating pressure basis for the Heat_release_curve.

> NOTE - The value of the isobaric_curve attribute shall be no, unspecified, or yes. If the value is no, the Heat_release_curve is non-isobaric. The pressure changes with each point on the curve. If the value is yes, the Heat_release_curve is isobaric. The pressure is constant for every point on the curve.

4.2.4.3.17.3 non_condensables

A non_condensables specifies an enumerated attribute that indicates whether non-condensable fluids are present, not present, or unspecified in the Heat_release_curve.

NOTE - If the value of the non_condensables attribute is no, there are no non-condensable fluids included in Heat_release_curve. If the value is yes, there are non-condensable fluids included in Heat_release_curve.

4.2.4.3.17.4 number_of_components

A number_of_components specifies the number of components included in a Heat_release_curve of Material_stream (see 4.2.3.3.7).

4.2.4.3.17.5 number_of_liquids

A number_of_liquids specifies the number of liquids included in a Heat_release_curve of the Material_-stream (see 4.2.3.3.7).

4.2.4.3.17.6 phase_change

A phase_change specifies an enumerated attribute indicating the Phase (see 4.2.2.2.15) of the Material_-stream (see 4.2.3.3.7) as liquid, two-phase, vapour, or unspecified.

4.2.4.3.17.7 single_component

A single_component specifies an enumerated attribute that indicates whether the Heat_release_curve is based on a single component or a Mixture (see 4.2.2.2.12). The value of the single_component attribute shall be one of the following:

— no;

— unspecified;

— yes.

4.2.4.3.17.7.1 no**:** an indication that the Heat_release_curve is based on a Mixture (see 4.2.2.2.12).

4.2.4.3.17.7.2 unspecified**:** an indication that the basis for the Heat_release_curve is not specified.

4.2.4.3.17.7.3 yes**:** an indication that the Heat_release_curve is based on a single component.

4.2.4.3.17.8 super_critical

A super_critical specifies an enumerated attribute that indicates whether the fluid is above the critical temperature. The value for the super_critical attribute shall be one of the following:

— no;

— unspecified;

— yes.

4.2.4.3.17.8.1 no**:** an indication that the fluid is not above the critical temperature.

4.2.4.3.17.8.2 unspecified**:** an indication that it is not specified whether the fluid is above the critical temperature.

4.2.4.3.17.8.3 yes**:** an indication that the fluid is above the critical temperature.

4.2.4.3.18 Heat_release_point

A Heat_release_point specifies the Phase_properties (see 4.2.4.3.26) about each Heat_release_point in the Heat_release_curve (see 4.2.4.3.17).

The data associated with Heat_release_point are the following:

— bubble_point;

— dew_point;

— number_of_phases;

— pressure;

— specific_enthalpy_mass_basis;

— specific_enthalpy_mole_basis;

— temperature;

— vapour_mass_fraction;

— vapour_mole_fraction.

4.2.4.3.18.1 bubble_point

A bubble_point specifies an enumerated attribute indicating if the bubble point is available, not available, or unspecified for the Heat_release_point.

> NOTE - If the value of the bubble_point attribute is no, the bubble point is not available for the Heat_-release_point. If the value is yes, the bubble_point is available for the Heat_release_point.

4.2.4.3.18.2 dew_point

A dew_point specifies an enumerated attribute indicating if the dew point is available, not available, or unspecified for the Heat_release_point.

> NOTE - If the value of the dew_point attribute is not, the dew point is not available for the Heat_release_-point. If the value is yes, the dew point is available for the Heat_release_point.

4.2.4.3.18.3 number_of_phases

A number_of_phases specifies the number of Phases (see 4.2.2.2.15) present in a Heat_release_point.

4.2.4.3.18.4 pressure

A pressure specifies the amount of force per unit area at a certain Heat_release_point that any portion of a Material (see 4.2.2.4.9) exerts on its surroundings at the thermodynamic state.

4.2.4.3.18.5 specific_enthalpy_mass_basis

A specific_enthalpy_mass_basis specifies the enthalpy per unit mass for any given portion of a Material (see 4.2.2.4.9) at the Thermodynamic_conditions (see 4.2.2.4.17).

4.2.4.3.18.6 specific_enthalpy_mole_basis

A specific_enthalpy_mole_basis specifies the enthalpy per mole for any given portion of a Material (see 4.2.2.4.9) at the Thermodynamic_conditions (see 4.2.2.4.17).

4.2.4.3.18.7 temperature

A temperature specifies the temperature of a Material (see 4.2.2.4.9) at a certain Heat_release_point at the thermodynamic state measured in one of the common scales of thermodynamic or thermometric temperature.

4.2.4.3.18.8 vapour_mass_fraction

A vapour_mass_fraction specifies the mass fraction of vapour of a Material (see 4.2.2.4.9) at a certain Heat_release_point.

4.2.4.3.18.9 vapour_mole_fraction

A vapour_mole_fraction specifies the mole fraction of vapour of a Material (see 4.2.2.4.9) at a certain Heat_release_point.

4.2.4.3.19 Heat_transfer_equipment

A Heat_transfer_equipment is a type of Process_equipment (see 4.2.4.2.8) that has as a principle function the transfer of energy in the form of heat from one Material (see 4.2.2.4.9) to another. Each Heat_-transfer_equipment may be one of the following: an Air_cooled_heat_exchanger_unit (see 4.2.4.3.1) or a Shell_and_tube_heat_exchanger_unit (see 4.2.4.3.28).

EXAMPLE 58 - Heat_transfer_equipment includes fired heaters, heat exchangers, and evaporators.

The data associated with Heat_transfer_equipment are the following:

— heat_transfer_coefficient;

— type.

4.2.4.3.19.1 heat_transfer_coefficient

A heat_transfer_coefficient specifies the overall Heat_transfer_coefficients (see 4.2.3.2.4) for the Heat_-transfer_equipment.

4.2.4.3.19.2 type

A type specifies the type of Heat_transfer_equipment.

4.2.4.3.20 Impingement_protection

An Impingement_protection is a flow distribution device used to protect the tube bundle from damage due to excessive velocities or two-phase flow.

The data associated with Impingement_protection are the following:

— diameter;

— length;

— location;

— number_of_rod_rows;

— number_of_rods;

— rod_diameter;

— rod_layout_angle;

— thickness;

— type;

— width.

4.2.4.3.20.1 diameter

A diameter specifies the diameter of the impingement plate.

4.2.4.3.20.2 length

A length specifies the length of the impingement plate.

4.2.4.3.20.3 location

A location specifies an enumerated attribute giving the impingement plate location as in the nozzle dome, on the bundle, tubeside, or unspecified.

4.2.4.3.20.4 number_of_rod_rows

A number_of_rod_rows specifies the number of rod rows used as impingement protection.

4.2.4.3.20.5 number_of_rods

A number_of_rods specifies the number of rods used as impingement protection.

4.2.4.3.20.6 rod_diameter

A rod_diameter specifies the diameter of the rod used as impingement protection.

4.2.4.3.20.7 rod_layout_angle

A rod_layout_angle specifies the layout angle of the rod used as impingement protection.

4.2.4.3.20.8 thickness

A thickness specifies the thickness of the impingement plate.

4.2.4.3.20.9 type

A type specifies an enumerated attribute that specifies the type of impingement protection used. The value of the type shall be one of the following:

— none;

— circular_plate;

— rectangular_plate;

— rod;

— unspecified.

4.2.4.3.20.9.1 none**:** an indication that no impingement protection is provided.

4.2.4.3.20.9.2 circular_plate**:** an indication the impingement protection is provided by a circular plate.

4.2.4.3.20.9.3 rectangular_plate**:** an indication the impingement protection is provided by a rectangular plate.

4.2.4.3.20.9.4 rod**:** an indication the impingement protection is provided by a number of rods. The rod type is used to protect tubes from impingement.

4.2.4.3.20.9.5 unspecified**:** an indication that the impingement protection is not specified.

4.2.4.3.20.10 width

A width specifies the width of the impingement plate.

4.2.4.3.21 Longitudinal_baffle

A Longitudinal_baffle is baffle sheets or plates within a heat exchanger that are parallel to the long dimension of the vessel.

NOTE - They are used to direct fluid flow in the desired flow pattern.

The data associated with Longitudinal_baffle are the following:

— baffle_to_shell_clearance;

— elastic_modulus;

— insulated;

— leakage;

— length;

— seal_type;

— thermal_conductivity;

— thickness;

— width.

4.2.4.3.21.1 baffle_to_shell_clearance

A baffle_to_shell_clearance specifies the distance between the edge of the baffle to the shell inside diameter.

4.2.4.3.21.2 elastic_modulus

An elastic_modulus specifies the modulus of elasticity for the Longitudinal_baffle.

4.2.4.3.21.3 insulated

An insulated specifies whether the Longitudinal_baffle is insulated to minimize heat losses.

4.2.4.3.21.4 leakage

A leakage specifies the percent of the total flow that leaks around the Longitudinal_baffle.

4.2.4.3.21.5 length

A length specifies the length of the Longitudinal_baffle.

4.2.4.3.21.6 seal_type

A seal_type specifies an enumerated attribute giving the type of seal used for the baffle. The value of the baffle_seal_type attribute shall be one of the following:

— channel_strips;

— lamiflex;

— unspecified;

— welded.

4.2.4.3.21.6.1 channel_strips**:** an indication that one or two strips are welded to each side of the shell, upon or in which the Longitudinal_baffle sits.

4.2.4.3.21.6.2 lamiflex**:** an indication that one or more flexible strips are clamped to the inlet side, along the length of the Longitudinal_baffle.

4.2.4.3.21.6.3 unspecified**:** an indication that the baffle_seal_type is not specified.

4.2.4.3.21.6.4 welded**:** an indication that the plate is welded to the shell and the front tubesheet.

4.2.4.3.21.7 thermal_conductivity

A thermal_conductivity specifies the thermal conductivity of the Longitudinal_baffle. It is the heat flow across a surface per unit area per unit time, divided by the negative of the rate of change of temperature with distance in a direction perpendicular to the surface.

4.2.4.3.21.8 thickness

A thickness specifies the thickness of the Longitudinal_baffle.

4.2.4.3.21.9 width

A width specifies the width of the Longitudinal_baffle.

4.2.4.3.22 Nozzle_dome

A Nozzle_dome is an enlarged nozzle neck used to reduce the velocity entering the heat exchanger and aid the distribution of a fluid into the heat exchanger.

The data associated with Nozzle_dome are the following:

— height;

— inside_diameter;

— nominal_diameter.

4.2.4.3.22.1 height

A height specifies the height of the Nozzle_dome.

4.2.4.3.22.2 inside_diameter

An inside_diameter specifies the inside diameter of the Nozzle_dome.

4.2.4.3.22.3 nominal_diameter

A nominal_diameter specifies the nominal_diameter of the Nozzle_dome.

4.2.4.3.23 Nozzle_performance

A Nozzle_performance specifies the overall performance of a Nozzle (see 4.2.4.2.5) on a heat exchanger.

The data associated with Nozzle_performance are the following:

— pressure_drop;

— rhov2;

— velocity.

4.2.4.3.23.1 pressure_drop

A pressure_drop specifies the pressure drop of fluid through the Nozzle (see 4.2.4.2.5).

4.2.4.3.23.2 rhov2

A rhov2 specifies the velocity head (ρv^2) in the Nozzle (see 4.2.4.2.5).

4.2.4.3.23.3 velocity

A velocity specifies the fluid velocity in the Nozzle (see 4.2.4.2.5).

4.2.4.3.24 Partition_seal_rod

A Partition_seal_rod is a rod connecting two baffles that is located near the pass partition lane to divert the shell side fluid from flowing through the pass partition lane.

The data associated with Partition_seal_rod are the following:

— diameter;

— horizontal_distance_from_tubesheet_centre;

— length;

— vertical_distance_from_tubesheet_centre.

4.2.4.3.24.1 diameter

A diameter specifies the diameter of the seal rod.

4.2.4.3.24.2 horizontal_distance_from_tubesheet_centre

A horizontal_distance_from_tubesheet_centre specifies the horizontal distance from the vertical centreline of the tubesheet to the centre of the seal rod.

4.2.4.3.24.3 length

A length specifies the total length of the seal rod.

4.2.4.3.24.4 vertical_distance_from_tubesheet_centre

A vertical_distance_from_tubesheet_centre specifies the vertical distance from the horizontal centreline of the tubesheet to the centre of the seal rod.

4.2.4.3.25 Passlane

A Passlane is an opening lane between tube passes.

The data associated with Passlane are the following:

— length;

— location;

— number_of_seal_rods;

— orientation;

— width.

4.2.4.3.25.1 length

A length specifies the length of the Passlane.

4.2.4.3.25.2 location

A location specifies the distance between the centre of the Passlane and the centreline of the tubesheet.

4.2.4.3.25.3 number_of_seal_rods

A number_of_seal_rods specifies the number of seals rods to prevent fluid bypassing through.

4.2.4.3.25.4 orientation

An orientation specifies an enumerated attribute giving the orientation of the Passlane as horizontal, vertical, or unspecified.

4.2.4.3.25.5 width

A width specifies the width of the Passlane from tube edge to tube edge.

4.2.4.3.26 Phase_properties

A Phase_properties is a collection of properties associated with the Phase (see 4.2.2.2.15) for a material at a given thermodynamic state.

The data associated with Phase_properties are the following:

— density_mass_basis;

— density_mole_basis;

— mole_fractions;

— molecular_weight;

— phase;

— specific_enthalpy_mass_basis;

— specific_enthalpy_mole_basis;

— specific_heat_capacity_constant_pressure_mass_basis;

— specific_heat_capacity_constant_pressure_mole_basis;

— surface_tension;

— thermal_conductivity;

— viscosity.

4.2.4.3.26.1 density_mass_basis

A density_mass_basis specifies the ratio of the mass to the volume in any portion of the Material (see 4.2.2.4.9) at a Heat_release_point (see 4.2.4.3.18).

4.2.4.3.26.2 density_mole_basis

A density_mole_basis specifies the ratio of the moles to the volume in any portion of the Material (see 4.2.2.4.9) at a Heat_release_point (see 4.2.4.3.18).

4.2.4.3.26.3 mole_fractions

A mole_fractions specifies the molar composition of each component associated with the Phase (see 4.2.2.2.15).

4.2.4.3.26.4 molecular_weight

A molecular_weight specifies the molecular weight of each component associated with the Phase (see 4.2.2.2.15).

4.2.4.3.26.5 phase

A phase specifies an enumerated attribute that indicates the phase of the Heat_release_point (see 4.2.4.3.18). The value of the phase attribute shall be one of the following:

— liquid_1;

— liquid_1_volatile;

— liquid_2;

— liquid_2_volatile;

— mixed;

— unspecified;

— vapour;

— vapour_condensable;

— vapour_noncondensable.

4.2.4.3.26.5.1 liquid_1**:** an indication that the Phase (see 4.2.2.2.15) of the Heat_release_point (see 4.2.4.3.18) is liquid 1 with low density.

4.2.4.3.26.5.2 liquid_1_volatile**:** an indication that the Phase (see 4.2.2.2.15) of the Heat_release_point (see 4.2.4.3.18) is liquid 1 volatile with low density.

4.2.4.3.26.5.3 liquid_2**:** an indication that the Phase (see 4.2.2.2.15) of the Heat_release_point (see 4.2.4.3.18) is liquid 2 with high density.

4.2.4.3.26.5.4 liquid_2_volatile**:** an indication that the Phase (see 4.2.2.2.15) of the Heat_release_point (see 4.2.4.3.18) is liquid 2 volatile with high density.

4.2.4.3.26.5.5 mixed**:** an indication that the Phase (see 4.2.2.2.15) of the Heat_release_point (see 4.2.4.3.18) is mixed Phase.

4.2.4.3.26.5.6 unspecified**:** an indication that the Phase (see 4.2.2.2.15) of the Heat_release_point (see 4.2.4.3.18) is not specified.

4.2.4.3.26.5.7 vapour**:** an indication that the Phase (see 4.2.2.2.15) of the Heat_release_point (see 4.2.4.3.18) is vapour.

4.2.4.3.26.5.8 vapour_condensable**:** an indication that the Phase (see 4.2.2.2.15) of the Heat_release_-point (see 4.2.4.3.18) is vapour condensable.

4.2.4.3.26.5.9 vapour_noncondensable**:** an indication that the Phase (see 4.2.2.2.15) of the Heat_-release_point (see 4.2.4.3.18) is noncondensable vapour.

4.2.4.3.26.6 specific_enthalpy_mass_basis

A specific_enthalpy_mass_basis specifies the enthalpy per unit mass for any given portion of a Material (see 4.2.2.4.9) at a certain Heat_release_point (see 4.2.4.3.18) at the Thermodynamic_conditions (see 4.2.2.4.17).

4.2.4.3.26.7 specific_enthalpy_mole_basis

A specific_enthalpy_mole_basis specifies the enthalpy per mole for any given portion of a Material (see 4.2.2.4.9) at a certain Heat_release_point (see 4.2.4.3.18) at the Thermodynamic_conditions (see 4.2.2.4.17).

4.2.4.3.26.8 specific_heat_capacity_constant_pressure_mass_basis

A specific_heat_capacity_constant_pressure_mass_basis specifies the instantaneous rate of change of the enthalpy with respect to changes in temperature at constant pressure for any given portion of a Material (see 4.2.2.4.9) at a Heat_release_point (see 4.2.4.3.18).

4.2.4.3.26.9 specific_heat_capacity_constant_pressure_mole_basis

A specific_heat_capacity_constant_pressure_mole_basis specifies the instantaneous rate of change of the enthalpy with respect to changes in temperature at constant pressure for any given portion of a Material (see 4.2.2.4.9) at a Heat_release_point (see 4.2.4.3.18).

4.2.4.3.26.10 surface_tension

A surface_tension specifies the force per unit length exerted by the surface of one liquid Phase (see 4.2.2.2.15) at the Phase boundary at a certain Heat_release_point (see 4.2.4.3.18).

4.2.4.3.26.11 thermal_conductivity

A thermal_conductivity specifies the amount of thermal energy per unit time, per unit length and per unit temperature that a Material (see 4.2.2.4.9) at certain Heat_release_point (see 4.2.4.3.18) at the Thermodynamic_conditions (see 4.2.2.4.17) will transport by conduction.

4.2.4.3.26.12 viscosity

A viscosity specifies the ratio of the shearing stress per unit area to the velocity gradient necessary to produce that stress for the given Thermodynamic_conditions (see 4.2.2.4.17) and shearing stress, for a given portion of a Material (see 4.2.2.4.9) at a certain Heat_release_point (see 4.2.4.3.18).

4.2.4.3.27 Reboiler_piping

A Reboiler_piping is all inlet and outlet piping pertaining to a thermosiphon reboiler system.

The data associated with Reboiler_piping are the following:

— fraction_delta_pressure_across_inlet_valve;

— number_feed_lines_from_column;

— number_return_lines_to_column;

— offset_to_reference_level;

— reboiler_piping_type;

— total_inlet_change_in_height;

— total_inlet_equivalent_length;

— total_outlet_change_in_height;

— total_outlet_equivalent_length.

4.2.4.3.27.1 fraction_delta_pressure_across_inlet_valve

A fraction_delta_pressure_across_inlet_valve specifies the fraction of the total piping pressure drop that occurs across an inlet valve or orifice expressed as a percentage.

4.2.4.3.27.2 number_feed_lines_from_column

A number_feed_lines_from_column specifies the number of feed lines from the column to the thermosiphon inlet.

4.2.4.3.27.3 number_return_lines_to_column

A number_return_lines_to_column specifies the number of return lines from the thermosiphon to the column.

4.2.4.3.27.4 offset_to_reference_level

An offset_to_reference_level specifies the distance from the bottom of the distillation column to the top tubesheet for a vertical heat exchanger and the distance from the bottom of the distillation column to the bottom of the shell for a horizontal heat exchanger.

4.2.4.3.27.5 reboiler_piping_type

A reboiler_piping_type specifies an enumerated attribute that indicates the type of Reboiler_piping as a forced flow reboiler with pump, a thermosiphon reboiler, or unspecified.

4.2.4.3.27.6 total_inlet_change_in_height

A total_inlet_change_in_height specifies the total change in elevation (height) from the bottom of the tower to the inlet of the heat exchanger for all thermosiphon inlet piping. The height is specified to the inside bottom tubesheet face for vertical units and the bottom of the inside of the shell for horizontal units.

> NOTE - This is an optional specification rather than using External_circuit_component (see 4.2.4.3.15) description of each piping element. Normally negative.

4.2.4.3.27.7 total_inlet_equivalent_length

A total_inlet_equivalent_length specifies the total equivalent length of all thermosiphon inlet piping.

> NOTE - This is an optional specification rather than using External_circuit_component (see 4.2.4.3.15) description of each piping element.

4.2.4.3.27.8 total_outlet_change_in_height

A total_outlet_change_in_height specifies the total change in elevation (height) from the heat exchanger to the tower for all thermosiphon outlet piping. The height is specified from the inside top tubesheet face for vertical units and the top of the inside of the shell for horizontal units.

NOTE - This is an optional specification rather than using External_circuit_component (see 4.2.4.3.15) description of each piping element.

4.2.4.3.27.9 total_outlet_equivalent_length

A total_outlet_equivalent_length specifies the total equivalent length of all thermosiphon outlet piping.

NOTE - This is an optional specification rather than using External_circuit_component (see 4.2.4.3.15) description of each piping element.

4.2.4.3.28 Shell_and_tube_heat_exchanger_unit

A Shell_and_tube_heat_exchanger_unit is a heat exchanger that is a composite of two or more shell-and-tube heat exchangers.

The data associated with Shell_and_tube_heat_exchanger_unit are the following:

— angle;

— bottoms_drawoff_rate;

— clean_coefficient;

— dirty_coefficient;

— discharge_pressure;

— effective_area;

— effective_temperature_difference;

— flow_direction;

— heat_duty;

— liquid_height_in_column;

— number_shell_passes;

— number_shells_in_parallel;

— number_shells_in_series;

— number_tube_passes;

— pressure_at_liquid_level;

— program;

— service_coefficient;

— shellside_fouling_factor;

— total_area;

— total_number_of_shells;

— tubeside_fouling_factor.

4.2.4.3.28.1 angle

An angle specifies the degree of inclination of a shell and tube heat exchanger from horizontal in the longitudinal direction.

4.2.4.3.28.2 bottoms_drawoff_rate

A bottoms_drawoff_rate specifies the flow rate of the bottoms liquid leaving the pool boiler.

4.2.4.3.28.3 clean_coefficient

A clean_coefficient specifies the predicted overall rate at which heat is transferred from the hot fluid on one side of the heat exchanger to the cold fluid on the other side, in the clean condition, within the Uo_-heat_exchanger (see 4.2.3.2.37) in the simulation.

4.2.4.3.28.4 dirty_coefficient

A dirty_coefficient specifies the predicted overall rate at which heat is transferred from the hot fluid on one side of the heat exchanger to the cold fluid on the other side, in the dirty condition, within the Uo_-heat_exchanger (see 4.2.3.2.37) in the simulation.

4.2.4.3.28.5 discharge_pressure

A discharge_pressure specifies the pressure discrepancy of the thermosiphon outlet line at the distillation column.

4.2.4.3.28.6 effective_area

An effective_area specifies the total tube outside surface area, including finned area, available for heat transfer for the heat exchanger.

4.2.4.3.28.7 effective_temperature_difference

An effective_temperature_difference specifies the log mean temperature difference associated with the Uo_heat_exchanger (see 4.2.3.2.37).

4.2.4.3.28.8 flow_direction

A flow_direction specifies an enumerated attribute indicating the relative fluid flow direction between the shell side and the first tube side pass. The value of the flow_direction attribute shall be one of the following:

— cocurrent;

— countercurrent;

— unspecified.

4.2.4.3.28.8.1 cocurrent**:** an indication that the flow of the shell and tube side fluids are in the same direction.

4.2.4.3.28.8.2 countercurrent**:** an indication that the flow of shell and tube side fluids are in opposite directions.

4.2.4.3.28.8.3 unspecified**:** an indication that the flow is not specified.

4.2.4.3.28.9 heat_duty

A heat_duty specifies the total duty (see 3.3) associated with the heat exchanger.

4.2.4.3.28.10 liquid_height_in_column

A liquid_height_in_column specifies the height of the liquid level in the column referenced to the bottom of the column.

4.2.4.3.28.11 number_shell_passes

A number_shell_passes specifies the number of times the shell side flow travels all or part of the shell in the longitudinal direction.

NOTE - A G-type shell has two passes. A H-type shell has four passes.

4.2.4.3.28.12 number_shells_in_parallel

A number_shells_in_parallel specifies the number of shells connected so that the shell side fluid is divided equally to each shell.

4.2.4.3.28.13 number_shells_in_series

A number_shells_in_series specifies the number of shells connected so that the shell side fluid flows through each shell consecutively.

4.2.4.3.28.14 number_tube_passes

A number_tube_passes specifies the number of times the tube side flow travels the length of the heat exchanger for a single shell and tube heat exchanger.

4.2.4.3.28.15 pressure_at_liquid_level

A pressure_at_liquid_level specifies the immediate pressure above the liquid level of the column.

4.2.4.3.28.16 program

A program specifies the application program, version, date, etc. that the associated performance data was derived from.

4.2.4.3.28.17 service_coefficient

A service_coefficient specifies the overall rate that heat is transferred from the hot fluid on one side of the heat exchanger to the cold fluid on the other side, in the maximum fouled condition, within the Uo_-heat_exchanger (see 4.2.3.2.37) in the simulation.

4.2.4.3.28.18 shellside_fouling_factor

A shellside_fouling_factor specifies the thermal resistance of fouling layers on the shell side of the heat exchanger.

4.2.4.3.28.19 total_area

A total_area specifies the total tube outside surface area, including non-effective heat transfer area, associated with the heat exchanger.

4.2.4.3.28.20 total_number_of_shells

A total_number_of_shells specifies the total number of shell and tube heat exchangers for the heat exchanger.

4.2.4.3.28.21 tubeside_fouling_factor

A tubeside_fouling_factor specifies the thermal resistance of fouling layers on the tube side of the heat exchanger.

4.2.4.3.29 Shellside_design

A Shellside_design is the design criteria on the shell side of the heat exchanger.

The data associated with Shellside_design are the following:

— allow_baffles_under_nozzles;

— allowable_number_of_baffles;

— allowable_pressure_drop;

— coefficient_method;

— corrosion_allowance;

— cut_proportional_to_spacing;

— cylinders_for_small_shells;

— design_pressure;

— design_temperature;

— expansion_joint_indicator;

— film_coefficient;

— film_coefficient_multiplier;

— front_head_reference;

— maximum_baffle_spacing;

— maximum_shell_diameter;

— maximum_velocity;

— minimum_baffle_spacing;

— minimum_shell_diameter;

— minimum_velocity;

— pressure_drop_multiplier;

— shell_diameter_increment;

— test_pressure;

— vacuum_service_design_pressure.

4.2.4.3.29.1 allow_baffles_under_nozzles

An allow_baffles_under_nozzles specifies an indicator of whether baffles are allowed under the nozzles. The value of the allow_baffles_under_nozzles attribute shall be yes, no, or unspecified.

4.2.4.3.29.2 allowable_number_of_baffles

An allowable_number_of_baffles specifies an enumerated attribute indicating the type of allowable number of baffles of the heat exchanger as even, odd, any (odd or even), or unspecified.

4.2.4.3.29.3 allowable_pressure_drop

An allowable_pressure_drop specifies the maximum allowable pressure drop on the shell side of the heat exchanger.

4.2.4.3.29.4 coefficient_method

A coefficient_method specifies whether the Heat_transfer_coefficient (see 4.2.3.2.4) used in the shell side design is based on clean, dirty, or service conditions.

4.2.4.3.29.5 corrosion_allowance

A corrosion_allowance specifies the thickness to be added for corrosion allowance on the shellside Material (see 4.2.2.4.9).

4.2.4.3.29.6 cut_proportional_to_spacing

A cut_proportional_to_spacing specifies an indicator of having the baffle cut proportional to baffle spacing. The value of the cut_proportional_to_spacing attribute shall be yes, no, or unspecified.

4.2.4.3.29.7 cylinders_for_small_shells

A cylinders_for_small_shells specifies an enumerated attribute indicating the type of cylinder for small shells as pipe, plate, or unspecified.

> NOTE - A small shell is up through 600 mm or 24 inches for carbon steel and up through 300 mm or 12 inches for alloys.

4.2.4.3.29.8 design_pressure

A design_pressure specifies the design pressure of the shell side of the heat exchanger.

4.2.4.3.29.9 design_temperature

A design_temperature specifies the design temperature of the shell side of the heat exchanger.

4.2.4.3.29.10 expansion_joint_indicator

An expansion_joint_indicator specifies an enumerated attribute indicator for the expansion joint. The value of the expansion_joint_indicator shall be yes, no, program control, or unspecified.

4.2.4.3.29.11 film_coefficient

A film_coefficient specifies the film heat transfer coefficient.

4.2.4.3.29.12 film_coefficient_multiplier

A film_coefficient_multiplier specifies a multiplier applied to the calculated film coefficient of the shell side of the heat exchanger.

4.2.4.3.29.13 front_head_reference

A front_head_reference specifies an enumerated attribute indicating which diameter will be the reference diameter for the shell and front head cylinder. The value of the front_head_reference attribute shall be inside diameter, outside diameter, or unspecified.

4.2.4.3.29.14 maximum_baffle_spacing

A maximum_baffle_spacing specifies the maximum baffle spacing in the heat exchanger.

4.2.4.3.29.15 maximum_shell_diameter

A maximum_shell_diameter specifies the maximum shell diameter of the heat exchanger.

4.2.4.3.29.16 maximum_velocity

A maximum_velocity specifies the maximum limit for fluid velocity anywhere within the shell side of the heat exchanger.

4.2.4.3.29.17 minimum_baffle_spacing

A minimum_baffle_spacing specifies the minimum baffle spacing in the heat exchanger.

4.2.4.3.29.18 minimum_shell_diameter

A minimum_shell_diameter specifies the minimum shell diameter of the heat exchanger.

4.2.4.3.29.19 minimum_velocity

A minimum_velocity specifies the minimum limit for fluid velocity anywhere within the shell side of the heat exchanger.

4.2.4.3.29.20 pressure_drop_multiplier

A pressure_drop_multiplier specifies a multiplier applied to the calculated shell side pressure drop excluding the pressure drop through the nozzles.

4.2.4.3.29.21 shell_diameter_increment

A shell_diameter_increment specifies the increment by which the shell diameter is to change.

4.2.4.3.29.22 test_pressure

A test_pressure specifies the test pressure that the shellside of the heat exchanger is hydrotested at.

4.2.4.3.29.23 vacuum_service_design_pressure

A vacuum_service_design_pressure specifies the vacuum service design pressure for the shellside of the heat exchanger.

4.2.4.3.30 Shellside_performance

A Shellside_performance is the overall shell side performance of the heat exchanger.

The data associated with Shellside_performance are the following:

— average_skin_temperature;

— beta_correction;

— bulk_film_coefficient;

— bundle_entrance_area;

— bundle_entrance_rhov2;

— bundle_exit_area;

— bundle_exit_rhov2;

— clean_pressure_drop;

— crossflow_nominal_velocity;

— dirty_pressure_drop;

— end_correction;

— fin_correction;

— fin_efficiency;

— fouling_resistance;

— fouling_thickness;

— gamma_correction;

— long_baffle_bulk_film_coefficient;

— longitudinal_baffle_correction;

— midpoint_velocity;

— outlet_temperature;

— pressure_drop_in_baffle_window;

— pressure_drop_in_crossflow;

— pressure_drop_in_ends;

— shell_entrance_area;

— shell_entrance_rhov2;

— shell_exit_area;

— shell_exit_rhov2;

— thermal_resistance;

— total_heat_transfer_correction;

— wall_film_coefficient;

— wall_temperature.

4.2.4.3.30.1 average_skin_temperature

An average_skin_temperature specifies the temperature of the tube outside fouling layer.

4.2.4.3.30.2 beta_correction

A beta_correction specifies a correction factor applied to the log mean temperature difference to account for partial counter-current flow patterns in a heat exchanger.

4.2.4.3.30.3 bulk_film_coefficient

A bulk_film_coefficient specifies the Heat_transfer_coefficient (see 4.2.3.2.4) between the bulk fluid and the fluid film for the shell side of the heat exchanger.

4.2.4.3.30.4 bundle_entrance_area

A bundle_entrance_area specifies the bundle entrance area of the bundle side of a heat exchanger.

4.2.4.3.30.5 bundle_entrance_rhov2

A bundle_entrance_rhov2 specifies the velocity head (ρv^2) at the bundle entrance of the bundle side of a heat exchanger.

4.2.4.3.30.6 bundle_exit_area

A bundle_exit_area specifies the bundle exit area of the bundle side of a heat exchanger.

4.2.4.3.30.7 bundle_exit_rhov2

A bundle_exit_rhov2 specifies the velocity head (ρv^2) at the bundle exit of the bundle side of a heat exchanger.

4.2.4.3.30.8 clean_pressure_drop

A clean_pressure_drop specifies the clean condition pressure drop on the shell side of the heat exchanger.

4.2.4.3.30.9 crossflow_nominal_velocity

A crossflow_nominal_velocity specifies the nominal velocity associated with the cross flow sections on the shell side of the heat exchanger.

4.2.4.3.30.10 dirty_pressure_drop

A dirty_pressure_drop specifies the dirty condition pressure drop on the shell side of the heat exchanger.

4.2.4.3.30.11 end_correction

An end_correction specifies the correction factor for the Heat_transfer_coefficient (see 4.2.3.2.4) associated with the inlet and outlet zones of the shell side of the heat exchanger.

4.2.4.3.30.12 fin_correction

A fin_correction specifies the correction factor to the Heat_transfer_coefficient (see 4.2.3.2.4) associated with the fins on tubes.

4.2.4.3.30.13 fin_efficiency

A fin_efficiency specifies the heat transfer efficiency of the fins on tubes.

4.2.4.3.30.14 fouling_resistance

A fouling_resistance specifies the thermal resistance of the fouling layer on the outside of the tube.

4.2.4.3.30.15 fouling_thickness

A fouling_thickness specifies the thickness of the fouling layer on the outside of the tube.

4.2.4.3.30.16 gamma_correction

A gamma_correction specifies a correction factor applied to the log mean temperature difference to account for partial counter-current flow patterns in a heat exchanger.

4.2.4.3.30.17 long_baffle_bulk_film_coefficient

A long_baffle_bulk_film_coefficient specifies the bulk film coefficient of the Longitudinal_baffle (see 4.2.4.3.21).

4.2.4.3.30.18 longitudinal_baffle_correction

A longitudinal_baffle_correction specifies the correction factor for the Heat_transfer_coefficient (see 4.2.3.2.4) associated with the longitudinal baffle on the shell side of a heat exchanger.

4.2.4.3.30.19 midpoint_velocity

A midpoint_velocity specifies the velocity associated with the midpoint of the shell side of a heat exchanger.

4.2.4.3.30.20 outlet_temperature

An outlet_temperature specifies the outlet temperature of shellside of the heat exchanger.

4.2.4.3.30.21 pressure_drop_in_baffle_window

A pressure_drop_in_baffle_window specifies the pressure drop associated with the baffle windows of the shell side of the heat exchanger.

4.2.4.3.30.22 pressure_drop_in_crossflow

A pressure_drop_in_crossflow specifies the pressure drop associated with the cross flow sections of the shell side of the heat exchanger.

4.2.4.3.30.23 pressure_drop_in_ends

A pressure_drop_in_ends specifies the pressure drop associated with the inlet and outlet zones of the shell side of the heat exchanger.

4.2.4.3.30.24 shell_entrance_area

A shell_entrance_area specifies the shell entrance area of the shell side of a heat exchanger.

4.2.4.3.30.25 shell_entrance_rhov2

A shell_entrance_rhov2 specifies the velocity head (ρv^2) at the shell entrance of the shell side of a heat exchanger.

4.2.4.3.30.26 shell_exit_area

A shell_exit_area specifies the shell exit area of the shell side of a heat exchanger.

4.2.4.3.30.27 shell_exit_rhov2

A shell_exit_rhov2 specifies the velocity head (ρv^2) at the shell exit of the shell side of a heat exchanger.

4.2.4.3.30.28 thermal_resistance

A thermal_resistance specifies the thermal resistance on the shell side of the heat exchanger.

4.2.4.3.30.29 total_heat_transfer_correction

A total_heat_transfer_correction specifies the total heat transfer correction associated with the shell side of the heat exchanger.

4.2.4.3.30.30 wall_film_coefficient

A wall_film_coefficient specifies the value of the convective Heat_transfer_coefficient (see 4.2.3.2.4) at the tube wall for the shell side of the heat exchanger.

4.2.4.3.30.31 wall_temperature

A wall_temperature specifies the outside wall temperature of the tubes.

4.2.4.3.31 Tie_rod

A Tie_rod is a device to hold the baffles in place.

> NOTE - One of several rods located at various points around the periphery of the bundle that run from the front tubesheet to the last baffle. They tie the baffles together and with the spacers hold the baffles in position.

The data associated with Tie_rod are the following:

— diameter;

— horizontal_distance_from_tubesheet_centre;

— length;

— number_of_spacers;

— vertical_distance_from_tubesheet_centre.

4.2.4.3.31.1 diameter

A diameter specifies the diameter of the Tie_rod.

4.2.4.3.31.2 horizontal_distance_from_tubesheet_centre

A horizontal_distance_from_tubesheet_centre specifies the horizontal distance from the vertical centreline of the tubesheet to the centre of the Tie_rod.

4.2.4.3.31.3 length

A length specifies the length of the Tie_rod.

4.2.4.3.31.4 number_of_spacers

A number_of_spacers specifies the number of Tie_rod_spacers (see 4.2.4.3.32) on the Tie_rod.

> NOTE - Tie_rod_spacers are tube or pipe material with an inside diameter greater than the Tie_rod diameter and an outside diameter greater than the baffle Tie_rod holes. The spacers slide over the Tie_rods and act as spacers to hold the baffles in position.

4.2.4.3.31.5 vertical_distance_from_tubesheet_centre

A vertical_distance_from_tubesheet_centre specifies the vertical distance from the horizontal centreline of the tubesheet to the centre of the Tie_rod.

4.2.4.3.32 Tie_rod_spacer

A Tie_rod_spacer is a device made of pipe or tube that is placed over a Tie_rod (see 4.2.4.3.31) to maintain a space between adjacent baffles.

The data associated with Tie_rod_spacer are the following:

— distance_from_front_face;

— inside_diameter;

— length;

— outside_diameter.

4.2.4.3.32.1 distance_from_front_face

A distance_from_front_face specifies the distance from the front face of the front tubesheet of the heat exchanger to the spacer.

4.2.4.3.32.2 inside_diameter

An inside_diameter specifies the inside diameter of the spacer.

4.2.4.3.32.3 length

A length specifies the length of the spacer.

4.2.4.3.32.4 outside_diameter

An outside_diameter specifies the outside diameter of the spacer.

4.2.4.3.33 Tube_external_characteristics

A Tube_external_characteristics is the type and dimensions of an external enhancement for tubes in a heat exchanger.

The data associated with Tube_external_characteristics are the following:

— base_thickness;

— bond_resistances;

— distance_unfinned_under_baffle;

— fin_pitch;

— finned_section_wall_thickness;

— height;

— outer_diameter;

— outside_area_per_unit_length;

— root_diameter;

— thermal_conductivity;

— tip_thickness;

— type;

— unfinned_under_baffles;

— width.

4.2.4.3.33.1 base_thickness

A base_thickness specifies the base thickness of the fin for an external finned tube.

4.2.4.3.33.2 bond_resistances

A bond_resistances specifies the thermal resistance across the bond between the fin and the tube.

4.2.4.3.33.3 distance_unfinned_under_baffle

A distance_unfinned_under_baffle specifies the length of one unfinned section of tube underneath the baffle.

4.2.4.3.33.4 fin_pitch

A fin_pitch specifies the distance between adjacent fins, centre to centre.

4.2.4.3.33.5 finned_section_wall_thickness

A finned_section_wall_thickness specifies the actual tube wall thickness underneath the external fin.

4.2.4.3.33.6 height

A height specifies the height of the fin for an externally finned tube.

4.2.4.3.33.7 outer_diameter

An outer_diameter specifies the outer diameter of the fin for an external finned tube.

4.2.4.3.33.8 outside_area_per_unit_length

An outside_area_per_unit_length specifies the actual outside area of the tube plus external device surface area per unit length of the tube.

4.2.4.3.33.9 root_diameter

A root_diameter specifies the outside diameter of the tube at the base of the fin for an external finned tube.

4.2.4.3.33.10 thermal_conductivity

A thermal_conductivity specifies the thermal conductivity of the tube external enhancement.

4.2.4.3.33.11 tip_thickness

A tip_thickness specifies the fin tip thickness for an external finned tube.

4.2.4.3.33.12 type

A type specifies an enumerated attribute indicating the type of external tube enhancement as corrugated, enhanced boiling, longitudinal fin, plain, sintered, spiral fin, or unspecified.

4.2.4.3.33.13 unfinned_under_baffles

An unfinned_under_baffles specifies the length of one unfinned section of tube located under the baffle.

4.2.4.3.33.14 width

A width specifies the width of a fin segment for segmented external finned tubes.

4.2.4.3.34 Tube_internal_characteristics

A Tube_internal_characteristics is the type and dimensions of an internal enhancement for tubes in a heat exchanger.

The data associated with Tube_internal_characteristics are the following:

— base_thickness;

— diameter;

— height;

— inside_area_per_unit_length;

— inside_cross_section;

— internal_hydraulic_diameter;

— length;

— number_internal_fins;

— spiral_fin_helix_angle;

— thermal_conductivity;

— tip_thickness;

— twisted_tape_pitch;

— twisted_tape_thickness;

— type;

— width.

4.2.4.3.34.1 base_thickness

A base_thickness specifies the thickness of the internal fin at its base.

4.2.4.3.34.2 diameter

A diameter specifies the diameter of the tube internal plug or wire loop device.

4.2.4.3.34.3 height

A height specifies the height of the internal tube fin.

4.2.4.3.34.4 inside_area_per_unit_length

An inside_area_per_unit_length specifies the actual inside area of the tube per unit length of tube.

4.2.4.3.34.5 inside_cross_section

An inside_cross_section specifies the actual inside cross sectional area of the tube with the internal device.

4.2.4.3.34.6 internal_hydraulic_diameter

An internal_hydraulic_diameter specifies the equivalent hydraulic diameter of the heat exchanger tube with an internal device.

4.2.4.3.34.7 length

A length specifies the length of the tube internal plug, twisted tape, or wire loop device.

4.2.4.3.34.8 number_internal_fins

A number_internal_fins specifies the number of internal fins around the inside circumference of the tubes.

4.2.4.3.34.9 spiral_fin_helix_angle

A spiral_fin_helix_angle specifies the helical angle of the spiral fin relative to the tube axis.

4.2.4.3.34.10 thermal_conductivity

A thermal_conductivity specifies the thermal conductivity of the tube internal device.

4.2.4.3.34.11 tip_thickness

A tip_thickness specifies the thickness of the internal fin at its tip.

4.2.4.3.34.12 twisted_tape_pitch

A twisted_tape_pitch specifies the distance between corresponding twists for the twisted tape internal device.

4.2.4.3.34.13 twisted_tape_thickness

A twisted_tape_thickness specifies the thickness of the twisted tape internal device.

4.2.4.3.34.14 type

A type specifies an enumerated attribute giving the type of internal tube enhancement as corrugated, longitudinal fin, plain, plug, spiral fin, twisted tape, wire loop, or unspecified.

4.2.4.3.34.15 width

A width specifies the width of the tube internal twisted tape device.

4.2.4.3.35 Tube_type

A Tube_type is the type, dimensions, and configuration of the tube.

The data associated with Tube_type are the following:

— effective_length;

— elastic_modulus;

— fin_area_per_unit_length;

— finned_length;

— heated_length;

— inside_diameter;

— outside_diameter;

— straight_length;

— tapered_ends;

— thermal_conductivity;

— thermal_resistance;

— total_length;

— tube_construction;

— tube_material_density;

— wall_specification;

— wall_thickness.

4.2.4.3.35.1 effective_length

An effective_length specifies the effective heat transfer length of the heat exchanger tubes.

NOTE - This normally does not include the tube length projecting from the tubesheet into the heads or the tube length contained inside the tubesheet(s).

4.2.4.3.35.2 elastic_modulus

An elastic_modulus specifies the modulus of elasticity for the heat exchanger tube material.

4.2.4.3.35.3 fin_area_per_unit_length

A fin_area_per_unit_length specifies the fin surface area per unit length of the heat exchanger tube.

4.2.4.3.35.4 finned_length

A finned_length specifies the total length of the heat exchanger tube that is finned.

4.2.4.3.35.5 heated_length

A heated_length specifies the length of the heat exchanger tube after it is heated to the operating temperature.

4.2.4.3.35.6 inside_diameter

An inside_diameter specifies the inside diameter of the heat exchanger tube.

4.2.4.3.35.7 outside_diameter

An outside_diameter specifies the outside diameter of the heat exchanger tube.

4.2.4.3.35.8 straight_length

A straight_length specifies the total straight length of the heat exchanger tubes.

NOTE - For U-tubes, the straight length is terminated at the tangent line of the U-bend.

4.2.4.3.35.9 tapered_ends

A tapered_ends specifies whether tapered tube ends are present, not present, or unspecified.

NOTE - Tapered tubes are tubes that are extended from the face of the tubesheet and cut at an angle (tapered).

4.2.4.3.35.10 thermal_conductivity

A thermal_conductivity specifies the thermal conductivity of the heat exchanger tube. The heat flow across a surface per unit area per unit time, divided by the negative of the rate of change of temperature with distance in a direction perpendicular to the surface.

4.2.4.3.35.11 thermal_resistance

A thermal_resistance specifies the thermal resistance of the heat exchanger tube. A measure of a body's ability to prevent heat from flowing through it, equal to the difference between the temperatures of opposite faces of the body divided by the rate of heat flow.

4.2.4.3.35.12 total_length

A total_length specifies the total length for the heat exchanger tube.

NOTE - For U-tubes the total length is the straight length.

4.2.4.3.35.13 tube_construction

A tube_construction specifies whether the tube is made to be seamless, welded, or its construction is not specified.

4.2.4.3.35.14 tube_material_density

A tube_material_density specifies the density of the heat exchanger tube material.

4.2.4.3.35.15 wall_specification

A wall_specification specifies an enumerated attribute giving the tube wall thickness specification to be used in ordering the tubes. The value of the wall_specification attributes shall be one of the following:

— average;

— minimum;

— unspecified.

4.2.4.3.35.15.1 average**:** an indication that the average tube wall thickness must meet the specified thickness.

4.2.4.3.35.15.2 minimum**:** an indication that the minimum tube wall thickness must meet the specified thickness.

4.2.4.3.35.15.3 unspecified**:** an indication that the wall thickness is not specified.

4.2.4.3.35.16 wall_thickness

A wall_thickness specifies the wall thickness of the tube.

4.2.4.3.36 Tubesheet

A Tubesheet is a sheet of material located between the heads and the shell to maintain separation of the shell and tube side fluids. The Tubesheet is perforated with tubes to permit passage of the tube side fluid through the shell.

The data associated with Tubesheet are the following:

— centreline_offset_from_shell_centreline;

— degree_of_symmetry;

— elastic_modulus;

— extension_outside_diameter;

— location;

— longitudinal_tube_pitch;

— number_of_tie_rods;

— number_tubes_removed;

— number_tubes_removed_under_nozzles;

— outside_diameter;

— thermal_conductivity;

— thickness;

— transverse_tube_pitch;

— tube_alignment;

— tube_pass_layout_type;

— tube_pattern;

— tube_to_tubesheet_joint;

— tubes_per_pass_deviation;

— type.

4.2.4.3.36.1 centreline_offset_from_shell_centreline

A centreline_offset_from_shell_centreline specifies the distance from the horizontal centreline of the Tubesheet to the horizontal centreline of the kettle cylinder (kettle only).

4.2.4.3.36.2 degree_of_symmetry

A degree_of_symmetry specifies an enumerated attribute giving the degree of symmetry of the tube layout with respect to the tube rows on or next to the horizontal centreline of the Tubesheet as non-symmetrical to centreline, symmetrical to centreline, or unspecified.

4.2.4.3.36.3 elastic_modulus

An elastic_modulus specifies the modulus of elasticity for the Tubesheet material.

4.2.4.3.36.4 extension_outside_diameter

An extension_outside_diameter specifies an enumerated attribute giving the type of extension of Tubesheet diameter as to shell outside diameter (N type head only), to gasket outside diameter (not bolted through), to flange outside diameter (bolted through), or integral with shell (bolted through).

4.2.4.3.36.5 location

A location specifies an enumerated attribute giving the location of the Tubesheet. The value of the location attribute shall by one of the following:

— front;

— rear;

— unspecified.

4.2.4.3.36.5.1 front**:** an indication the location of the Tubesheet is at the front head or top of the heat exchanger if vertical.

4.2.4.3.36.5.2 rear**:** an indication the location of the Tubesheet is at the read head or bottom of heat exchanger if vertical.

4.2.4.3.36.5.3 unspecified**:** an indication the location of the Tubesheet is not specified.

4.2.4.3.36.6 longitudinal_tube_pitch

A longitudinal_tube_pitch specifies the shortest tube centre to centre distance between adjacent tubes within the tube_pattern.

4.2.4.3.36.7 number_of_tie_rods

A number_of_tie_rods specifies the number of Tie_rods (see 4.2.4.3.31) used to hold the baffles in position.

4.2.4.3.36.8 number_tubes_removed

A number_tubes_removed specifies the number of tubes removed from the Tubesheet.

4.2.4.3.36.9 number_tubes_removed_under_nozzles

A number_tubes_removed_under_nozzles specifies the number of tubes removed from the Tubesheet layout under the nozzles.

4.2.4.3.36.10 outside_diameter

An outside_diameter specifies the diameter of the heat exchanger Tubesheet.

4.2.4.3.36.11 thermal_conductivity

A thermal_conductivity specifies the thermal conductivity of the Tubesheet material.

4.2.4.3.36.12 thickness

A thickness specifies the thickness of the heat exchanger Tubesheet.

4.2.4.3.36.13 transverse_tube_pitch

A transverse_tube_pitch specifies the distance between the tube row centrelines in a direction perpendicular to the shell side fluid flow direction.

4.2.4.3.36.14 tube_alignment

A tube_alignment specifies an enumerated attribute giving the degree of tube alignment between tube passes. The value of the tube_alignment attribute shall be one of the following:

— full_alignment;

— none;

— semi_alignment;

— u_tube;

— unspecified.

4.2.4.3.36.14.1 full_alignment**:** an indication the alignment of tube lattices is preserved in all directions between passes, in the direction of the flow, perpendicular to the flow and diagonally.

NOTE - In order to do this pass lanes are adjusted.

4.2.4.3.36.14.2 none**:** an indication tube lattices are not aligned at all between passes.

NOTE - This gives the most tubes in shell.

4.2.4.3.36.14.3 semi_alignment**:** an indication that alignment of the tube lattice between passes is preserved only in the direction of the flow and perpendicular to the flow.

4.2.4.3.36.14.4 u_tube**:** an indication the pass partition lanes are adjusted to give the minimum tube bend radius allowed.

4.2.4.3.36.14.5 unspecified**:** an indication the tube_alignment is not specified.

4.2.4.3.36.15 tube_pass_layout_type

A tube_pass_layout_type specifies an enumerated attribute giving the type of tube pass layout as mixed or H-banded, quadrant, ribbon, or unspecified.

4.2.4.3.36.16 tube_pattern

A tube_pattern specifies an enumerated attribute giving the layout of the tubes in relation to the direction of the shell side crossflow. The value of the tube_pattern attribute shall be one of the following:

— rotated_square;

— rotated_triangular;

— square;

— triangular;

— unspecified.

4.2.4.3.36.16.1 rotated_square**:** an indication that the tube_pattern is rotated 45 degrees with respect to flow direction (see item 4 in the figure 9).

4.2.4.3.36.16.2 rotated_triangular**:** an indication that the tube_pattern is rotated 60 degrees with respect to flow direction (see item 2 in figure 9).

4.2.4.3.36.16.3 square**:** an indication that the tube_pattern is 90 degrees with respect to the flow direction (see item 3 in figure 9).

4.2.4.3.36.16.4 triangular**:** an indication that the tube_pattern is 30 degrees with respect to the flow direction (see item 1 in figure 9).

4.2.4.3.36.16.5 unspecified**:** an indication that the tube_pattern is not specified.

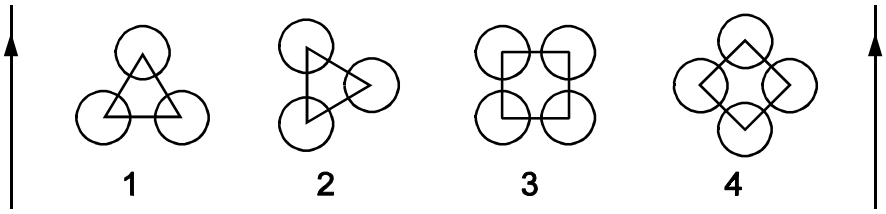


Figure 9 - Tube pattern

4.2.4.3.36.17 tube_to_tubesheet_joint

A tube_to_tubesheet_joint specifies an enumerated attribute specifying the type of tube to Tubesheet joint used in fabrication of the Tubesheet. The value of the tube_to_tubesheet_joint shall be one of the following:

— expanded_only;

— expanded_and_seal_welded;

— expanded_and_strength_welded;

— seal_welded_only;

— strength_welded_only;

— unspecified.

4.2.4.3.36.17.1 expanded_only**:** an indication that the tube_to_tubesheet_joint is only expanded (see items 1, 2, and 3 in figure 10) for no groove, one groove, and two groove expansion, respectively.

4.2.4.3.36.17.2 expanded_and_seal_welded**:** an indication that the tube_to_tubesheet_joint is expanded and seal welded (see items 6, 7, and 8 in figure 10) for no groove, one groove, and two groove expansion, respectively.

4.2.4.3.36.17.3 expanded_and_strength_welded**:** an indication that the tube_to_tubesheet_joint is expanded and strength welded (see item 9 in figure 10).

4.2.4.3.36.17.4 seal_welded_only**:** an indication that the tube_to_tubesheet_joint is seal welded (see item 4 in figure 10).

4.2.4.3.36.17.5 strength_welded_only**:** an indication that the tube_to_tubesheet_joint is strength welded (see item 5 in figure 10).

4.2.4.3.36.17.6 unspecified**:** an indication that the tube to Tubesheet joint type is not specified.

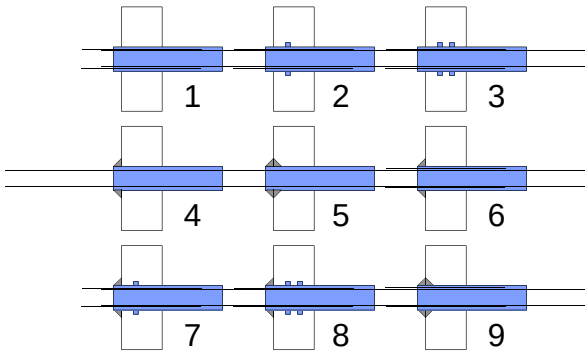


Figure 10 - Tube to tubesheet joint types

4.2.4.3.36.18 tubes_per_pass_deviation

A tubes_per_pass_deviation specifies the highest percent deviation from the median number of tubes per pass.

4.2.4.3.36.19 type

A type specifies an enumerated attribute giving the type of Tubesheet. The value of the type attribute shall be one of the following:

— double_integral;

— double_with_gap;

— single;

— unspecified.

4.2.4.3.36.19.1 double_integral**:** an indication the Exchanger_tubesheet is a single plate with an internal space where a leaking fluid can flow out (see item 3 in figure 11).

4.2.4.3.36.19.2 double_with_gap**:** an indication the Exchanger_tubesheet consists of two tubesheets at an end with a gap between them (see item 2 in figure 11).

4.2.4.3.36.19.3 single**:** an indication the Exchanger_tubesheet is one tubesheet at an end (see item 1 in figure 11).

4.2.4.3.36.19.4 unspecified**:** an indication the Exchanger_tubesheet type is not specified.

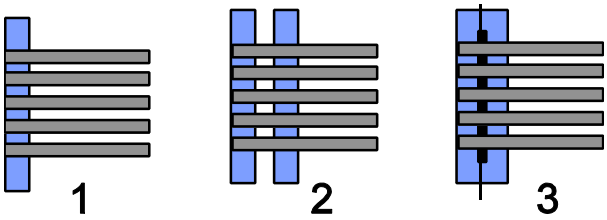


Figure 11 - Tubesheet types

4.2.4.3.37 Tubeside_design

A Tubeside_design is the design criteria on the tube side.

The data associated with Tubeside_design are the following:

— allowable_pressure_drop;

— allowable_tubesheet_stress;

— coefficient_method;

— corrosion_allowance;

— design_degree_of_symmetry;

— design_pressure;

— design_temperature;

— design_tube_alignment;

— film_coefficient;

— film_coefficient_multiplier;

— maximum_deviation_tubes_per_pass;

— maximum_tube_length;

— maximum_tube_passes;

— maximum_velocity;

— minimum_tube_length;

— minimum_tube_passes;

— minimum_ubend_diameter;

— minimum_velocity;

— pressure_drop_multiplier;

— test_pressure;

— tube_length_increment;

— tube_pass_increment;

— vacuum_service_design_pressure.

4.2.4.3.37.1 allowable_pressure_drop

An allowable_pressure_drop specifies the maximum allowable pressure drop on the tube side of the heat exchanger.

4.2.4.3.37.2 allowable_tubesheet_stress

An allowable_tubesheet_stress specifies the allowable Tubesheet (see 4.2.4.3.36) material stress for the heat exchanger.

4.2.4.3.37.3 coefficient_method

A coefficient_method specifies whether the Heat_transfer_coefficient (see 4.2.3.2.4) used in the tube side design is based on clean, dirty, or service conditions.

4.2.4.3.37.4 corrosion_allowance

A corrosion_allowance specifies the allowable corrosive thickness of the tube side material.

4.2.4.3.37.5 design_degree_of_symmetry

A design_degree_of_symmetry specifies an indicator of design degree of symmetry to centreline of the Tubesheet (see 4.2.4.3.36). The value of the design_degree_of_symmetry attribute shall be one of the following:

— non_symmetrical_to_centreline;

— symmetrical_to_centreline;

— unspecified.

4.2.4.3.37.5.1 non_symmetrical_to_centreline**:** an indication the Tubesheet (see 4.2.4.3.36) design is non-symmetrical to the centreline of the Tubesheet.

4.2.4.3.37.5.2 symmetrical_to_centreline**:** an indication the Tubesheet (see 4.2.4.3.36) design is symmetrical to the centreline of the Tubesheet.

4.2.4.3.37.5.3 unspecified**:** an indication the Tubesheet (see 4.2.4.3.36) design is not specified.

4.2.4.3.37.6 design_pressure

A design_pressure specifies the design pressure of the tube side of the heat exchanger.

4.2.4.3.37.7 design_temperature

A design_temperature specifies the design temperature of the tube side of the heat exchanger.

4.2.4.3.37.8 design_tube_alignment

A design_tube_alignment specifies an enumerated attribute indicating the type of tube alignment in the heat exchanger design. The value of the design_tube_alignment attribute shall be one of the following:

— full_alignment;

— none;

— semi_alignment;

— u_tube;

— unspecified.

4.2.4.3.37.8.1 full_alignment**:** an indication that the alignment of tube lattices is preserved in all directions between passes; in direction of flow, perpendicular to flow; and diagonally.

NOTE - In order to do this pass lanes are adjusted.

4.2.4.3.37.8.2 none**:** an indication that tube lattices are not aligned at all between passes.

NOTE - This gives the most tubes in shell.

4.2.4.3.37.8.3 semi_alignment**:** an indication that alignment of the tube lattice between passes is preserved only in the direction of flow and perpendicular flow.

4.2.4.3.37.8.4 u_tube**:** an indication that pass partition lanes are adjusted to give the minimum tube bend radius allowed.

4.2.4.3.37.8.5 unspecified**:** an indication that tube alignment is not specified.

4.2.4.3.37.9 film_coefficient

A film_coefficient specifies the film Heat_transfer_coefficient (see 4.2.3.2.4).

4.2.4.3.37.10 film_coefficient_multiplier

A film_coefficient_multiplier specifies the multiplier for the film coefficient of the tube side of the heat exchanger.

4.2.4.3.37.11 maximum_deviation_tubes_per_pass

A maximum_deviation_tubes_per_pass specifies the maximum percent deviation of tubes per pass.

4.2.4.3.37.12 maximum_tube_length

A maximum_tube_length specifies the maximum tube length of the heat exchanger.

4.2.4.3.37.13 maximum_tube_passes

A maximum_tube_passes specifies the maximum number of tube passes of the heat exchanger.

4.2.4.3.37.14 maximum_velocity

An maximum_velocity specifies the maximum limit for liquid or vapour velocity anywhere within the tube side of the heat exchanger.

4.2.4.3.37.15 minimum_tube_length

A minimum_tube_length specifies the minimum tube length of the heat exchanger.

4.2.4.3.37.16 minimum_tube_passes

A minimum_tube_passes specifies the minimum number of tube passes of the heat exchanger.

4.2.4.3.37.17 minimum_ubend_diameter

A minimum_ubend_diameter specifies the minimum U-bend diameter of the heat exchanger.

4.2.4.3.37.18 minimum_velocity

A minimum_velocity specifies the minimum limit for liquid or vapour velocity anywhere within the tube side of the heat exchanger.

4.2.4.3.37.19 pressure_drop_multiplier

A pressure_drop_multiplier specifies a multiplier applied to the calculated tube side pressure drop excluding the pressure drop through the Nozzles (see 4.2.4.2.5).

4.2.4.3.37.20 test_pressure

A test_pressure specifies the test pressure that the tube side of the heat exchanger is hydrotested at.

4.2.4.3.37.21 tube_length_increment

A tube_length_increment specifies the increment by which the tube length can be changed.

4.2.4.3.37.22 tube_pass_increment

A tube_pass_increment specifies an enumerated attribute indicating the type of increment for tube passes of the heat exchanger as any (odd or even), even, odd, or unspecified.

4.2.4.3.37.23 vacuum_service_design_pressure

A vacuum_service_design_pressure specifies the vacuum service design pressure for the tube side of the heat exchanger.

4.2.4.3.38 Tubeside_performance

A Tubeside_performance is the overall tube side performance of the heat exchanger.

The data associated with Tubeside_performance are the following:

— average_skin_temperature;

— bulk_film_coefficient;

— clean_pressure_drop;

— dirty_pressure_drop;

— fouling_resistance;

— fouling_thickness;

— inlet_velocity;

— midpoint_velocity;

— outlet_temperature;

— outlet_velocity;

— thermal_resistance;

— wall_film_coefficient;

— wall_temperature.

4.2.4.3.38.1 average_skin_temperature

An average_skin_temperature specifies the temperature of the tube inside fouling layer in tube side of a heat exchanger.

4.2.4.3.38.2 bulk_film_coefficient

A bulk_film_coefficient specifies the Heat_transfer_coefficient (see 4.2.3.2.4) between the bulk fluid and the fluid film for the tube side of a heat exchanger.

4.2.4.3.38.3 clean_pressure_drop

A clean_pressure_drop specifies the pressure drop of the clean tube side heat exchanger.

4.2.4.3.38.4 dirty_pressure_drop

A dirty_pressure_drop specifies the pressure drop of the dirty tube side heat exchanger.

4.2.4.3.38.5 fouling_resistance

A fouling_resistance specifies the thermal resistance of fouling layers on the tube side of the heat exchanger.

4.2.4.3.38.6 fouling_thickness

A fouling_thickness specifies the thickness of fouling layers on the tube side of the heat exchanger.

4.2.4.3.38.7 inlet_velocity

An inlet_velocity specifies the fluid velocity at the inlet of the heat exchanger.

4.2.4.3.38.8 midpoint_velocity

A midpoint_velocity specifies the velocity associated with the midpoint of the tube side of a heat exchanger.

4.2.4.3.38.9 outlet_temperature

An outlet_temperature specifies the outlet temperature of the tube side of the heat exchanger.

4.2.4.3.38.10 outlet_velocity

An outlet_velocity specifies the fluid velocity at the exit of the heat exchanger.

4.2.4.3.38.11 thermal_resistance

A thermal_resistance specifies the thermal resistance of the tube side of the heat exchanger.

4.2.4.3.38.12 wall_film_coefficient

A wall_film_coefficient specifies the value of the convective Heat_transfer_coefficient (see 4.2.3.2.4) at the tube wall on the tube side of a heat exchanger.

4.2.4.3.38.13 wall_temperature

A wall_temperature specifies the inside wall temperature of the tube on the tube side of a heat exchanger.

4.2.4.3.39 U_bend_support

An U_bend_support is the support plates or grids that are used to give additional support to the tubes at the U-bend.

The data associated with U_bend_support are the following:

— angle;

— type.

4.2.4.3.39.1 angle

An angle specifies the angle of the U_bend_support to the axis of the U-bend.

4.2.4.3.39.2 type

A type specifies an enumerated attribute giving the type of U-bend support as full support, none, two supports with vertical cut windows, vibration support, or unspecified.

NOTE - A vibration support is a support made of pieces for each tube row that are fitted in the U-bends during construction.

4.2.4.3.40 Vapour_belt

A Vapour_belt (see figure 12) is a cylinder of larger diameter than the shell cylinder, centrally located two separate shell cylinders that aids in the distribution of a vapour into the shell side of a heat exchanger.

The data associated with Vapour_belt are the following:

— inside_diameter;

— length;

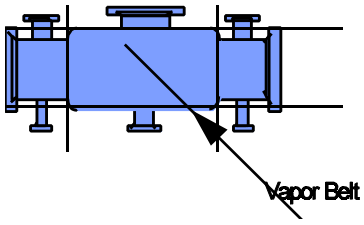


Figure 12 - Vapour belt

— outside_diameter;

— radial_clearance;

— slot_area.

4.2.4.3.40.1 inside_diameter

An inside_diameter specifies the inside diameter of the Vapour_belt cylinder.

4.2.4.3.40.2 length

A length specifies the overall length of the Vapour_belt cylinder.

4.2.4.3.40.3 outside_diameter

An outside_diameter specifies the outside diameter of the Vapour_belt cylinder.

4.2.4.3.40.4 radial_clearance

A radial_clearance specifies the radial clearance of the Vapour_belt inside diameter to the shell inside diameter.

4.2.4.3.40.5 slot_area

A slot_area specifies the total area of the distribution slots in the Vapour_belt.

4.2.4.4 mass_transfer_equipment_data

Refer to 4.1.5 for a description of what this UoF specifies. The ARM diagrams related to this UoF are provided as figures G.10 through G.15 in annex G of this part to ISO 10303.

4.2.4.4.1 Active_area_shape

An Active_area_shape is that region of the Tray_panel (see 4.2.4.4.59) where good vapour and liquid contact is achieved. The shape is described by a Perimeter (see 4.2.4.4.34).

NOTE - There may be several active areas on a Tray_panel and they need not be contiguous.

4.2.4.4.2 Baffle_and_disengaging_panel_intersection

A Baffle_and_disengaging_panel_intersection is the layout of a baffle on a downcomer disengaging panel. The intersection is described by a Curve (see 4.2.4.4.13) or length.

The data associated with Baffle_and_disengaging_panel_intersection are the following:

— length.

A length specifies the horizontal baffle dimension on the downcomer disengaging panel.

4.2.4.4.3 Baffle_and_seal_pan_intersection

A Baffle_and_seal_pan_intersection is the layout of a baffle on a Seal_pan (see 4.2.4.4.39). The intersection is described by a Curve (see 4.2.4.4.13) or length.

The data associated with Baffle_and_seal_pan_intersection are the following:

— length.

A length specifies the horizontal baffle dimension on the Seal_pan (see 4.2.4.4.39).

4.2.4.4.4 Baffle_and_tray_panel_intersection

A Baffle_and_tray_panel_intersection is the layout of a baffle on a tray panel. The intersection is described by a Curve (see 4.2.4.4.13) or length.

The data associated with Baffle_and_tray_panel_intersection are the following:

— length.

A length specifies the horizontal baffle dimension on the tray panel.

4.2.4.4.5 Blinding_strip

A Blinding_strip is an unperforated plate that is attached to a separation tray so as to cover some perforations and tray slots.

NOTE - This increases the vapour load to uncovered perforations and tray slots.

4.2.4.4.6 Blinding_strip_shape

A Blinding_strip_shape is described by a Perimeter (see 4.2.4.4.34) and indicates the number of blinded perforations or tray slots.

4.2.4.4.7 Bubble_cap

A Bubble_cap is a type of perforation cover that reverses the vapour flow up through the riser down in the annular space between the riser and the cap and into the liquid surrounding the cap on the top of the Tray_panel (see 4.2.4.4.59).

4.2.4.4.8 Bubble_cap_shape

A Bubble_cap_shape is composed of a riser and a cap. The riser creates a weir for each perforation and is covered by a cap to reverse the vapour flow.

The data associated with Bubble_cap_shape are the following:

— type_code;

— type_name.

4.2.4.4.8.1 type_code

A type_code specifies a descriptive code for identifying various Bubble_caps (see 4.2.4.4.7).

4.2.4.4.8.2 type_name

A type_name specifies a textual labeling convention for various types of Bubble_caps (see 4.2.4.4.7).

4.2.4.4.9 Bubble_slot_shape

A Bubble_slot_shape is described by a Perimeter (see 4.2.4.4.34) and the distance from the bottom of the cap to the bottom of the bubble slot.

The data associated with Bubble_slot_shape are the following:

— distance_from_bottom_of_cap.

A distance_from_bottom_of_cap specifies the distance the bottom of the cap is from the tray deck.

4.2.4.4.10 Cap_shape

A Cap_shape is characterized by its height, the number of bubble slots in the cap, and the number of serrations in the bottom edge of the cap.

The data associated with Cap_shape are the following:

— height;

— number_of_bubble_slots;

— number_of_serrations_in_bottom_edge.

4.2.4.4.10.1 height

A height specifies the physical height or dimension of the cap.

4.2.4.4.10.2 number_of_bubble_slots

A number_of_bubble_slots specifies the numeric quantity of bubble slots in the cap circumference.

4.2.4.4.10.3 number_of_serrations_in_bottom_edge

A number_of_serrations_in_bottom_edge specifies a rate of serrations expressed as the number of serrations per unit length in the bottom edge of the cap.

4.2.4.4.11 Cartesian_point

A Cartesian_point is the rectangular coordinates for a particular point on a tray.

4.2.4.4.12 Corrugation

A Corrugation is the design for a type of Tray_panel (see 4.2.4.4.59) as described by a corrugation_type, height, and length or by a Curve (see 4.2.4.4.13).

The data associated with Corrugation are the following:

— height;

— length;

— type.

4.2.4.4.12.1 height

A height specifies the vertical height of the Corrugation.

4.2.4.4.12.2 length

A length specifies the horizontal length for each Corrugation that may also be described as a Curve (see 4.2.4.4.13).

4.2.4.4.12.3 type

A type specifies an enumerated attribute that indicates the Corrugation is triangular, rectangular, sinusoidal, or an other shape.

4.2.4.4.13 Curve

A Curve is the particular shape used to describe a geometric form or intersection.

4.2.4.4.14 Demister_pad

A Demister_pad is a circular pad located above the top tray used to separate liquid particles from the vapour.

4.2.4.4.15 Demister_pad_stack

A Demister_pad_stack is a group of Demister_pads (see 4.2.4.4.14) stacked together for disengaging liquid particles from the vapour.

4.2.4.4.16 Disengaging_panel_opening_shape

A Disengaging_panel_opening_shape is any area for liquid flow lost to Tray_support (see 4.2.4.4.65) such as a support ring.

4.2.4.4.17 Downcomer

A Downcomer is an aggregate of a downcomer disengaging panel with one or more disengaging panel openings and one or more downcomer aprons.

4.2.4.4.18 Downcomer_apron_section_shape

A Downcomer_apron_section_shape is characterized by a vertical height and a horizontal pitch that is always such that the cross-sectional area of the flow channel will be smaller at the bottom of the Downcomer (see 4.2.4.4.17) apron section that at the top.

The data associated with Downcomer_apron_section_shape are the following:

— apron_section_number_from_top;

— horizontal_pitch;

— vertical_height.

4.2.4.4.18.1 apron_section_number_from_top

An apron_section_number_from_top specifies the particular apron section.

4.2.4.4.18.2 horizontal_pitch

A horizontal_pitch specifies the angle for making the Downcomer (see 4.2.4.4.17) wall smaller at its base than at the top.

4.2.4.4.18.3 vertical_height

A vertical_height specifies the apron section vertical height.

4.2.4.4.19 Downcomer_apron_shape

A Downcomer_apron_shape is characterized by the combination of section shapes, either perfectly vertical or angled from vertical.

The data associated with Downcomer_apron_shape are the following:

— number_of_apron_sections.

A number_of_apron_sections specifies the total number of sections required for the complete Downcomer_apron_shape.

4.2.4.4.20 Downcomer_disengaging_panel_shape

A Downcomer_disengaging_panel_shape is the geometric features described by a Perimeter (see 4.2.4.4.34).

4.2.4.4.21 Downcomer_hydraulics

A Downcomer_hydraulics is the fluid flow dynamics in the Downcomer (see 4.2.4.4.17).

The data associated with Downcomer_hydraulics are the following:

— clear_liquid_height;

— flooding_safety_factor;

— froth_height;

— liquid_height_at_flood_point;

— liquid_residence_time;

— liquid_velocity_at_top;

— maximum_liquid_height;

— maximum_liquid_velocity.

4.2.4.4.21.1 clear_liquid_height

A clear_liquid_height specifies the height of the liquid containing no vapour or froth at the bottom of the Downcomer (see 4.2.4.4.17).

4.2.4.4.21.2 flooding_safety_factor

A flooding_safety_factor specifies the percentage safety factor built into the Downcomer (see 4.2.4.4.17) design to estimate flooding conditions when the Downcomer is handling maximum liquid flow.

4.2.4.4.21.3 froth_height

A froth_height specifies the level of froth over the clear liquid inside the Downcomer (see 4.2.4.4.17).

4.2.4.4.21.4 liquid_height_at_flood_point

A liquid_height_at_flood_point specifies the liquid height in the Downcomer (see 4.2.4.4.17) at the point of flooding.

4.2.4.4.21.5 liquid_residence_time

A liquid_residence_time specifies the holdup time required for liquid flow through the Downcomer (see 4.2.4.4.17).

4.2.4.4.21.6 liquid_velocity_at_top

A liquid_velocity_at_top specifies the velocity of the liquid flow at the top of the Downcomer (see 4.2.4.4.17) and as it enters the Downcomer.

4.2.4.4.21.7 maximum_liquid_height

A maximum_liquid_height specifies the maximum possible liquid height inside the Downcomer (see 4.2.4.4.17).

4.2.4.4.21.8 maximum_liquid_velocity

A maximum_liquid_velocity specifies the maximum liquid velocity possible inside the Downcomer (see 4.2.4.4.17).

4.2.4.4.22 Downcomer_liquid_flow_channel_shape

A Downcomer_liquid_flow_channel_shape is described by the volume and the Perimeter (see 4.2.4.4.34) at the top and bottom of the channel.

NOTE - The shape is confined by the Downcomer (see 4.2.4.4.17) apron section.

The data associated with Downcomer_liquid_flow_channel_shape are the following:

— volume.

A volume specifies the size of the Downcomer (see 4.2.4.4.17) liquid flow channel.

4.2.4.4.23 Downcomer_shape

A Downcomer_shape is the geometric features of a Downcomer (see 4.2.4.4.17).

The data associated with Downcomer_shape are the following:

— downcomer_location_type.

A downcomer_location_type specifies the location of the Downcomer (see 4.2.4.4.17) disengaging panel on the Separation_tray (see 4.2.4.4.49) and is either a side downcomer, a centre downcomer, or an off-centre downcomer.

4.2.4.4.24 Escape_area_shape

An Escape_area_shape is that portion of the tray used for vapour escape. It is described by a Perimeter (see 4.2.4.4.34).

4.2.4.4.25 Flashing_feed_gallery

A Flashing_feed_gallery is a type of Separation_packing_component (see 4.2.4.4.44) that is a specification of the characteristics of feed spargers used with Separation_packing (see 4.2.4.4.43).

The data associated with Flashing_feed_gallery are the following:

— diameter;

— length;

— sparge_opening.

4.2.4.4.25.1 diameter

A diameter specifies the numeric size of the pipe used to feed the Separation_tower (see 4.2.4.4.47).

NOTE - This value is usually expressed in inches or millimeters.

4.2.4.4.25.2 length

A length specifies the numeric dimension of the internal feed pipe for the Separation_tower (see 4.2.4.4.47).

NOTE - This value is usually expressed in inches, feet, millimeters, or meters.

4.2.4.4.25.3 sparge_opening

A sparge_opening specifies the opening in the internal feed pipe. This allows the feed to the Separation_-tower (see 4.2.4.4.47) to be deposited onto the internal packing via a separation packing distributor or a separation packing re-distributor. The sparge_opening is a numeric value usually specified as either a rectangular opening or as a specific number of holes of some specified diameter.

4.2.4.4.26 Mass_transfer_equipment

A Mass_transfer_equipment is a type of Process_equipment (see 4.2.4.2.8) that is used to transfer Process_material (see 4.2.2.4.13) from one Phase (see 4.2.2.2.15) to another Phase.

The data associated with Mass_transfer_equipment are the following:

— type.

A type specifies the various types of equipment that are used to transfer Process_material (see 4.2.2.4.13) from one Phase (see 4.2.2.2.15) to another.

EXAMPLE 59 - A type of mass transfer equipment are separation towers.

4.2.4.4.27 Matched_perimeter_segments

A Matched_perimeter_segments is exactly two Perimeter (see 4.2.4.4.34) segments, one from one Perimeter and one from another Perimeter, that are in common. Each segment should have an association with the same lengths.

4.2.4.4.28 Packing_stack

A Packing_stack is the object class name given to the link attributes between Separation_packing (see 4.2.4.4.43) and Separation_packing_stack (see 4.2.4.4.46).

The data associated with Packing_stack are the following:

— section_number_from_bottom_of_stack;

— section_number_from_top_of_stack.

4.2.4.4.28.1 section_number_from_bottom_of_stack

A section_number_from_bottom_of_stack specifies the Separation_packing (see 4.2.4.4.43) section number when counting from the bottom to the top of the Separation_packing_stack (see 4.2.4.4.46).

4.2.4.4.28.2 section_number_from__top_of_stack

A section_number_from_top_of_stack specifies the Separation_packing (see 4.2.4.4.43) section number when counting from the top to the bottom of the Separation_packing_stack (see 4.2.4.4.46).

4.2.4.4.29 Pad_and_pad_stack

A Pad_and_pad_stack is the total number of Demister_pads (see 4.2.4.4.14) used in the column.

The data associated with Pad_and_pad_stack are the following:

— pad_number_from_bottom_of_stack;

— pad_number_from_top_of_stack.

4.2.4.4.29.1 pad_number_from_bottom_of_stack

A pad_number_from_bottom_of_stack specifies the number of the pad when counting from the bottom to the top.

4.2.4.4.29.2 pad_number_from_top_of_stack

A pad_number_from_top_of_stack specifies the number of the pad when counting from the top to the bottom.

4.2.4.4.30 Pattern

A Pattern is the layout of the perforations on the Tray_panel (see 4.2.4.4.59).

The data associated with Pattern are the following:

— description;

— name;

— pitch_separation_distance;

— pitch_type.

4.2.4.4.30.1 description

A description specifies a textual explanation or summary for the perforation layout.

4.2.4.4.30.2 name

A name specifies the unique textual label for the perforation layout.

4.2.4.4.30.3 pitch_separation_distance

A pitch_separation_distance specifies the separation distance for the particular pitch pattern.

4.2.4.4.30.4 pitch_type

A pitch_type specifies an enumerated attribute that designates the pitch as triangular, square, rectangular, radial, or an other pitch.

4.2.4.4.31 Perforation_cover

A Perforation_cover is on the top of the tray to help prevent downward liquid flow through the perforation as the vapour Phase (see 4.2.2.2.15) flows upward.

4.2.4.4.32 Perforation_cover_shape

A Perforation_cover_shape is either a Bubble_cap (see 4.2.4.4.7) or a Valve_cap (see 4.2.4.4.67).

4.2.4.4.33 Perforation_shape

A Perforation_shape is described by a geometry that includes the top edge and bottom edge geometry.

The data associated with Perforation_shape are the following:

— bottom_edge;

— top_edge.

4.2.4.4.33.1 bottom_edge

A bottom_edge specifies an enumerated attribute that indicates whether the bottom edge of the perforation is sharp or smooth.

4.2.4.4.33.2 top_edge

A top_edge specifies an enumerated attribute that indicates whether the top edge of the perforation is sharp or smooth.

4.2.4.4.34 Perimeter

A Perimeter is the edges of a bounded surface.

The data associated with Perimeter are the following:

— length;

— number_of_perimeter_segments;

— surface_area_enclosed.

4.2.4.4.34.1 length

A length specifies the numeric total length of all Perimeter_segments (see 4.2.4.4.35).

4.2.4.4.34.2 number_of_perimeter_segments

A number_of_perimeter_segments specifies the aggregate quantity of segments included in the Perimeter.

4.2.4.4.34.3 surface_area_enclosed

A surface_area_enclosed specifies the total area enclosed by the Perimeter.

4.2.4.4.35 Perimeter_segment

A Perimeter_segment is described by a Curve (see 4.2.4.4.13).

The data associated with Perimeter_segment are the following:

— length;

— liquid_flow_status;

— segment_number.

4.2.4.4.35.1 length

A length specifies the total length of each Perimeter_segment.

4.2.4.4.35.2 liquid_flow_status

A liquid_flow_status specifies an enumerated attribute that designates the Perimeter_segment as a barrier edge (no flow), an inlet flow edge, or an outlet flow edge.

4.2.4.4.35.3 segment_number

A segment_number specifies the identification for each Perimeter_segment.

> NOTE - Many Perimeter_segments may be described by the same Curve (see 4.2.4.4.13) and they need not be contiguous.

4.2.4.4.36 Pressure_equalization_channel_shape

A Pressure_equalization_channel_shape is described by a length and a channel cross-section described by a Perimeter (see 4.2.4.4.34).

The data associated with Pressure_equalization_channel_shape are the following:

— length.

A length specifies the numeric length of the pressure equalization channel.

4.2.4.4.37 Riser_and_tray_panel_shape

A Riser_and_tray_panel_shape is the geometric description of the Bubble_cap (see 4.2.4.4.7) riser and the Tray_panel_shape (see 4.2.4.4.63) characterized by the rise above the panel top.

The data associated with Riser_and_tray_panel_shape are the following:

— rise_above_panel_top.

A rise_above_panel_top specifies the difference between the rise above base and the thickness of the material from which the Tray_panel (see 4.2.4.4.59) is made.

4.2.4.4.38 Riser_shape

A Riser_shape is described by Perimeters (see 4.2.4.4.34).

The data associated with Riser_shape are the following:

— rise_above_base;

— width_of_base.

4.2.4.4.38.1 rise_above_base

A rise_above_base specifies the distance from the top of the expanded base to the top of the riser.

4.2.4.4.38.2 width_of_base

A width_of_base specifies the dimension such that the riser will fit up through the perforation but the expanded base will seal against the bottom of the Tray_panel (see 4.2.4.4.59).

4.2.4.4.39 Seal_pan

A Seal_pan is used to redirect liquid across the Separation_tray (see 4.2.4.4.49) to help provide a liquid seal to prevent the vapour from flowing upward through the liquid flow channel.

> NOTE - The Seal_pan is located beneath the liquid flow channels, has no perforations, and may have recessed areas to collect liquid and aid in the creation of an effective liquid seal.

4.2.4.4.40 Seal_pan_recess_shape

A Seal_pan_recess_shape is described by a Perimeter (see 4.2.4.4.34) and is used to collect liquid and aid in the creation of a liquid seal.

The data associated with Seal_pan_recess_shape are the following:

— recess_depth.

A recess_depth specifies the vertical depth of the recessed area.

4.2.4.4.41 Seal_pan_shape

A Seal_pan_shape is a geometry described by a Perimeter (see 4.2.4.4.34) and is dependent on whether the liquid flow is chordal, radial, or reverse.

The data associated with Seal_pan_shape are the following:

— seal_pan_location_type.

A seal_pan_location_type specifies an enumerated attribute that indicates that the Seal_pan (see 4.2.4.4.39) is a side, centre, or off-centre Seal_pan.

4.2.4.4.42 Separation_efficiency

A Separation_efficiency is the percentage efficiency for a Separation_tray (see 4.2.4.4.49) between the theoretical and actual separation within the Separation_tower (see 4.2.4.4.47).

The data associated with Separation_efficiency are the following:

— efficiency_method;

— efficiency_type;

— efficiency_value.

4.2.4.4.42.1 efficiency_method

An efficiency_method specifies an enumerated attribute that indicates whether the method used is an uncorrected Murphree plate efficiency or a corrected Murphree plate efficiency.

4.2.4.4.42.2 efficiency_type

An efficiency_type specifies the effects of liquid entrainment by the vapour Phase (see 4.2.2.2.15).

4.2.4.4.42.3 efficiency_value

An efficiency_value specifies the percentage number that specifies the Separation_efficiency.

NOTE - This value is usually between 50 and 100 percent.

4.2.4.4.43 Separation_packing

A Separation_packing is a type of Separation_tower_internal (see 4.2.4.4.48) whose purpose is to contact a liquid Phase (see 4.2.2.2.15) and a vapour Phase, generally to effect mass transfer between the phases.

The data associated with Separation_packing are the following:

— bed_volume;

— bed_weight;

— differential_pressure;

— head_pressure;

— height_equivalent_to_a_theoretical_plate;

— manufacturer;

— maximum_liquid_loading;

— maximum_vapour_loading;

— name;

— packing_factor;

— percent_of_design;

— type.

4.2.4.4.43.1 bed_volume

A bed_volume specifies the volume that a packing_section occupies within a Separation_tower (see 4.2.4.4.47).

EXAMPLE 60 - Volume may be expressed in gallons, liters, cubic feet, cubic meters, etc.

4.2.4.4.43.2 bed_weight

A bed_weight specifies the mass for a packing_section within a Separation_tower (see 4.2.4.4.47).

EXAMPLE 61 - Weight may be expressed in pounds, kilograms, etc.

4.2.4.4.43.3 differential_pressure

A differential_pressure specifies the change in pressure within the Separation_tower (see 4.2.4.4.47) between the pressure at the top of the Separation_tower and the pressure at the bottom of the Separation_tower.

4.2.4.4.43.4 head_pressure

A head_pressure specifies the operating pressure within the Separation_tower (see 4.2.4.4.47).

NOTE - This pressure measurement is taken at the top of the Separation_tower.

4.2.4.4.43.5 height_equivalent_to_a_theoretical_plate

A height_equivalent_to_a_theoretical_plate specifies a calculated value for the height of packing as a function of theoretical stages in a simulation model for the Separation_tower (see 4.2.4.4.47).

4.2.4.4.43.6 manufacturer

A manufacturer specifies the particular name of the company that produces the Separation_packing used inside the Separation_tower (see 4.2.4.4.47).

4.2.4.4.43.7 maximum_liquid_loading

A maximum_liquid_loading specifies a calculated value that specifies the maximum liquid rate for the packing.

NOTE - This calculated value is a function of the tower geometry, specific characteristics of the packing, and physical properties of the liquid.

4.2.4.4.43.8 maximum_vapour_loading

A maximum_vapour_loading specifies a calculated value that specifies the maximum vapour rate for the packing.

NOTE - This calculated value is a function of the tower geometry, specific characteristics of the packing, and physical properties of the vapour.

4.2.4.4.43.9 name

A name specifies the manufacturer's nomenclature for the type of Separation_packing used inside the Separation_tower (see 4.2.4.4.47).

4.2.4.4.43.10 packing_factor

A packing_factor specifies a numeric value that is characterized by the size and type of packing and is used to calculate column_differential_pressure values.

4.2.4.4.43.11 percent_of_design

A percent_of_design specifies the ratio of the normal operating rate to the design operating rate for the Separation_packing.

4.2.4.4.43.12 type

A type specifies an enumerated attribute that designates a Separation_packing to be random_packing, structural_packing, or wire_mesh_packing.

EXAMPLE 62 - Examples of these enumerated types are: random_packing - 'Raschig Ring' or 'Intalox Saddle'; structural_packing - 'Koch Flexipac'; wire_mesh_packing - 'Koch Sulzer'.

4.2.4.4.44 Separation_packing_component

A Separation_packing_component is a type of Separation_tower_internal (see 4.2.4.4.48) that is one or more components of Separation_packing (see 4.2.4.4.43). Each Separation_packing_component may be one of the following: a Flashing_feed_gallery (see 4.2.4.4.25) or a Separation_packing_internal (see 4.2.4.4.45).

The data associated with Separation_packing_component are the following:

— type.

A type specifies the types of components that make up Separation_packing including Separation_-packing_internal (see 4.2.4.4.45) and Flashing_feed_gallery (see 4.2.4.4.25).

4.2.4.4.45 Separation_packing_internal

A Separation_packing_internal is a type of Separation_packing_component (see 4.2.4.4.44) that is a specification of the characteristics and types of internals used with Separation_packing (see 4.2.4.4.43).

The data associated with Separation_packing_internal are the following:

— access_diameter;

— corrosion_allowance;

— support_ledge;

— type.

4.2.4.4.45.1 access_diameter

An access_diameter specifies the numeric size of the Separation_packing_internal. This numeric size is usually expressed as inches, feet, meters, or centimeters and represents the diameter of that particular internal.

4.2.4.4.45.2 corrosion_allowance

A corrosion_allowance specifies a numeric value for additional material thickness to accommodate the ratio of corrosion over time. This value is usually added to the code thickness determination to specify the total thickness for that particular Separation_packing_internal.

4.2.4.4.45.3 support_ledge

A support_ledge specifies the size of a ring of material that is attached to the Separation_tower (see 4.2.4.4.47) internal wall and is used to support the specific Separation_packing_internal.

4.2.4.4.45.4 type

A type specifies an enumerated attribute that designates a Separation_packing_component (see 4.2.4.4.44) to be a separation packing support plate, a separation packing hold down plate, a separation packing liquid distributor, a separation packing liquid re-distributor, a separation packing bed limiter, or a separation packing collector tray.

4.2.4.4.46 Separation_packing_stack

A Separation_packing_stack is a type of Separation_tower_internal (see 4.2.4.4.48) that is a collection of one or more Separation_packing (see 4.2.4.4.43) in a vertical arrangement.

NOTE - The gross flow of the liquid Phase (see 4.2.2.2.15) is from the top to the bottom of the Separation_packing_stack while the vapour Phase gross flow is from the bottom to the top.

The data associated with Separation_packing_stack are the following:

— diameter;

— height;

— number_of_stacks;

— section_number.

4.2.4.4.46.1 diameter

A diameter specifies the numeric value for the cross-sectional dimension for the Separation_packing_stack.

NOTE - This value is usually expressed in units of length such as feet, inches, meters, or centimeters.

4.2.4.4.46.2 height

A height specifies the individual thickness of each packing section within the Separation_packing_stack.

EXAMPLE 63 - An example of this numeric value is: section 1 height is 10.0 feet or 3.048 meters.

4.2.4.4.46.3 number_of_stacks

A number_of_stacks specifies the total number of Separation_packing (see 4.2.4.4.43) sections in the Separation_tower (see 4.2.4.4.47).

4.2.4.4.46.4 section_number

A section_number specifies the location of that specific packing section within the total Separation_packing_stack.

EXAMPLE 64 - An example is: packing section number 2 or packing section 2 of 5.

4.2.4.4.47 Separation_tower

A Separation_tower is a type of Process_equipment (see 4.2.4.2.8) generally used to perform a chemical separation that is a composite of one or more Cylindrical_pressure_vessels (see 4.2.4.6.9) and zero or more Separation_tower_internals (see 4.2.4.4.48).

The data associated with Separation_tower are the following:

— number_of_demister_pad_stacks;

— number_of_demister_pads;

— number_of_separate_tray_stacks;

— number_of_separation_packing_stacks;

— type.

4.2.4.4.47.1 number_of_demister_pad_stacks

A number_of_demister_pad_stacks specifies the numeric quantity of Demister_pad_stacks (see 4.2.4.4.15) within the Separation_tower.

4.2.4.4.47.2 number_of_demister_pads

A number_of_demister_pads specifies the number of Demister_pads (see 4.2.4.4.14) within each set of Demister_pad_stacks (see 4.2.4.4.15).

4.2.4.4.47.3 number_of_separate_tray_stacks

A number_of_separate_tray_stacks specifies the assembly of one or more Separation_trays (see 4.2.4.4.49) in a vertical arrangement.

4.2.4.4.47.4 number_of_separation_packing_stacks

A number_of_separation_packing_stacks specifies the number of different Separation_packing_stacks (see 4.2.4.4.46) within a Separation_tower.

4.2.4.4.47.5 type

A type specifies an enumerated attribute that designates a Separation_tower to be a distillation column, extraction column, stripping column, rectifying column, splash tower, spray tower, wetted-wall column, absorption column, or an other column.

4.2.4.4.48 Separation_tower_internal

A Separation_tower_internal is a type of Process_equipment (see 4.2.4.2.8) made of Construction_-material (see 4.2.2.4.5) that permanently resides inside the Cylindrical_pressure_vessel (see 4.2.4.6.9). Each Separation_tower_internal may be one of the following: a Separation_packing (see 4.2.4.4.43), a Separation_packing_component (see 4.2.4.4.44), a Separation_packing_stack (see 4.2.4.4.46), a Separation_tray (see 4.2.4.4.49), a Separation_tray_component (see 4.2.4.4.52), or a Separation_tray_-stack (see 4.2.4.4.55).

The data associated with Separation_tower_internal are the following:

— type.

A type specifies composites of other Separation_tower_internals.

EXAMPLE 65 - Other internals include Separation_tray_stacks (see 4.2.4.4.55) that are composites of Separation_trays (see 4.2.4.4.49) that are composites of Separation_tray_components (see 4.2.4.4.52).

4.2.4.4.49 Separation_tray

A Separation_tray is a type of Separation_tower_internal (see 4.2.4.4.48) whose purpose is to contact a liquid Phase (see 4.2.2.2.15) and vapour Phase, generally to effect mass transfer, but occasionally to effect heat transfer between the Phases.

4.2.4.4.50 Separation_tray_baffle

A Separation_tray_baffle is a vertical barrier that is placed in the liquid flow to force the liquid to flow around the barrier.

NOTE - There may be a number of baffles on a Separation_tray (see 4.2.4.4.49) and they may reside on the Tray_panels (see 4.2.4.4.59), Seal_pans (see 4.2.4.4.39), and the Downcomer (see 4.2.4.4.17) disengaging panels.

4.2.4.4.51 Separation_tray_baffle_shape

A Separation_tray_baffle_shape is the geometric features of a baffle.

The data for Separation_tray_baffle_shape are the following:

— attachment_method;

— disengaging_panel_intersection_length;

— height;

— seal_pan_intersection_length;

— tray_panel_intersection_length.

4.2.4.4.51.1 attachment_method

An attachment_method specifies an enumerated attribute that indicates whether the baffle is welded, extends between tray components, or is bolted.

4.2.4.4.51.2 disengaging_panel_intersection_length

A disengaging_panel_intersection_length specifies the length of the intersection between the Separation_tray_baffle (see 4.2.4.4.50) and the disengaging panel.

4.2.4.4.51.3 height

A height specifies the vertical distance from the Separation_tray (see 4.2.4.4.49) to the top of the Separation_tray_baffle (see 4.2.4.4.50).

4.2.4.4.51.4 seal_pan_intersection_length

A seal_pan_intersection_length specifies the length of the intersection between the Separation_tray_-baffle (see 4.2.4.4.50) and the Seal_pan (see 4.2.4.4.39).

4.2.4.4.51.5 tray_panel_intersection_length

A tray_panel_intersection_length specifies the length of the intersection between the Separation_tray_-baffle (see 4.2.4.4.50) and the Tray_panel (see 4.2.4.4.59).

4.2.4.4.52 Separation_tray_component

A Separation_tray_component is a type of Separation_tower_internal (see 4.2.4.4.48) that is one or more components of Separation_trays (see 4.2.4.4.49).

The data associated with Separation_tray_component are the following:

— type.

A type specifies the types of components that make up a Separation_tray (see 4.2.4.4.49) including Seal_-pans (see 4.2.4.4.39), Tray_panels (see 4.2.4.4.59), Downcomers (see 4.2.4.4.17), Perforation_covers (see 4.2.4.4.31), and Weirs (see 4.2.4.4.69).

4.2.4.4.53 Separation_tray_hydraulics

A Separation_tray_hydraulics is a description of the hydraulic features of the Separation_tray (see 4.2.4.4.49).

The data associated with Separation_tray_hydraulics are the following:

— absorption_factor;

— capacity_parameter;

— dry_tray_pressure_drop;

— entrainment_rate;

— flow_parameter;

— fractional_entrainment;

— jet_flood_vapour_load_at_constant_liquid_flow;

— jet_flood_vapour_load_at_constant_molar_overflow;

— liquid_height;

— liquid_residence_time;

— percentage_probability_of_flooding;

— safety_factor_for_flooding;

— tray_pressure_drop;

— vapour_capacity_factor;

— vapour_load_at_dump_point;

— vapour_load_at_weep_point;

— vapour_load_limit;

— vapour_residence_time;

— weep_fraction;

— weep_rate.

4.2.4.4.53.1 absorption_factor

An absorption_factor specifies the rate of absorption on each Separation_tray (see 4.2.4.4.49).

4.2.4.4.53.2 capacity_parameter

A capacity_parameter specifies the hydraulic capacity for each Separation_tray (see 4.2.4.4.49).

4.2.4.4.53.3 dry_tray_pressure_drop

A dry_tray_pressure_drop specifies the pressure drop across the Separation_tray (see 4.2.4.4.49) when there is no liquid on the Separation_tray.

4.2.4.4.53.4 entrainment_rate

An entrainment_rate specifies the rate of liquid entrainment in the vapour on each Separation_tray (see 4.2.4.4.49).

4.2.4.4.53.5 flow_parameter

A flow_parameter specifies the hydraulic flow across the Separation_tray (see 4.2.4.4.49).

4.2.4.4.53.6 fractional_entrainment

A fractional_entrainment specifies the portion of liquid entrainment in the vapour flow rate.

4.2.4.4.53.7 jet_flood_vapour_load_at_constant_liquid_flow

A jet_flood_vapour_load_at_constant_liquid_flow specifies the maximum vapour flow rate at a particular constant liquid flow rate.

4.2.4.4.53.8 jet_flood_vapour_load_at_constant_molar_overflow

A jet_flood_vapour_load_at_constant_molar_overflow specifies a maximum vapour flow rate at a constant molar liquid flow on the Separation_tray (see 4.2.4.4.49).

4.2.4.4.53.9 liquid_height

A liquid_height specifies the hydraulic liquid depth on the Separation_tray (see 4.2.4.4.49).

NOTE - The liquid_height varies across the Separation_tray due to a hydraulic gradient that enables liquid flow across the Separation_tray.

4.2.4.4.53.10 liquid_residence_time

A liquid_residence_time specifies the time that the liquid is on the Separation_tray_structural_-component (see 4.2.4.4.56).

4.2.4.4.53.11 percentage_probability_of_flooding

A percentage_probability_of_flooding specifies a percentage value indicating the probability for tray flooding.

4.2.4.4.53.12 safety_factor_for_flooding

A safety_factor_for_flooding specifies the design safety factor for the Separation_tray (see 4.2.4.4.49) to prevent liquid flooding.

4.2.4.4.53.13 tray_pressure_drop

A tray_pressure_drop specifies the pressure drop across the Separation_tray (see 4.2.4.4.49) when it is operating with normal hydraulic liquid flows.

4.2.4.4.53.14 vapour_capacity_factor

A vapour_capacity_factor specifies a numeric value indicating the vapour capacity of the Separation_tray (see 4.2.4.4.49) and how close the design approaches this value.

4.2.4.4.53.15 vapour_load_at_dump_point

A vapour_load_at_dump_point specifies the reduced vapour load when the Separation_tray (see 4.2.4.4.49) begins to dump liquid down the Separation_tower (see 4.2.4.4.47).

4.2.4.4.53.16 vapour_load_at_weep_point

A vapour_load_at_weep_point specifies the vapour load at the point that weeping begins to occur on the Separation_tray (see 4.2.4.4.49).

NOTE - Weeping is when liquid starts flowing down through the perforation.

4.2.4.4.53.17 vapour_load_limit

A vapour_load_limit specifies the upper vapour flow rate limit for the Separation_tray (see 4.2.4.4.49).

4.2.4.4.53.18 vapour_residence_time

A vapour_residence_time specifies the time it takes for the vapour to pass through the liquid on the Separation_tray (see 4.2.4.4.49).

4.2.4.4.53.19 weep_fraction

A weep_fraction specifies the portion of weeping that occurs on each Separation_tray (see 4.2.4.4.49) at design conditions.

4.2.4.4.53.20 weep_rate

A weep_rate specifies the flow rate for tray weeping on each Separation_tray (see 4.2.4.4.49).

4.2.4.4.54 Separation_tray_shape

A Separation_tray_shape is the geometric feature that describes the shape of the Separation_tray (see 4.2.4.4.49). The Separation_tray_shape may have a Perimeter (see 4.2.4.4.34) and is described by an aggregation of one or more Tray_panel_shapes (see 4.2.4.4.63), zero or more Seal_pan_shapes (see 4.2.4.4.41), zero or more Downcomer_shapes (see 4.2.4.4.23), zero or more Weir_shapes (see 4.2.4.4.73), zero or more Baffle_cap_shapes (see 4.2.4.4.8), and zero or more Blinding_strip_shapes (see 4.2.4.4.6). If the Separation_tray_shape describes a cascade tray, there will be one or more Tray_-cascades (see 4.2.4.4.58) associated with the Separation_tray_shape.

The data associated with Separation_tray_shape are the following:

— liquid_flow_type;

— number_of_baffles;

— number_of_blinding_strips;

— number_of_cascades;

— number_of_downcomers;

— number_of_liquid_passes;

— number_of_liquid_reverses;

— number_of_panels;

— number_of_seal_pans;

— number_of_weirs;

— tray_repeat_frequency;

— tray_to_tray_image;

— tray_to_tray_rotation_angle;

— tray_type.

4.2.4.4.54.1 liquid_flow_type

A liquid_flow_type specifies an enumerated attribute that indicates whether the liquid flow is radial, chordal, or reverse. The value of the liquid_flow_attribute shall be one of the following:

— chordal;

— radial;

— reverse.

4.2.4.4.54.1.1 chordal**:** an indication that liquid flow is along a radius of the circular tower cross-section.

4.2.4.4.54.1.2 radial**:** an indication that liquid flow is from chord of the circular tower cross-section to another chord.

4.2.4.4.54.1.3 reverse**:** an indication that liquid flow encounters obstructions that require the liquid to reverse its direction of flow on portions of the Separation_tray (see 4.2.4.4.49).

4.2.4.4.54.2 number_of_baffles

A number_of_baffles specifies the numeric quantity of baffles associated with each Separation_tray (see 4.2.4.4.49).

4.2.4.4.54.3 number_of_blinding_strips

A number_of_blinding_strips specifies the numeric quantity of blinding strips associated with each Separation_tray (see 4.2.4.4.49).

4.2.4.4.54.4 number_of_cascades

A number_of_cascades specifies the numeric quantity of Tray_cascades (see 4.2.4.4.58) associated with each Separation_tray (see 4.2.4.4.49).

4.2.4.4.54.5 number_of_downcomers

A number_of_downcomers specifies the numeric quantity of Downcomers (see 4.2.4.4.17) associated with each Separation_tray (see 4.2.4.4.49).

4.2.4.4.54.6 number_of_liquid_passes

A number_of_liquid_passes specifies the numeric quantity of discontiguous liquid flows on the Separation_tray (see 4.2.4.4.49).

4.2.4.4.54.7 number_of_liquid_reverses

A number_of_liquid_reverses specifies the numeric quantity of times the flow is reversed on the Separation_tray (see 4.2.4.4.49).

4.2.4.4.54.8 number_of_panels

A number_of_panels specifies the numeric quantity of Tray_panels (see 4.2.4.4.59) that are used on each Separation_tray (see 4.2.4.4.49).

4.2.4.4.54.9 number_of_seal_pans

A number_of_seal_pans specifies the numeric quantity of Seal_pans (see 4.2.4.4.39) that are used on each Separation_tray (see 4.2.4.4.49).

4.2.4.4.54.10 number_of_weirs

A number_of_weirs specifies the numeric quantity of Weirs (see 4.2.4.4.69) used with each Separation_-tray (see 4.2.4.4.49).

4.2.4.4.54.11 tray_repeat_frequency

A tray_repeat_frequency specifies an enumerated attribute that indicates whether every Separation_tray (see 4.2.4.4.49) in the Separation_tray_stack (see 4.2.4.4.55) is identical in shape and orientation, or that every other Separation_tray in the Separation_tray_stack is identical in shape and orientation, or that some other frequency occurs.

4.2.4.4.54.12 tray_to_tray_image

A tray_to_tray_image specifies an enumerated attribute that indicates whether the Separation_tray_shape of one Separation_tray (see 4.2.4.4.49) is an identical image, a mirror image, or some other image of the next Separation_tray in the Separation_tray_stack (see 4.2.4.4.55).

4.2.4.4.54.13 tray_to_tray_rotation_angle

A tray_to_tray_rotation_angle specifies that every Separation_tray (see 4.2.4.4.49) in the Separation_-tray_stack (see 4.2.4.4.55) is similar in shape but is oriented by a rotation angle from one Separation_tray to the next.

4.2.4.4.54.14 tray_type

A tray_type specifies an enumerated attribute that indicates whether the Separation_tray (see 4.2.4.4.49) is a cross-flow, counter-flow, or splash-flow tray.

4.2.4.4.55 Separation_tray_stack

A Separation_tray_stack is a type of Separation_tower_internal (see 4.2.4.4.48) that is a collection of one or more Separation_trays (see 4.2.4.4.49) in a vertical arrangement.

> NOTE - The gross flow of the liquid Phase (see 4.2.2.2.15) is from the top to the bottom of the Separation_-tray_stack while the vapour Phase gross flow is from the bottom to the top.

The data associated with Separation_tray_stack are the following:

— number_of_trays;

— overall_corrected_efficiency;

— overall_uncorrected_efficiency;

— stack_type;

— tray_spacing.

4.2.4.4.55.1 number_of_trays

A number_of_trays specifies the total number of Separation_trays (see 4.2.4.4.49) in each Separation_-tray_stack.

4.2.4.4.55.2 overall_corrected_efficiency

An overall_corrected_efficiency specifies the Separation_efficiency (see 4.2.4.4.42) of the Separation_-trays (see 4.2.4.4.49) in a Separation_tray_stack based on the overall wet vapour efficiency and the effect of liquid entrainment by the vapour Phase (see 4.2.2.2.15).

4.2.4.4.55.3 overall_uncorrected_efficiency

An overall_uncorrected_efficiency specifies the Separation_efficiency (see 4.2.4.4.42) of the Separation_trays (see 4.2.4.4.49) in a Separation_tray_stack based on the overall dry vapour efficiency.

4.2.4.4.55.4 stack_type

A stack_type specifies an enumerated attribute that indicates that the Separation_tray_stack is a preassembled stack or a stack assembled in tower.

4.2.4.4.55.5 tray_spacing

A tray_spacing specifies the distance between Separation_trays (see 4.2.4.4.49) within a Separation_-tray_stack.

4.2.4.4.56 Separation_tray_structural_component

A Separation_tray_structural_component is the part of a Separation_tray (see 4.2.4.4.49) that does not have ports.

The data associated with Separation_tray_structural_component are the following:

— type.

A type specifies an enumerated attribute that indicates whether the Separation_tray_structural_-components are baffles or blinding strips.

4.2.4.4.57 Tray_and_tray_stack

A Tray_and_tray_stack is the object class name given to the link attributes between Separation_tray (see 4.2.4.4.49) and Separation_tray_stack (see 4.2.4.4.55).

The data associated with Tray_and_tray_stack are the following:

— tray_number_from_bottom_of_stack;

— tray_number_from_top_of_stack.

4.2.4.4.57.1 tray_number_from_bottom_of_stack

A tray_number_from_bottom_of_stack specifies the Separation_tray (see 4.2.4.4.49) number when counting from the bottom to the top of the Separation_tray_stack (see 4.2.4.4.55).

4.2.4.4.57.2 tray_number_from_top_of_stack

A tray_number_from_top_of_stack specifies the Separation_tray (see 4.2.4.4.49) number when counting from the top to the bottom of the Separation_tray_stack (see 4.2.4.4.55).

4.2.4.4.58 Tray_cascade

A Tray_cascade is an abrupt vertical decline in the liquid flow path. A Separation_tray (see 4.2.4.4.49) may have zero or more Tray_cascades.

The data associated with Tray_cascade are the following:

— cascade_number;

— vertical_drop.

4.2.4.4.58.1 cascade_number

A cascade_number specifies the identification number for each Tray_cascade.

4.2.4.4.58.2 vertical_drop

A vertical_drop specifies the vertical distance that the liquid flow path declines at the Tray_cascade.

4.2.4.4.59 Tray_panel

A Tray_panel is part of a Separation_tray (see 4.2.4.4.49) that usually has vertical perforations for the passage of the vapour Phase (see 4.2.2.2.15).

NOTE - Typically, Tray_panels are horizontal and constructed from flat plates, but occasionally they are sloped and corrugated. The Tray_panel may also have tray slots that are designed to create a horizontal vapour jet in the liquid on top of the Tray_panel.

4.2.4.4.60 Tray_panel_and_perforation_shape

A Tray_panel_and_perforation_shape is the object class name assigned to the link attributes between the Tray_panel_shape (see 4.2.4.4.63) and the Perforation_shape (see 4.2.4.4.33).

The data associated with Tray_panel_and_perforation_shape are the following:

— hole_area;

— number_of_perforations.

4.2.4.4.60.1 hole_area

A hole_area specifies the total perforation area for each Tray_panel (see 4.2.4.4.59).

4.2.4.4.60.2 number_of_perforations

A number_of_perforations specifies the numeric quantity of hole perforations for each Tray_panel (see 4.2.4.4.59).

4.2.4.4.61 Tray_panel_and_slot_shape

A Tray_panel_and_slot_shape is the object class name assigned to the link attributes between the Tray_-panel_shape (see 4.2.4.4.63) and the Tray_slot_shape (see 4.2.4.4.64).

The data associated with Tray_panel_and_slot_shape are the following:

— number_of_slots;

— slot_area.

4.2.4.4.61.1 number_of_slots

A number_of_slots specifies the numeric quantity of tray slots on each Tray_panel (see 4.2.4.4.59).

4.2.4.4.61.2 slot_area

A slot_area specifies the total area of tray slots for that particular Tray_slot_shape (see 4.2.4.4.64).

4.2.4.4.62 Tray_panel_hydraulics

A Tray_panel_hydraulics is a description of the hydraulic features for each Tray_panel (see 4.2.4.4.59).

The data associated with Tray_panel_hydraulics are the following:

— jet_vapour_flood_at_constant_liquid;

— jet_vapour_flood_at_constant_molar_level;

— percentage_jet_flood_at_constant_liquid;

— percentage_jet_flood_at_constant_molar_overflow;

— vapour_load_limit.

4.2.4.4.62.1 jet_vapour_flood_at_constant_liquid

A jet_vapour_flood_at_constant_liquid specifies the vapour flood rate at a constant liquid height on a Tray_panel (see 4.2.4.4.59).

4.2.4.4.62.2 jet_vapour_flood_at_constant_molar_level

A jet_vapour_flood_at_constant_molar_level specifies the vapour flood rate at a constant molar liquid flow on a Tray_panel (see 4.2.4.4.59).

4.2.4.4.62.3 percentage_jet_flood_at_constant_liquid

A percentage_jet_flood_at_constant_liquid specifies the design vapour rate as a percent of jet flooding at a particular liquid height on a Tray_panel (see 4.2.4.4.59).

4.2.4.4.62.4 percentage_jet_flood_at_constant_molar_overflow

A percentage_jet_flood_at_constant_molar_overflow specifies the design vapour rate as a percent of jet flooding at a particular molar liquid flow on a Tray_panel (see 4.2.4.4.59).

4.2.4.4.62.5 vapour_load_limit

A vapour_load_limit specifies the actual vapour load that can be passed through a particular Tray_panel (see 4.2.4.4.59).

4.2.4.4.63 Tray_panel_shape

A Tray_panel_shape is a set of geometric features used to describe a Tray_panel (see 4.2.4.4.59).

The data associated with Tray_panel_shape are the following:

— hole_area;

— number_of_active_areas;

— number_of_perforation_geometries;

— percentage_hole_area;

— slope.

4.2.4.4.63.1 hole_area

A hole_area specifies the percentage of each Tray_panel (see 4.2.4.4.59) that has perforations.

4.2.4.4.63.2 number_of_active_areas

A number_of_active_areas specifies the number of active areas on each Tray_panel (see 4.2.4.4.59).

NOTE - The active areas need not be contiguous.

4.2.4.4.63.3 number_of_perforation_geometries

A number_of_perforation_geometries specifies the number of Perforation_shapes (see 4.2.4.4.33) on each Tray_panel (see 4.2.4.4.59).

4.2.4.4.63.4 percentage_hole_area

A percentage_hole_area specifies the fraction of total Tray_panel (see 4.2.4.4.59) area that has active hole areas.

4.2.4.4.63.5 slope

A slope specifies the change in vertical elevation for a Tray_panel (see 4.2.4.4.59).

4.2.4.4.64 Tray_slot_shape

A Tray_slot_shape is the geometric description, including Perimeter (see 4.2.4.4.34), that specifies a slot shape for each Tray_panel (see 4.2.4.4.59).

4.2.4.4.65 Tray_support

A Tray_support is generally that part of the Cylindrical_pressure_vessel (see 4.2.4.6.9) that is used to support each Separation_tray (see 4.2.4.4.49).

4.2.4.4.66 Tray_support_shape

A Tray_support_shape is the geometric description of the Tray_support (see 4.2.4.4.65).

NOTES

1 - This description is usually of a ring welded to the inside of the Cylindrical_pressure_vessel (see 4.2.4.6.9).

2 - The Tray_support_shape object represents a typical Tray_support. There are no attributes associated with this object since that part of the ARM has yet to be detailed. The Tray_support_shape object has been mapped to the AIM, however, consistent with the rest of the typical items in the mass_transfer_equipment UoF. Further attribution may be provided in future editions of this part of ISO 10303.

4.2.4.4.67 Valve_cap

A Valve_cap is a type of Perforation_cover_shape (see 4.2.4.4.32).

4.2.4.4.68 Valve_cap_shape

A Valve_cap_shape is a description of the shape of the Valve_cap (see 4.2.4.4.67).

The data associated with Valve_cap_shape are the following:

— characteristic_size;

— type_code;

— type_name.

4.2.4.4.68.1 characteristic_size

A characteristic_size specifies the Valve_cap (see 4.2.4.4.67) size in terms of a numeric value or code.

4.2.4.4.68.2 type_code

A type_code specifies the particular code name for a Valve_cap (see 4.2.4.4.67).

4.2.4.4.68.3 type_name

A type_name specifies the particular Valve_cap (see 4.2.4.4.67) textual label that is used to characterize the Valve_cap.

4.2.4.4.69 Weir

A Weir is a vertical barrier placed in the liquid flow so that the liquid will collect behind it and will overflow the top of the Weir.

4.2.4.4.70 Weir_and_disengaging_panel_intersection

A Weir_and_disengaging_panel_intersection is the layout of a Weir (see 4.2.4.4.69) in a Downcomer (see 4.2.4.4.17) disengaging panel and is described by a Curve (see 4.2.4.4.13) and a length.

The data associated with Weir_and_disengaging_panel_intersection are the following:

— length.

A length specifies the horizontal distance of the intersection between the Weir (see 4.2.4.4.69) and the Downcomer (see 4.2.4.4.17) disengaging panel.

4.2.4.4.71 Weir_and_seal_pan_intersection

A Weir_and_seal_pan_intersection is the layout of a Weir (see 4.2.4.4.69) on a Seal_pan (see 4.2.4.4.39) and can be described by a Curve (see 4.2.4.4.13) or length.

The data associated with Weir_and_seal_panel_intersection are the following:

— length.

A length specifies the horizontal distance of the intersection between the Weir (see 4.2.4.4.69) and the Seal_pan (see 4.2.4.4.39).

4.2.4.4.72 Weir_and_tray_panel_intersection

A Weir_and_tray_panel_intersection is the layout of a Weir (see 4.2.4.4.69) on a Tray_panel (see 4.2.4.4.59) and can be described by a Curve (see 4.2.4.4.13) or length.

The data associated with Weir_and_tray_panel_intersection are the following:

— length.

A length specifies the horizontal distance of the intersection between the Weir (see 4.2.4.4.69) and the Tray_panel (see 4.2.4.4.59).

4.2.4.4.73 Weir_shape

A Weir_shape is a description of the shape of the Weir (see 4.2.4.4.69).

NOTE - This shape is typically vertical with smooth top edges over which the liquid flows. However, they are occasionally swept back in the direction of the liquid flow or have serrated, notched, or curved top edges.

The data associated with Weir_shape are the following:

— angle_swept_back_in_direction_of_flow;

— attachment_method;

— disengaging_panel_intersection_length;

— seal_pan_intersection_length;

— tray_panel_intersection_length;

— vertical_height.

4.2.4.4.73.1 angle_swept_back_in_direction_of_flow

An angle_swept_back_in_direction_of_flow specifies Weirs (see 4.2.4.4.69) that are not vertical.

4.2.4.4.73.2 attachment_method

An attachment_method specifies how Weirs (see 4.2.4.4.69) are connected to the Separation_tray (see 4.2.4.4.49).

NOTE - Methods include welding, bolting, and extending between tray components.

4.2.4.4.73.3 disengaging_panel_intersection_length

A disengaging_panel_intersection_length specifies the horizontal distance between the Weir (see 4.2.4.4.69) and the Downcomer (see 4.2.4.4.17) disengaging panel intersection.

4.2.4.4.73.4 seal_pan_intersection_length

A seal_pan_intersection_length specifies the horizontal distance between the Weir (see 4.2.4.4.69) and the Seal_pan (see 4.2.4.4.39) intersection.

4.2.4.4.73.5 tray_panel_intersection_length

A tray_panel_intersection_length specifies the horizontal distance between the Weir (see 4.2.4.4.69) and the Tray_panel (see 4.2.4.4.59) intersection.

4.2.4.4.73.6 vertical_height

A vertical_height specifies the vertical distance from the Separation_tray (see 4.2.4.4.49) to the top of the Weir (see 4.2.4.4.69).

4.2.4.5 material_transfer_equipment_data

Refer to 4.1.7 for a description of what this UoF specifies. The ARM diagrams related to this UoF are provided as figures G.20 through G.23 in annex G of this part to ISO 10303.

4.2.4.5.1 Cc_balance_piston

A Cc_balance_piston is an element of a Centrifugal_compressor (see 4.2.4.5.14) that provides some thrust compensation against the full force generated by the shaft-impeller system.

The data associated with Cc_balance_piston are the following:

— area;

— fixation_method.

4.2.4.5.1.1 area

An area specifies the area of contact for the balance piston and the gas.

4.2.4.5.1.2 fixation_method

A fixation_method specifies a reference to a construction method.

4.2.4.5.2 Cc_casing

A Cc_casing is the external shell of a Centrifugal_compressor (see 4.2.4.5.14) that contains the fluid.

The data associated with Cc_casing are the following:

— casing_split_seal;

— corrosion_allowance;

— maximum_casing_capacity;

— maximum_number_impellers;

— maximum_operating_temperature;

— maximum_working_pressure;

— minimum_operating_temperature;

— radiograph_quality;

— split;

— test_pressure_helium;

— test_pressure_hydrostatic;

— thickness.

4.2.4.5.2.1 casing_split_seal

A casing_split_seal specifies a sealing device used in split casing closure.

4.2.4.5.2.2 corrosion_allowance

A corrosion_allowance specifies the additional wall thickness of the casing provided for metal loss because of chemical or mechanical attack by the process Stream (see 4.2.3.3.16).

NOTE - The casing thickness minus the corrosion allowance is the thickness of the wall that was designed to contain the maximum design pressure under some standard design methodology.

4.2.4.5.2.3 maximum_casing_capacity

A maximum_casing_capacity specifies the maximum volumetric capacity of the casing in process gas flow.

4.2.4.5.2.4 maximum_number_impellers

A maximum_number_impellers specifies the maximum number of impellers in the Centrifugal_-compressor (see 4.2.4.5.14).

4.2.4.5.2.5 maximum_operating_temperature

A maximum_operating_temperature specifies the specified temperature to which the casing wall thickness is to be calculated and tested.

4.2.4.5.2.6 maximum_working_pressure

A maximum_working_pressure specifies the maximum pressure intended for sustained operation.

4.2.4.5.2.7 minimum_operating_temperature

A minimum_operating_temperature specifies the minimum temperature intended for sustained operation.

NOTE - For compressors, as the pressure is increased and the temperature is dropped, the work load can be increased so that the mechanical stress on the equipment goes up. These two items are intended to set limits on the operation.

4.2.4.5.2.8 radiograph_quality

A radiograph_quality specifies whether radiography will be used in testing the integrity of the casing.

4.2.4.5.2.9 split

A split specifies the type of casing split.

EXAMPLE 66 - Types of splits are horizontal and vertical.

4.2.4.5.2.10 test_pressure_helium

A test_pressure_helium specifies the helium pressure used for leak testing a casing during construction.

4.2.4.5.2.11 test_pressure_hydrostatic

A test_pressure_hydrostatic specifies the hydraulic test pressure applied to test the mechanical integrity of the casing during construction and inspection.

4.2.4.5.2.12 thickness

A thickness specifies the nominal wall thickness of the Cc_casing.

4.2.4.5.3 Cc_critical_speed

A Cc_critical_speed is a resonant frequency(ies) of the rotor-bearing support system. Each Cc_critical_-speed may be one of the following: Cc_lateral_critical_speed (see 4.2.4.5.7) or a Cc_torsional_critical_-speed (see 4.2.4.5.12).

The data associated with Cc_critical_speed are the following:

— level;

— type.

4.2.4.5.3.1 level

A level specifies an enumerated attribute that describes critical speed. The value of the level attribute shall be one of the following:

— first;

— fourth;

— second;

— third.

4.2.4.5.3.1.1 first: an indication that the first critical speed is being described.

4.2.4.5.3.1.2 fourth**:** an indication that the fourth critical speed is being described.

4.2.4.5.3.1.3 second**:** an indication that the second critical speed is being described.

4.2.4.5.3.1.4 third**:** an indication that the third critical speed is being described.

4.2.4.5.3.2 type

A type specifies the lateral or torsional critical speed from the natural frequencies of the system and from forcing phenomenon.

4.2.4.5.4 Cc_diaphragm

A Cc_diaphragm is the diaphragm in the Centrifugal_compressor (see 4.2.4.5.14).

4.2.4.5.5 Cc_impeller

A Cc_impeller is a wheel-like device mounted on the Shaft (see 4.2.4.1.53) of the Centrifugal_-compressor (see 4.2.4.5.14) with vanes that provides the impulsive force to the fluid causing motion or pressure.

The data associated with Cc_impeller are the following:

— diameter;

— fabrication_type;

— impeller_number;

— maximum_head_at_rated_speed;

— maximum_mach_at_eye;

— number_of_vanes;

— smallest_tip_internal_width;

— tip_speed_at_maximum_continuous_speed;

— tip_speed_at_rated_speed;

— type.

4.2.4.5.5.1 diameter

A diameter specifies the diameter of the locus of points furthest from the centre of rotation when the impeller is turned on its Shaft (see 4.2.4.1.53).

4.2.4.5.5.2 fabrication_type

A fabrication_type specifies a reference to a fabrication method for impellers. The value of the fabrication_type attribute shall be one of the following:

— cast;

— forged;

— machined.

4.2.4.5.5.2.1 cast**:** an indication that the impeller is fabricated by pouring molten metal into a mould.

4.2.4.5.5.2.2 forged**:** an indication that the impeller is fabricated by heating metal and shaping it by hammering or some other means.

4.2.4.5.5.2.3 machined**:** an indication that the impeller is fabricated by cutting and shaping a piece of metal using a mechanically operated tool.

4.2.4.5.5.3 impeller_number

A impeller_number specifies the particular impeller number of all impellers assembled on a Shaft (see 4.2.4.1.53).

4.2.4.5.5.4 maximum_head_at_rated_speed

A maximum_head_at_rated_speed specifies the maximum pressure rise in the gas being compressed at the rated rpm of the machine.

4.2.4.5.5.5 maximum_mach_at_eye

A maximum_mach_at_eye specifies the maximum velocity at the eye of the impeller as a fraction of the speed of sound.

4.2.4.5.5.6 number_of_vanes

A number_of_vanes specifies the actual number of vanes in a Cc_impeller.

4.2.4.5.5.7 smallest_tip_internal_width

A smallest_tip_internal_width specifies the width at the tip of the smallest vane.

4.2.4.5.5.8 tip_speed_at_maximum_continuous_speed

A tip_speed_at_maximum_continuous_speed specifies the linear velocity at the maximum continuous allowed rotation speed of the impeller.

4.2.4.5.5.9 tip_speed_at_rated_speed

A tip_speed_at_rated_speed specifies the linear velocity of the impeller tip when the centrifugal compressor is at the maximum rated speed it is designed for during continuous operation.

4.2.4.5.5.10 type

A type specifies an enumerated attribute that provides a reference to a standard impeller design. The value of the type attribute shall be one of the following:

— enclosed;

— open.

4.2.4.5.5.10.1 enclosed**:** an indication that the impeller design consists of a disk, vanes, and cover.

4.2.4.5.5.10.2 open**:** an indication that the impeller design consists of a disk and vanes.

4.2.4.5.6 Cc_labyrinth

A Cc_labyrinth is a series of perpendicular baffles with a low contact area with the Shaft (see 4.2.4.1.53) that act as a high resistance barrier to gas leakage.

The data associated with Cc_labyrinth are the following:

— location.

A location specifies an enumerated attribute that indicates the location within the compressor where the labyrinth is located. The value of the location attribute shall be one of the following:

— balance_piston;

— interstage.

4.2.4.5.6.0.1 balance_piston**:** an indication that a balance piston is located at the discharge end of the rotor and works to balance the differential pressure across the system.

4.2.4.5.6.0.2 interstage**:** an indication that there is a seal on both the inlet and discharge sides of each impeller.

4.2.4.5.7 Cc_lateral_critical_speed

A Cc_lateral_critical_speed is a type of Cc_critical_speed (see 4.2.4.5.3) that is the lateral critical speed for the compressor.

The data associated with Cc_lateral_critical_speed are the following:

— damped;

— lateral_basis;

— mode_shape;

— undamped.

4.2.4.5.7.1 damped

A damped specifies the critical speed under damped conditions.

4.2.4.5.7.2 lateral_basis

A lateral_basis specifies an enumerated attribute that indicates under what conditions the critical speed was determined. The value of the lateral_basis attribute shall be one of the following:

— damped;

— other;

— shop_test;

— unbalanced.

4.2.4.5.7.2.1 damped**:** an indication that the critical speed was determined under damped conditions.

4.2.4.5.7.2.2 other**:** an indication that the critical speed was determined under some condition other than those given by other enumeration values.

4.2.4.5.7.2.3 shop_test**:** an indication that the critical speed was determined with a shop test.

4.2.4.5.7.2.4 unbalanced**:** an indication that the critical speed was determined under unbalanced rotor conditions.

4.2.4.5.7.3 mode_shape

A mode_shape specifies a textual description of the shape of the mode of the critical speed.

4.2.4.5.7.4 undamped

A undamped specifies the critical speed under undamped conditions.

4.2.4.5.8 Cc_miscellaneous

A Cc_miscellaneous is a miscellaneous collection of specifications for the Centrifugal_compressor (see 4.2.4.5.14).

The data associated with Cc_miscellaneous are the following:

— optical_alignment_flats_required;

— pipe_diameter_before_suction;

— provision_for_water_wash_before_open_casing;

— torsional_analysis_report_required;

— vendor_review_of_piping_and_foundation_required.

4.2.4.5.8.1 optical_alignment_flats_required

An optical_alignment_flats_required specifies optical alignment of the rotor Shaft (see 4.2.4.1.53) to determine flat spots.

4.2.4.5.8.2 pipe_diameter_before_suction

A pipe_diameter_before_suction specifies the diameter of the pipe connected to the suction side of the Centrifugal_compressor (see 4.2.4.5.14).

4.2.4.5.8.3 provision_for_water_wash_before_open_casing

A provision_for_water_wash_before_open_casing specifies whether or not there are connections to water-wash the compressor prior to opening the compressor for maintenance.

4.2.4.5.8.4 torsional_analysis_report_required

A torsional_analysis_report_required specifies whether or not to produce the report documenting the torque settings for all bolts on the compressor.

4.2.4.5.8.5 vendor_review_of_piping_and_foundation_required

A vendor_review_of_piping_and_foundation_required specifies the necessary drawings to be reviewed for both compressor piping and compressor foundations.

4.2.4.5.9 Cc_shaft_sleeve

A Cc_shaft_sleeve is a Shaft (see 4.2.4.1.53) sleeve for the Centrifugal_compressor (see 4.2.4.5.14).

The data associated with Cc_shaft_sleeve are the following:

— location.

A location specifies an enumerated attribute giving the location of the Shaft (see 4.2.4.1.53) sleeve being described. The value of the location attribute shall be one of the following:

— interstage;

— shaft_seals.

4.2.4.5.9.0.1 interstage**:** an indication that the Shaft (see 4.2.4.1.53) sleeve is an interstage sleeve.

4.2.4.5.9.0.2 shaft_seals**:** an indication that the Shaft (see 4.2.4.1.53) sleeve is at the seals.

4.2.4.5.10 Cc_speed_control_method

A Cc_speed_control_method is the method of controlling the speed of the Centrifugal_compressor (see 4.2.4.5.14) when using a non-electric motor-driven compressor.

The data associated with Cc_speed_control_method are the following:

— anti_surge_bypass;

— bypass;

— other_speed_control_method;

— speed_range;

— suction_throttling.

4.2.4.5.10.1 anti_surge_bypass

An anti_surge_bypass specifies the type of anti-surge bypass used to control the Centrifugal_compressor (see 4.2.4.5.14) to maintain a constant speed. The value of the anti_surge_bypass attribute shall be one of the following:

— automatic;

— manual.

4.2.4.5.10.1.1 automatic**:** an indication that automatic anti-surge bypass is used.

4.2.4.5.10.1.2 manual**:** an indication that manual anti-surge bypass is used.

4.2.4.5.10.2 bypass

A bypass specifies the origin and destination of the anti-surge bypass.

4.2.4.5.10.3 other_speed_control_method

An other_speed_control_method specifies alternative methods for controlling the speed of a Centrifugal_compressor (see 4.2.4.5.14) with variable speed drivers.

NOTE - Variable speed drivers include steam pistons, steam turbines, gas engines, and diesel engines.

4.2.4.5.10.4 speed_range

A speed_range specifies the range of speeds available to the controller, including turn-down values.

4.2.4.5.10.5 suction_throttling

A suction_throttling specifies the range of suction throttling pressures available or allowed when unloading the compressor flow rates.

4.2.4.5.11 Cc_speed_control_signal

A Cc_speed_control_signal is the transducer signal used to signal speed to a speed controller as a portion of the overall compressor speed control mechanism..

The data associated with Cc_speed_control_signal are the following:

— range_other;

— range_pneumatic_control.

— source;

— type;

4.2.4.5.11.1 range_other

A range_other specifies an ordered list of value pairs showing the relationship between required speed in rpm and the control signal value for other than pneumatic signaling.

4.2.4.5.11.2 range_pneumatic_control

A range_pneumatic_control specifies an ordered list of value pairs relating control signal value and desired rpm for pneumatic control.

4.2.4.5.11.3 source

A source specifies the location of the speed variable on the compressor.

4.2.4.5.11.4 type

A type specifies an enumerated attribute that indicates whether the type of signal from the speed control variable is analog or digital.

4.2.4.5.12 Cc_torsional_critical_speed

A Cc_torsional_critical_speed is a type of Cc_critical_speed (see 4.2.4.5.3) that is the torsional critical speed for the Centrifugal_compressor (see 4.2.4.5.14).

4.2.4.5.13 Cc_weights

A Cc_weights is the total weight in pounds or kilograms for the Centrifugal_compressor (see 4.2.4.5.14).

The data associated with Cc_weights are the following:

— compressor_upper_case;

— compressor_only;

— rotor_compressor;

— rotor_driver;

— rotor_gear;

4.2.4.5.13.1 compressor_upper_case

A compressor_upper_case specifies the weight for the upper case portion of the Centrifugal_compressor (see 4.2.4.5.14).

4.2.4.5.13.2 compressor_only

A compressor_only specifies the weight for the compressor portion of the total assembly.

4.2.4.5.13.3 rotor_compressor

A rotor_compressor specifies the weight for only the compressor rotor portion of the total assembly.

4.2.4.5.13.4 rotor_driver

A rotor_driver specifies the weight for only the rotor driver portion of the total assembly.

4.2.4.5.13.5 rotor_gear

A rotor_gear specifies the weight for the rotor gear box portion of the total assembly.

4.2.4.5.14 Centrifugal_compressor

A Centrifugal_compressor is a machine that raises the pressure of a gas or vapour Stream (see 4.2.3.3.16) through rotating radial vanes that impel the gas toward the periphery of the Centrifugal_compressor casing where it is either redirected to another stage of compression or to a discharge pipe.

The data associated with Centrifugal_compressor are the following:

— estimated_surge;

— guarantee_point;

— manufacturer_performance_curve_number.

— number_of_stages;

— speed_trip;

4.2.4.5.14.1 estimated_surge

An estimated_surge specifies the estimated surge point speed at the design flow rate, which indicates the point of instability for the Centrifugal_compressor.

4.2.4.5.14.2 guarantee_point

A guarantee_point specifies a point on the Performance_curve (see 4.2.4.1.34) that a performance guarantee must meet.

> NOTE - The manufacturer guarantees the performance of the compressor at a specific point on the compressor's performance curve.

4.2.4.5.14.3 manufacturer_performance_curve_number

The manufacturer_performance_curve_number specifies a reference to a relationship in graphical form among the power requirement, head, or differential pressure generated and inlet flow rate in a Centrifugal_compressor.

> NOTE - The curve number relates to a catalogue of such Performance_curves (see 4.2.4.1.34) depending on the properties of the fluid being compressed.

4.2.4.5.14.4 number_of_stages

A number_of_stages specifies the number of stages in the Centrifugal_compressor.

4.2.4.5.14.5 speed_trip

A speed_trip specifies the maximum speed at which the compressor will be tripped or shut down because the unit has exceeded the maximum speed for that particular compressor.

4.2.4.5.15 Centrifugal_compressor_stage

A Centrifugal_compressor_stage is that portion of the compressor that causes a pressure rise in the compressed gas or fluid.

> NOTE - Multiple stages are used within a compressor when the compression required is higher than can be achieved in a single stage.

The data associated with Centrifugal_compressor_stage are the following:

— stage_number.

A stage_number specifies the number assigned to the Centrifugal_compressor_stage.

4.2.4.5.16 Centrifugal_pump

A Centrifugal_pump is a machine that raises the pressure of a liquid Stream (see 4.2.3.3.16) through rotating radial vanes that impel the fluid toward the periphery of the Pump_casing (see 4.2.4.5.22) where it is redirected to a discharge pipe.

The data associated with Centrifugal_pump are the following:

— corrosion_erosion_caused_by;

— manufacturer_performance_curve_number;

— net_positive_suction_head_available;

— net_positive_suction_head_required;

— speed_rpm;

— suction_specific_speed.

4.2.4.5.16.1 corrosion_erosion_caused_by

A corrosion_erosion_caused_by specifies the properties of the fluid or contaminants within the fluid that may cause corrosion or erosion of the Centrifugal_pump and rotor.

4.2.4.5.16.2 manufacturer_performance_curve_number

A proposal_curve_number specifies a reference to a relationship in graphical form among the power requirement, head, or differential pressure generated and inlet flow rate in a Centrifugal_pump.

NOTE - The curve number relates to a catalogue of such Performance_curves (see 4.2.4.1.34) depending on the properties of the fluid being compressed.

4.2.4.5.16.3 net_positive_suction_head_available

A net_positive_suction_head_available specifies the net pressure, or net positive suction head available at the suction Equipment_port (see 4.2.4.1.16) of a Centrifugal_pump.

4.2.4.5.16.4 net_positive_suction_head_required

A net_positive_suction_head_required specifies the net positive suction head required for the safe operation of the Centrifugal_pump.

NOTE - The required NPSH must be exceeded in order to avoid pump cavitation because of the release of gases in solution.

4.2.4.5.16.5 speed_rpm

A speed_rpm specifies the rotational speed of the Centrifugal_pump in revolutions per minute.

4.2.4.5.16.6 suction_specific_speed

A suction_specific_speed specifies the necessary Centrifugal_pump speed to provide adequate operation at the pump suction.

4.2.4.5.17 Fluid_transfer_machine

A Fluid_transfer_machine is a machine for moving a fluid, gas, liquid or both, from one place to another, generally making the transfer possible by raising the pressure of the process Stream (see 4.2.3.3.16). Each Fluid_transfer_machine may be one of the following: a Centrifugal_pump (see 4.2.4.5.16) or a Gas_-transfer_machine (see 4.2.4.5.18).

The data associated with Fluid_transfer_machine are the following:

— type.

A type specifies the type of Fluid_transfer_machine.

EXAMPLE 67 - Fluid_transfer_machines may include items such as pumps, compressors, fans, blowers, jet ejectors, turbines, and expanders.

4.2.4.5.18 Gas_transfer_machine

A Gas_transfer_machine is a machine for moving a gas from one place to another, generally making the transfer possible by raising the pressure of the process Stream (see 4.2.3.3.16). Each Gas_transfer_-machine may be one of the following: a Centrifugal_compressor (see 4.2.4.5.14), a Centrifugal_-compressor_stage (see 4.2.4.5.15), or a Positive_displacement_compressor (see 4.2.4.5.20).

The data associated with Gas_transfer_machine are the following:

— isentropic_efficiency;

— type.

4.2.4.5.18.1 isentropic_efficiency

An isentropic_efficiency specifies the efficiency defined as the isentropic work divided by the actual work required.

4.2.4.5.18.2 type

A type specifies the type of the Gas_transfer_machine.

4.2.4.5.19 Material_transfer_equipment

A Material_transfer_equipment is a type of Process_equipment (see 4.2.4.2.8) that, as a principle function, produces or requires the movement of Process_materials. Each Material_transfer_equipment may be a Fluid_transfer_machine (see 4.2.4.5.17).

NOTE - The Process_materials may be solid, liquid, gas, or multi-phase.

The data associated with Material_transfer_equipment are the following:

— type.

A type specifies the type of equipment performing the transfer of Process_materials (see 4.2.2.4.13).

EXAMPLE 68 - Material_transfer_equipment includes items such as pumps, fans, blowers, compressors, conveyors, elevators, jet ejectors, turbines, and expanders.

4.2.4.5.20 Positive_displacement_compressor

A Positive_displacement_compressor is a generic class of machines that moves gases or raises their pressure by pushing or shrinking the occupied volume. Each Positive_displacement_compressor may be one of the following: a Reciprocating_compressor (see 4.2.4.5.28) or a Reciprocating_compressor_stage (see 4.2.4.5.29).

The data associated with Positive_displacement_compressor are the following:

— type;

— volumetric_efficiency.

4.2.4.5.20.1 type

A type specifies a type of Positive_displacement_compressor.

4.2.4.5.20.2 volumetric_efficiency

A volumetric efficiency specifies the volume moved on every stroke of the displacing device divided by the total volume of the cavity contacted by fluid.

4.2.4.5.21 Pump

A Pump is a type of Fluid_transfer_machine (see 4.2.4.5.17) that raises the pressure of a liquid Stream (see 4.2.3.3.16). Each Pump may be one of the following: a Centrifugal_pump (see 4.2.4.5.16).

The data associated with Pump are the following:

— type.

A type specifies the type of Pump.

4.2.4.5.22 Pump_casing

A Pump_casing is that portion of the Pump (see 4.2.4.5.21) that houses the Pump rotor and enables the pumped fluid to flow from suction to discharge.

The data associated with Pump_casing are the following:

— mount;

— split;

— type.

4.2.4.5.22.1 mount

A mount specifies how the Pump_casing is mounted on the baseplate. The value of the mount attribute shall be one of the following:

— bracket;

— centreline;

— foot;

— inline;

— near_centreline;

— sump;

— vertical;

— vertical_barrel.

4.2.4.5.22.1.1 bracket**:** an indication that the Pump_casing is bracket mounted.

4.2.4.5.22.1.2 centreline**:** an indication that the Pump_casing is centreline mounted.

4.2.4.5.22.1.3 foot**:** an indication that the Pump_casing is foot mounted.

4.2.4.5.22.1.4 inline**:** an indication the Pump_casing is inline mounted.

4.2.4.5.22.1.5 near_centreline**:** an indication that the Pump_casing has a near centreline mount.

4.2.4.5.22.1.6 sump**:** an indication that the Pump_casing is for a sump-mounted Pump (see 4.2.4.5.21).

4.2.4.5.22.1.7 vertical**:** an indication that the Pump_casing is vertically mounted.

4.2.4.5.22.1.8 vertical_barrel**:** an indication that the Pump_casing has a vertical barrel mount.

4.2.4.5.22.2 split

A split specifies that the Pump_casing is not a continuous piece but is split in one of two directions so that the casing may be disassembled in the field for maintenance. The value of the split attribute shall be one of the following:

— axial;

— radial.

4.2.4.5.22.2.1 axial**:** an indication that the Pump_casing is axially spilt.

4.2.4.5.22.2.2 radial**:** an indication that the Pump_casing is vertically split.

4.2.4.5.22.3 type

A type specifies the type of Pump_casing. The value of the type attribute shall be one of the following:

— diffuser;

— double_volute;

— single_volute;

— staggered_volute.

4.2.4.5.22.3.1 diffuser**:** an indication that the Pump_casing is for a Pump (see 4.2.4.5.21) with a diffuser.

4.2.4.5.22.3.2 double_volute**:** an indication that the Pump_casing is for a double volute Pump (see 4.2.4.5.21).

4.2.4.5.22.3.3 single_volute**:** an indicationt that the Pump_casing is for a single volute Pump (see 4.2.4.5.21).

4.2.4.5.22.3.4 staggered_volute**:** an indication that the Pump_casing is for a staggered volute Pump (see 4.2.4.5.21).

4.2.4.5.23 Pump_casing_test

A Pump_casing_test is the operating test for the Pump_casing (see 4.2.4.5.22) to determine if the Pump (see 4.2.4.5.21) meets design criteria.

The data associated with Pump_casing_test are the following:

— hydrostatic_test_pressure;

— location;

— maximum_allowable_pressure;

— temperature.

4.2.4.5.23.1 hydrostatic_test_pressure

A hydrostatic_test_pressure specifies the hydraulic test pressure with a liquid inside the Pump_casing (see 4.2.4.5.22) to determine the maximum allowable working pressure.

4.2.4.5.23.2 location

A location specifies the location for the Pump_casing_test. The value of the location attribute shall be one of the following;

— inner;

— outer.

4.2.4.5.23.2.1 inner**:** an indication that the test is for an inner case.

4.2.4.5.23.2.2 outer**:** an indication that the test is for the outer case.

4.2.4.5.23.3 maximum_allowable_pressure

A maximum_allowable_pressure specifies the maximum continuous pressure for which the manufacturer has designed the Pump_casing (see 4.2.4.5.22).

4.2.4.5.23.4 temperature

A temperature specifies the temperature of the fluid used in the Pump_casing_test. The value of the temperature attribute shall be one of the following:

— ambient_conditions;

— normal_operating_temperature.

4.2.4.5.23.4.1 ambient_conditions**:** an indication that the test is carried out at or near the ambient air temperature at the test location.

4.2.4.5.23.4.2 normal_operating_temperature**:** an indication that the test is carried out at normal operating temperatures.

4.2.4.5.24 Pump_gland

A Pump_gland is a pump seal or packing gland.

4.2.4.5.25 Pump_gland_taps

A Pump_gland_taps is the connection taps on a gland as part of a mechanical seal or packing.

The data associated with Pump_gland_taps are the following:

— taps_number;

— taps_type.

4.2.4.5.25.1 taps_number

A taps_number specifies the number of taps available for that particular Pump_gland (see 4.2.4.5.24).

4.2.4.5.25.2 taps_type

A taps_type specifies the function of the taps being described. The value of the taps_type attribute shall be one of the following:

— drain;

— flush;

— quench;

— vent.

4.2.4.5.25.2.1 drain**:** an indication that the taps are for the gland drain.

4.2.4.5.25.2.2 flush**:** an indication that the taps are for a seal flushing Stream (see 4.2.3.3.16).

4.2.4.5.25.2.3 quench**:** an indication that the taps are for a safety quench.

4.2.4.5.25.2.4 vent**:** an indication that the taps are for a gland vent.

4.2.4.5.26 Pump_impeller

A Pump_impeller is the moving element in a Centrifugal_pump (see 4.2.4.5.16), generally with integral vanes to deliver a velocity impulse to the fluid.

The data associated with Pump_impeller are the following:

— diameter;

— mount.

4.2.4.5.26.1 diameter

A diameter specifies the diameter size of the Pump_impeller.

NOTE - Usually, the impeller size is specified as a trimmed version of the maximum diameter, such as 11.25/12. This nomenclature means that the actual diameter is 11.25 inches and the maximum diameter is 12 inches for that particular size Pump (see 4.2.4.5.21).

4.2.4.5.26.2 mount

A mount specifies the type of mounting that is used for the Pump_impeller. The value of the mount attribute shall be one of the following:

— between_bearings;

— overhung.

4.2.4.5.26.2.1 between_bearings**:** an indication that the impeller is mounted between Bearings (see 4.2.4.1.3).

4.2.4.5.26.2.2 overhung**:** an indication that the impeller has an overhung mounting.

4.2.4.5.27 Pump_packing

A Pump_packing is a compressible ring of Material (see 4.2.2.4.9) used to seal the space between the Shaft (see 4.2.4.1.53) and packing gland against leakage of process fluid.

The data associated with Pump_packing are the following:

— number_of_rings.

A number_of_rings specifies the actual number of rings of packing that are used in the Pump_packing assembly.

4.2.4.5.28 Reciprocating_compressor

A Reciprocating_compressor is a type of Positive_displacement_compressor (see 4.2.4.5.20) that operates on the principle of a two-stroke piston, a suction followed by discharge. The piston may be replaced by a flexible diaphragm that oscillates back and forth.

The data associated with Reciprocating_compressor are the following:

— number_of_stages.

A number of stages specifies the number of stages in a Reciprocating_compressor.

4.2.4.5.29 Reciprocating_compressor_stage

A Reciprocating_compressor_stage is a type of Positive_displacement_compressor (see 4.2.4.5.20) that is one compressor stage that is a component part of a multi-stage Reciprocating_compressor (see 4.2.4.5.28).

NOTE - The number of stages is determined by the required compression ratio.

The data associated with Reciprocating_compressor_stage are the following:

— clearance_fraction;

— displacement;

— stage_number;

— type.

4.2.4.5.29.1 clearance_fraction

A clearance_fraction specifies the fraction of the total displacement volume that is needed to make room for valves, such as intake and exhaust, and any other top works in the compression chamber.

4.2.4.5.29.2 displacement

A displacement specifies the volumetric displacement of each compressor stage.

4.2.4.5.29.3 stage_number

A stage_number specifies the specific stage number as part of the total number of stages.

EXAMPLE 69 - Stage 3 of 6 indicates the third stage in a six-stage compressor.

4.2.4.5.29.4 type

A type specifies the type stage used in the Reciprocating_compressor (see 4.2.4.5.28) based on material construction requirements and compression requirements. The value of the type shall be one of the following:

— diaphragm;

— piston.

4.2.4.5.29.4.1 diaphragm**:** an indication that the stage is a diaphragm type.

4.2.4.5.29.4.2 piston**:** an indication that the stage is a reciprocating piston type.

4.2.4.5.30 Service_connections

A Service_connections is miscellaneous external connections on a Fluid_transfer_machine (see 4.2.4.5.17), such as a compressor or pump.

NOTE - These external connections are most likely pipe taps or fittings.

The data associated with Service_connections are the following:

— casing_drain;

— connection_between_bearing_and_seal;

— connection_between_seal_and_fluid;

— connection_bearing_housing_purge;

— connection_cooling_water;

— connection_pressure_tap;

— connection_solvent_injection;

— connection_temperature_tap;

— connection_vents;

— connection_warm_up;

— lubrication_oil_inlet;

— lubrication_oil_outlet;

— seal_oil_inlet;

— seal_oil_outlet;

— stage_drain.

4.2.4.5.30.1 casing_drain

A casing_drain specifies whether or not there are service connections for the casing drain from the Pump_casing (see 4.2.4.5.22) or compressor casing.

4.2.4.5.30.2 connection_between_bearing_and_seal

A connection_between_bearing_and_seal specifies whether or not there are service connections between the compressor or pump bearings and mechanical seal.

4.2.4.5.30.3 connection_between_seal_and_fluid

A connection_between_seal_and_fluid specifies whether or not there are service connections between the compressor or pump mechanical seal and the fluid being transferred.

4.2.4.5.30.4 connection_bearing_housing_purge

A connection_bearing_housing_purge specifies whether or not there are service connections on the purge for the bearing housing.

4.2.4.5.30.5 connection_cooling_water

A connection_cooling_water specifies whether or not there are service connections for cooling water.

4.2.4.5.30.6 connection_pressure_tap

A connection_pressure_tap specifies whether or not there are service connections for pressure measurement taps on the pump or compressor.

4.2.4.5.30.7 connection_solvent_injection

A connection_solvent_injection specifies whether or not there are service connections for solvent injection to the pump or compressor.

4.2.4.5.30.8 connection_temperature_tap

A connection_temperature_tap specifies whether or not there are service connections for temperature measurement on the pump or compressor.

4.2.4.5.30.9 connection_vents

A connections_vents specifies whether or not there are service connections for vents from the pump or compressor.

4.2.4.5.30.10 connection_warm_up

A connections_warm_up specifies whether or not there are service connections for warm-up connections on the pump or compressor.

4.2.4.5.30.11 lubrication_oil_inlet

A lubrication_oil_inlet specifies whether or not there are service connections for the lubrication oil inlet to the pump or compressor.

4.2.4.5.30.12 lubrication_oil_outlet

A lubrication_oil_outlet specifies whether or not there are service connections for the lubrication oil outlet from the pump or compressor.

4.2.4.5.30.13 seal_oil_inlet

A seal_oil_inlet specifies whether or not there are service connections for the mechanical seal oil inlet to the pump or compressor.

4.2.4.5.30.14 seal_oil_outlet

A seal_oil_outlet specifies whether or not there are service connections for the mechanical seal oil outlet from the pump or compressor.

4.2.4.5.30.15 stage_drain

A stage_drain specifies whether or not there are service connections for each drain stage from the pump or compressor.

4.2.4.6 process_vessel_equipment_data

Refer to 4.1.14 for a description of what this UoF specifies. The ARM diagrams related to this UoF are provided as figures G.39 through G.42 in annex G of this part to ISO 10303.

4.2.4.6.1 Atmospheric_tank

An Atmospheric_tank is a cylindrical tank used for storage of liquids under atmospheric or near atmospheric pressure.

The data associated with Atmospheric_tank are the following:

— foundation;

— roof_type;

— temperature;

— wall_thickness;

— water_drawoff.

4.2.4.6.1.1 foundation

A foundation specifies whether the Atmospheric_tank requires a foundation.

4.2.4.6.1.2 roof_type

A roof_type specifies an enumerated attribute indicating the general type of roof. The value of the roof_-type attribute shall be one of the following:

— bag;

— fixed;

— floating;

— unspecified.

4.2.4.6.1.2.1 bag: an indication that the roof_type is a bag sealed roof.

4.2.4.6.1.2.2 fixed**:** an indication that the roof_type is a fixed roof.

4.2.4.6.1.2.3 floating**:** an indication that the roof_type is a floating roof.

4.2.4.6.1.2.4 unspecified**:** an indication that the roof_type is not specified.

4.2.4.6.1.3 temperature

A temperature specifies the rated temperature for the Atmospheric_tank.

4.2.4.6.1.4 wall_thickness

A wall_thickness specifies the wall thickness of the Atmospheric_tank.

4.2.4.6.1.5 water_drawoff

A water_drawoff specifies whether the Atmospheric_tank requires a water drawoff.

4.2.4.6.2 Bin_section

A Bin_section is a section of a Solids_storage_bin (see 4.2.4.6.24).

The data associated with Bin_section are the following:

— agitated;

— flexible_or_rigid_sides;

— height;

— wall_thickness.

4.2.4.6.2.1 agitated

An agitated specifies if the Bin_section has agitation.

4.2.4.6.2.2 flexible_or_rigid_sides

A flexible_or_rigid_sides specifies an enumerated attribute that describes the physical characteristic of the walls of the bin. The value of the flexible_or_rigid_sides attribute shall be one of the following:

— flexible;

— rigid.

4.2.4.6.2.2.1 flexible**:** an indication that the bin walls are flexible.

4.2.4.6.2.2.2 rigid**:** an indication that the bin walls are rigid.

4.2.4.6.2.3 height

A height specifies the height of the Bin_section.

4.2.4.6.2.4 wall_thickness

A wall_thickness specifies the wall thickness of the Bin_section.

4.2.4.6.3 Boot

A Boot is an assembly of Cylindrical_pressure_vessel_sections (see 4.2.4.6.14) that is attached to another Cylindrical_pressure_vessel_section. The Boot functions as a means to handle drawoff from the Pressure_vessel (see 4.2.4.6.21).

4.2.4.6.4 Boot_location_on_cylinder_section

A Boot_location_on_cylinder_section is the location of the Boot (see 4.2.4.6.3) on the Cylindrical_-pressure_vessel_cylinder_section (see 4.2.4.6.11).

4.2.4.6.5 Boot_location_on_head_section

A Boot_location_on_head_section is the location of the Boot (see 4.2.4.6.3) on a Cylindrical_pressure_-vessel_head_section (see 4.2.4.6.13).

4.2.4.6.6 Boot_section_relationship

A Boot_section_relationship is the position of the boot in relationship with the Cylindrical_pressure_-vessel_section (see 4.2.4.6.14).

4.2.4.6.7 Bounded_curve

A Bounded_curve is the naturally bounded curves, trimmed curves, and composite curves used by this part of ISO 10303. Naturally bounded curves are bspline, circle, ellipse, and polyline. Trimmed curves are bounded either parametrically or by coordinates and consist of trimmed versions of the naturally bounded curves plus parabola and hyperbola. Composite curves are comprised of connected curves of the naturally bounded and trimmed curve types that may or may not be slope continuous.

4.2.4.6.8 Conical_head

A Conical_head is a type of head for the Cylindrical_pressure_vessel_head_section (see 4.2.4.6.13) with a truncated cone shape.

The data associated with Conical_head are the following:

— height;

— inside_diameter_large_end;

— inside_diameter_small_end;

— outside_diameter_large_end;

— outside_diameter_small_end.

4.2.4.6.8.1 height

A height specifies the height of the Conical_head.

4.2.4.6.8.2 inside_diameter_large_end

An inside_diameter_large_end specifies the inside diameter of the large end of the Conical_head.

4.2.4.6.8.3 inside_diameter_small_end

An inside_diameter_small_end specifies the inside diameter of the small end of the Conical_head.

4.2.4.6.8.4 outside_diameter_large_end

An outside_diameter_large_end specifies the outside diameter of the large end of the Conical_head.

4.2.4.6.8.5 outside_diameter_small_end

An outside_diameter_small_end specifies the outside diameter of the small end of the Conical_head.

4.2.4.6.9 Cylindrical_pressure_vessel

A Cylindrical_pressure_vessel is a type of Pressure_vessel (see 4.2.4.6.21) having cylindrical geometry.

The data associated with Cylindrical_pressure_vessel are the following:

— orientation;

— overall_height;

— overall_length.

4.2.4.6.9.1 orientation

An orientation specifies an enumerated attribute giving the overall orientation of the Cylindrical_-pressure_vessel. The value of the orientation attribute shall be one of the following:

— horizontal;

— other;

— unspecified;

— vertical.

4.2.4.6.9.1.1 horizontal: an indication that the general orientation of the Cylindrical_pressure_vessel is along a horizontal axis.

4.2.4.6.9.1.2 other**:** an indication that the general orientation of the Cylindrical_pressure_vessel is along an axis other than horizontal or vertical.

4.2.4.6.9.1.3 unspecified**:** an indication that the orientation of the Cylindrical_pressure_vessel is not specified.

4.2.4.6.9.1.4 vertical**:** an indication that the general orientation of the Cylindrical_pressure_vessel is along a vertical axis.

4.2.4.6.9.2 overall_height

An overall_height specifies the overall height associated with the Cylindrical_pressure_vessel in the vertical direction.

4.2.4.6.9.3 overall_length

An overall_length specifies the overall length associated with the Cylindrical_pressure_vessel in the horizontal direction.

4.2.4.6.10 Cylindrical_pressure_vessel_connection

A Cylindrical_pressure_vessel_connection is the connection between two Cylindrical_pressure_vessel_-sections (see 4.2.4.6.14).

The data associated with Cylindrical_pressure_vessel_connection are the following:

— inside_radius;

— thickness;

— type.

4.2.4.6.10.1 inside_radius

An inside_radius specifies the smallest inside radius of the transition of a Cylindrical_pressure_vessel_-connection between two unequal sized sections.

4.2.4.6.10.2 thickness

A thickness specifies the wall thickness of the Cylindrical_pressure_vessel_connection.

4.2.4.6.10.3 type

A type specifies an enumerated attribute specifying the type of Cylindrical_pressure_vessel_connection. The value of the type attribute shall be one of the following:

— flanged;

— unspecified;

— welded.

4.2.4.6.10.3.1 flanged**:** an indication that the type of connection is flanged for the Cylindrical_pressure_-vessel_connection.

4.2.4.6.10.3.2 unspecified**:** an indication that the type of connection is unspecified for the Cylindrical_-pressure_vessel_connection.

4.2.4.6.10.3.3 welded**:** an indication that the type of connection is welded for the Cylindrical_pressure_-vessel_connection.

4.2.4.6.11 Cylindrical_pressure_vessel_cylinder_section

A Cylindrical_pressure_vessel_cylinder_section is a type of Cylinder_pressure_vessel_section (see 4.2.4.6.14) that is a straight walled section in the Cylindrical_pressure_vessel (see 4.2.4.6.9) with two possible diameters.

The data associated with Cylindrical_pressure_vessel_cylinder_section are the following:

— cylinder_section_diameter_1;

— cylinder_section_diameter_2;

— cylinder_section_length.

4.2.4.6.11.1 cylinder_section_diameter_1

A cylinder_section_diameter_1 specifies one of the two possible diameters of a Cylindrical_pressure_-vessel_cylinder_section.

NOTE - If tapered, it is for the end towards the lowest ordered section of the vessel.

4.2.4.6.11.2 cylinder_section_diameter_2

A cylinder_section_diameter_2 specifies the possible diameter for a tapered cylinder for the Cylinder_-pv_cylinder_section. It is for the ends towards the highest ordered section.

NOTE - If untapered, it is NULL valued.

4.2.4.6.11.3 cylinder_section_length

A cylinder_section_length specifies the length associated with the Cylindrical_pressure_vessel_-cylinder_section.

4.2.4.6.12 Cylindrical_pressure_vessel_eccentric_section

A Cylindrical_pressure_vessel_eccentric_section is a type of Cylindrical_pressure_vessel_section (see 4.2.4.6.14) that has the geometry of an eccentric cylinder.

The data associated with Cylindrical_pressure_vessel_eccentric_section are the following:

— angular_offset_of_small_side;

— eccentric_diameter_1;

— eccentric_diameter_2;

— eccentric_length.

4.2.4.6.12.1 angular_offset_of_small_side

An angular_offset_of_small_side specifies the angular offset of the small side of the section associated with the Cylindrical_pressure_vessel_eccentric_section.

4.2.4.6.12.2 eccentric_diameter_1

An eccentric_diameter_1 specifies the diameter of the Cylindrical_pressure_vessel_eccentric_section towards the lowest number section.

4.2.4.6.12.3 eccentric_diameter_2

An eccentric_diameter_2 specifies the diameter of the Cylindrical_pressure_vessel_eccentric_section towards the highest numbered section.

4.2.4.6.12.4 eccentric_length

An eccentric_length specifies the length of the Cylindrical_pressure_vessel_eccentric_section.

4.2.4.6.13 Cylindrical_pressure_vessel_head_section

A Cylindrical_pressure_vessel_head_section is a Cylindrical_pressure_vessel_section (see 4.2.4.6.14) that forms part of the pressure vessel head. Each Cylindrical_pressure_vessel_head_section may be one of the following: a Conical_head (see 4.2.4.6.8), an Ellipsoidal_head (see 4.2.4.6.15), a Flat_head (see 4.2.4.6.16), a Hemispherical_head (see 4.2.4.6.17), a Standard_dished_head (see 4.2.4.6.27), or a Torispherical_head (see 4.2.4.6.28).

4.2.4.6.14 Cylindrical_pressure_vessel_section

A Cylindrical_pressure_vessel_section is a section of a Cylindrical_pressure_vessel (see 4.2.4.6.9). Each Cylindrical_pressure_vessel_section may be one of the following: a Cylindrical_pressure_vessel_-eccentric_section (see 4.2.4.6.12), a Cylindrical_pressure_vessel_cylinder_section (see 4.2.4.6.11), or a Cylindrical_pressure_vessel_head_section (see 4.2.4.6.13).

The data associated with Cylindrical_pressure_vessel_section are the following:

— corrosion_allowance;

— joint_efficiency;

— wall_thickness.

4.2.4.6.14.1 corrosion_allowance

A corrosion_allowance specifies the minimum acceptable allowance to accommodate anticipated corrosion rates on the Cylindrical_pressure_vessel_section. This value, normally expressed as a numeric ratio in mils per year, is added to the calculated pressure vessel code thickness value to determine the total thickness for the Cylindrical_pressure_vessel_section.

4.2.4.6.14.2 joint_efficiency

A joint_efficiency specifies the numerical (decimal) quantity used in the design of a joint as a multiplier of the appropriate allowable stress value for the particular material. The joint_efficiency depends upon the type of joint and the extent of examination of the joint.

4.2.4.6.14.3 wall_thickness

A wall_thickness specifies the wall thickness of the Cylindrical_pressure_vessel_section.

4.2.4.6.15 Ellipsoidal_head

An Ellipsoidal_head is a type of head for the Cylindrical_pressure_vessel_head_section (see 4.2.4.6.13) that has an ellipsoidal shape.

The data associated with Ellipsoidal_head are the following:

— inside_diameter;

— outside_diameter.

4.2.4.6.15.1 inside_diameter

An inside_diameter specifies the inside diameter of the Ellipsoidal_head.

4.2.4.6.15.2 outside_diameter

An outside_diameter specifies the outside diameter of the Ellipsoidal_head.

4.2.4.6.16 Flat_head

A Flat_head is a type of Cylindrical_pressure_vessel_head_section (see 4.2.4.6.13) that is made of a flat plate with possible buttresses.

The data associated with Flat_head are the following:

— diameter;

— number_of_buttresses.

4.2.4.6.16.1 diameter

A diameter specifies the outer diameter of the Flat_head.

4.2.4.6.16.2 number_of_buttresses

A number_of_buttresses specifies the number of added supports for the Flat_head.

4.2.4.6.17 Hemispherical_head

A Hemispherical_head is a type of head for the Cylindrical_pressure_vessel_head_section (see 4.2.4.6.13) that has a hemispherical geometry.

The data associated with Hemispherical_head are the following:

— inside_diameter;

— outside_diameter.

4.2.4.6.17.1 inside_diameter

A inside_diameter specifies the inside diameter for the Hemispherical_head.

4.2.4.6.17.2 outside_diameter

A outside_diameter specifies the outside diameter for the Hemispherical_head.

4.2.4.6.18 Intersection_description

An Intersection_description is a textual explanation or summary of how a Boot (see 4.2.4.6.3) or Nozzle (see 4.2.4.2.5) fits into a Cylindrical_pressure_vessel_cylinder_section (see 4.2.4.6.11) or Cylindrical_-pressure_vessel_head_section (see 4.2.4.6.13).

The data associated with Intersection_description are the following:

— relative_location;

— relative_orientation.

4.2.4.6.18.1 relative_location

A relative_location specifies the location of the Boot (see 4.2.4.6.3) or Nozzle (see 4.2.4.2.5) relative to a Cylindrical_pressure_vessel_cylinder_section (see 4.2.4.6.11) or Cylindrical_pressure_vessel_head_-section (see 4.2.4.6.13).

4.2.4.6.18.2 relative_orientation

A relative_orientation specifies the orientation of the Boot (see 4.2.4.6.3) or Nozzle (see 4.2.4.2.5) relative to a Cylindrical_pressure_vessel_cylinder_section (see 4.2.4.6.11) or Cylindrical_pressure_-vessel_head_section (see 4.2.4.6.13).

4.2.4.6.19 Nozzle_location_for_pressure_vessel_cylinder_section

A Nozzle_location_for_pressure_vessel_cylinder_section specifies the Nozzle (see 4.2.4.2.5) location on a Cylindrical_pressure_vessel_cylinder_section (see 4.2.4.6.11).

The data associated with Nozzle_location_for_pressure_vessel_cylinder_section are the following:

— cylinder_section_flush_with_inside.

A cylinder_section_flush_with_inside specifies whether the child Nozzle_section (see 4.2.4.2.6) is made flush with the inside surface of the parent section.

4.2.4.6.20 Nozzle_location_for_pressure_vessel_head_section

A Nozzle_location_for_pressure_vessel_head_section specifies the location of a Nozzle (see 4.2.4.2.5) attached to a head section.

The data associated with Nozzle_location_for_pressure_vessel_head_section are the following:

— head_section_flush_with_inside.

A head_section_flush_with_inside specifies whether the child Nozzle_section (see 4.2.4.2.6) is made flush with the inside surface of the parent section.

4.2.4.6.21 Pressure_vessel

A Pressure_vessel is a type of Process_vessel (see 4.2.4.6.22) that is designed to operate under pressure in excess of five inches of water head or under a vacuum and is characterized by its shape. Each Pressure_vessel may be one of the following: a Cylindrical_pressure_vessel (see 4.2.4.6.9), a Spherical_-pressure_vessel (see 4.2.4.6.25), or a Spheroidal_pressure_vessel (see 4.2.4.6.26).

The data associated with Pressure_vessel are the following:

— shape.

A shape specifies the type of Pressure_vessel as a Cylindrical_pressure_vessel (see 4.2.4.6.9), a Spherical_pressure_vessel (see 4.2.4.6.25), a Spheroidal_pressure_vessel (see 4.2.4.6.26), or some other shape.

4.2.4.6.22 Process_vessel

A Process_vessel is a type of Process_equipment (see 4.2.4.2.8) for the principle purpose of containment of Materials (see 4.2.2.4.9). Each Process_vessel may be one of the following: an Atmospheric_tank (see 4.2.4.6.1), a Pressure_vessel (see 4.2.4.6.21), or a Solids_storage_bin (see 4.2.4.6.24).

The data associated with Process_vessel are the following:

— capacity;

— diking_required;

— type.

4.2.4.6.22.1 capacity

A capacity specifies the available volume for storing a Process_material (see 4.2.2.4.13).

4.2.4.6.22.2 diking_required

A diking_required specifies whether the Process_vessel requires a dike around it.

4.2.4.6.22.3 type

A type specifies a type of Process_vessel as an Atmospheric_tank (see 4.2.4.6.1), a Pressure_vessel (see 4.2.4.6.21), or a Solids_storage_bin (see 4.2.4.6.24).

4.2.4.6.23 Process_vessel_level

A Process_vessel_level is the height of a process fluid or solids in a vessel or section of a vessel.

The data associated with Process_vessel_level are the following:

— description;

— tag_name;

— type;

— volume_above;

— volume_below.

4.2.4.6.23.1 description

A description specifies a textual explanation or summary of key aspects of the Process_vessel_level.

4.2.4.6.23.2 tag_name

A tag_name specifies a textual label associated with the Process_vessel_level.

4.2.4.6.23.3 type

A type specifies an enumerated attribute describing the type or function of the Process_vessel_level. The value of the type attribute may be one of the following:

— high_level;

— high_shutdown_level;

— low_level;

— low_shutdown_level;

— maximum_level;

— minimum_level;

— normal_level;

— other_level;

— overflow_level;

— unspecified_level.

4.2.4.6.23.3.1 high_level**:** an indication that the Process_vessel_level is the high level for the vessel.

4.2.4.6.23.3.2 high_shutdown_level**:** an indication that the Process_vessel_level is the high shutdown level for the vessel.

4.2.4.6.23.3.3 low_level**:** an indication that the Process_vessel_level is the low level for the vessel.

4.2.4.6.23.3.4 low_shutdown_level**:** an indication that the Process_vessel_level is the low shutdown level for the vessel.

4.2.4.6.23.3.5 maximum_level**:** an indication that the Process_vessel_level the maximum level for the vessel.

4.2.4.6.23.3.6 minimum_level**:** an indication that the Process_vessel_level is the minimum level for the vessel.

4.2.4.6.23.3.7 normal_level**:** an indication that the Process_vessel_level is the normal operating level.

4.2.4.6.23.3.8 other_level**:** an indication that the Process_vessel_level has some other function besides high, high shutdown, maximum, overflow, low, low shutdown, or minimum levels.

4.2.4.6.23.3.9 overflow_level**:** an indication that the Process_vessel_level is the level at which overflow starts to occur.

4.2.4.6.23.3.10 unspecified_level**:** an indication that the Process_vessel_level does not have a specified function.

4.2.4.6.23.4 volume_above

A volume_above specifies the volume of the vessel or section associated with the level above the point of the level.

4.2.4.6.23.5 volume_below

A volume_below specifies the volume of the vessel or section associated with the level below the point of the level.

4.2.4.6.24 Solids_storage_bin

A Solids_storage_bin is a type of Process_vessel (see 4.2.4.6.22) that is primarily for the storage of solid Material (see 4.2.2.4.9).

The data associated with Solids_storage_bin are the following:

— description_of_discharge;

— top_type.

4.2.4.6.24.1 description_of_discharge

A description_of_discharge specifies a textual explanation or summary of the critical dimensions of the bin opening required to adequately discharge the solids.

NOTE - This critical dimension determination is based on flow characteristics of the solid being discharged and on the geometry of the Solids_storage_bin.

4.2.4.6.24.2 top_type

A top_type specifies an enumerated attribute that specifies the top type of the bin. The value of the top_-type attribute shall be one of the following:

— closed;

— open;

— other;

— unspecified.

4.2.4.6.24.2.1 closed**:** an indication that the top of the Solids_storage_bin is closed.

4.2.4.6.24.2.2 open**:** an indication that the top of the Solids_storage_bin is open.

4.2.4.6.24.2.3 other**:** an indication that the top of the Solids_storage_bin is other.

4.2.4.6.24.2.4 unspecified**:** an indication that the top of the Solids_storage_bin is unspecified.

4.2.4.6.25 Spherical_pressure_vessel

A Spherical_pressure_vessel is a type of Pressure_vessel (see 4.2.4.6.21) that has a spherical shape.

The data associated with Spherical_pressure_vessel are the following:

— inside_diameter;

— outside_diameter;

— wall_thickness.

4.2.4.6.25.1 inside_diameter

An inside_diameter specifies the inside diameter of the Spherical_pressure_vessel.

4.2.4.6.25.2 outside_diameter

An outside_diameter specifies the outside diameter of the Spherical_pressure_vessel.

4.2.4.6.25.3 wall_thickness

A wall_thickness specifies the wall thickness of the Spherical_pressure_vessel.

4.2.4.6.26 Spheroidal_pressure_vessel

A Spheroidal_pressure_vessel is a type of Pressure_vessel (see 4.2.4.6.21) that has a spheroidal shape.

The data associated with Spheroidal_pressure_vessel are the following:

— axis_of_rotation_orientation;

— wall_thickness.

4.2.4.6.26.1 axis_of_rotation_orientation

An axis_of_rotation_orientation specifies an enumerated attribute of Spheroidal_pressure_vessel (see 4.2.4.6.26) that describes the orientation of the axis of rotation of the outside_shape sweeping out the vessel's outer surface. The value of the axis_of_rotation_orientation attribute shall be one of the following:

— horizontal;

— inclined;

— unspecified;

— vertical.

4.2.4.6.26.1.1 horizontal**:** an indication that the orientation is horizontal.

4.2.4.6.26.1.2 inclined**:** an indication that the orientation is other than horizontal or vertical.

4.2.4.6.26.1.3 unspecified**:** an indication that the orientation is not specified.

4.2.4.6.26.1.4 vertical**:** an indication that the orientation is vertical.

4.2.4.6.26.2 wall_thickness

A wall_thickness specifies the wall thickness of the Spheroidal_pressure_vessel.

4.2.4.6.27 Standard_dished_head

A Standard_dished_head is a type of head for the Cylindrical_pressure_vessel_head_section (see 4.2.4.6.13).

The data associated with Standard_dished_head are the following:

— inside_diameter;

— knuckle_radius;

— nominal_diameter;

— outside_diameter.

4.2.4.6.27.1 inside_diameter

An inside_diameter specifies the inside diameter of the Standard_dished_head.

4.2.4.6.27.2 knuckle_radius

A knuckle_radius specifies the knuckle radius of the Standard_dished_head.

4.2.4.6.27.3 nominal_diameter

A nominal_diameter specifies the nominal diameter of the Standard_dished_head.

4.2.4.6.27.4 outside_diameter

An outside_diameter specifies the outside diameter of the Standard_dished_head.

4.2.4.6.28 Torispherical_head

A Torispherical_head is a type of head for the Cylindrical_pressure_vessel_head_section (see 4.2.4.6.13) with torispherical geometry.

The data associated with Torispherical_head are the following:

— inside_diameter;

— knuckle_radius;

— outside_diameter.

4.2.4.6.28.1 inside_diameter

An inside_diameter specifies the inside diameter of the Torispherical_head.

4.2.4.6.28.2 knuckle_radius

A knuckle_radius specifies the knuckle radius of the Torispherical_head.

4.2.4.6.28.3 outside_diameter

An outside_diameter specifies the outside diameter of the Torispherical_head.

4.3 Application assertions

This subclause specifies the application assertions for the process plant engineering application protocol. Application assertions specify the relationships between application objects, the cardinality of the relationships, and the rules required for the integrity and validity of the application objects and UoFs. The application assertions and their definitions are given below.

4.3.1 Active_area_shape to Tray_panel_shape

Each Active_area_shape describes the active area for exactly one Tray_panel_shape. Each Tray_panel_-shape has as active area description zero, one, or many Active_area_shape objects.

4.3.2 Axial_position_detector to Centrifugal_compressor

Each Axial_position_detector is a component of exactly one Centrifugal_compressor. Each Centrifugal_-compressor has as a component zero, one, or many Axial_position_detector objects.

4.3.3 Baffle_and_disengaging_panel_intersection to Downcomer_disengaging_panel_shape

Each Baffle_and_disengaging_panel_intersection is intersected by exactly one Downcomer_disengaging_panel_shape. Each Downcomer_disengaging_panel_shape intersects zero, one, or many Baffle_and_disengaging_panel_intersection objects.

4.3.4 Baffle_and_disengaging_panel_intersection to Separation_tray_baffle_shape

Each Baffle_and_disengaging_panel_intersection is intersected by exactly one Separation_tray_baffle_shape. Each Separation_tray_baffle_shape intersects zero or one Baffle_and_disengaging_panel_intersection.

4.3.5 Baffle_and_seal_pan_intersection to Seal_pan_shape

Each Baffle_and_seal_pan_intersection is intersected by exactly one Seal_pan_shape. Each Seal_pan_shape intersects zero, one, or many Baffle_and_seal_pan_intersection objects.

4.3.6 Baffle_and_seal_pan_intersection to Separation_tray_baffle_shape

Each Baffle_and_seal_pan_intersection is intersected by exactly one Separation_tray_baffle_shape. Each Separation_tray_baffle_shape intersects zero or one Baffle_and_seal_pan_intersection.

4.3.7 Baffle_and_tray_panel_intersection to Separation_tray_baffle_shape

Each Baffle_and_tray_panel_intersection is intersected by exactly one Separation_tray_baffle_shape. Each Separation_tray_baffle_shape intersects zero or one Baffle_and_tray_panel_intersection.

4.3.8 Baffle_and_tray_panel_intersection to Tray_panel_shape

Each Baffle_and_tray_panel_intersection is intersected by exactly one Tray_panel_shape. Each Tray_panel_shape intersects zero, one, or many Baffle_and_tray_panel_intersection objects.

4.3.9 Balance to Process_simulation

Each Balance is a result for exactly one Process_simulation. Each Process_simulation has as a result of zero, one, or many Balance objects.

4.3.10 Baseplates_and_soleplates to Fluid_transfer_machine

Each Baseplates_and_soleplates is a component of exactly one Fluid_transfer_machine. Each Fluid_transfer_machine has as a component exactly one Baseplates_and_soleplates.

4.3.11 Bearing to Bearing_housing

Each Bearing is part of exactly one Bearing_housing. Each Bearing_housing contains one or more Bearing objects.

4.3.12 Bearing to Fluid_transfer_machine

Each Bearing may be a component of exactly one Fluid_transfer_machine. Each Fluid_transfer_machine has as a component zero, one, or many Bearing objects.

4.3.13 Bearing_housing to Fluid_transfer_machine

Each Bearing_housing is a component of exactly one Fluid_transfer_machine. Each Fluid_transfer_-machine has as a component zero or one Bearing_housing.

4.3.14 Bin_section to Bounded_curve

Each Bin_section has lower cross section represented by exactly one Bounded_curve. Each Bounded_-curve is lower cross section for zero, one, or many Bin_section objects.

Each Bin_section has upper cross section represented by exactly one Bounded_curve. Each Bounded_-curve is upper cross section for zero, one, or many Bin_section objects.

4.3.15 Bin_section to Construction_material

Each Bin_section may be made from exactly one Construction_material. Each Construction_material is used to make zero, one, or many Bin_section objects.

4.3.16 Bin_section to External_treatment

Each Bin_section may be the treatment for exactly one External_treatment. Each External_treatment is treatment for zero, one, or many Bin_section objects.

4.3.17 Bin_section to Solids_storage_bin

Each Bin_section is a component of exactly one Solids_storage_bin. Each Solids_storage_bin has as ordered components one or more Bin_section objects.

4.3.18 Binary_parameter_value to Substance

Each Binary_parameter_value may be a property value of exactly one Substance. Each Substance has property value of zero, one, or many Binary_parameter_value objects.

4.3.19 Blinding_strip to Blinding_strip_shape

Each Blinding_strip may be described by exactly one Blinding_strip_shape. Each Blinding_strip_shape describes zero, one, or many Blinding_strip objects.

4.3.20 Blinding_strip_shape to Separation_tray_shape

Each Blinding_strip_shape composes exactly one Separation_tray_shape. Each Separation_tray_shape consists of zero, one, or many Blinding_strip_shape objects.

4.3.21 Boot to Cylindrical_pressure_vessel_section

Each Boot is attached to exactly one Cylindrical_pressure_vessel_section. Each Cylindrical_pressure_-vessel_section has attached zero, one, or many Boot objects.

4.3.22 Boot_location_on_cylinder_section to Boot

Each Boot_location_on_cylinder_section has child boot of exactly one Boot. Each Boot is child boot for zero or one Boot_location_on_cylinder_section.

4.3.23 Boot_location_on_cylinder_section to Cylindrical_pressure_vessel_-cylinder_section

Each Boot_location_on_cylinder_section is an attachment of exactly one Cylindrical_pressure_vessel_-cylinder_section. Each Cylindrical_pressure_vessel_cylinder_section has as attachments zero, one, or many Boot_location_on_cylinder_section objects.

4.3.24 Boot_location_on_head_section to Boot

Each Boot_location_on_head_section has child boot of exactly one Boot. Each Boot is child boot for zero or one Boot_location_on_head_section.

4.3.25 Boot_location_on_head_section to Cylindrical_pressure_vessel_head_-section

Each Boot_location_on_head_section is attachment of exactly one Cylindrical_pressure_vessel_head_-section. Each Cylindrical_pressure_vessel_head_section has as attachments zero, one, or many Boot_-location_on_head_section objects.

4.3.26 Boot_section_relationship to Boot

Each Boot_section_relationship has as ordered sections exactly one Boot. Each Boot has as ordered sections exactly two Boot_section_relationship objects.

4.3.27 Boot_section_relationship to Cylindrical_pressure_vessel_section

Each Boot_section_relationship has section of exactly one Cylindrical_pressure_vessel_section. Each Cylindrical_pressure_vessel_section is sections of zero or one Boot_section_relationship.

4.3.28 Bulk_thermodynamic_properties to Bulk_thermophysical_properties

Each Bulk_thermodynamic_properties is property of exactly one Bulk_thermophysical_properties. Each Bulk_thermophysical_properties has properties of zero or one Bulk_thermodynamic_properties.

4.3.29 Bulk_thermodynamic_properties to Reference_state

Each Bulk_thermodynamic_properties may have reference state provided by exactly one Reference_state. Each Reference_state provides reference state for zero, one, or many Bulk_thermodynamic_properties objects.

4.3.30 Bulk_thermophysical_properties to Material_amount

Each Bulk_thermophysical_properties may be a property of exactly one Material_amount. Each Material_amount has composite properties of zero or one Bulk_thermophysical_properties.

NOTE - Each Bulk_thermophysical_properties shall be related to exactly one Material_amount, Material_-stream, or Specific_phase.

4.3.31 Bulk_thermophysical_properties to Material_stream

Each Bulk_thermophysical_properties may be property of exactly one Material_stream. Each Material_-stream has composite properties of zero or one Bulk_thermophysical_properties.

NOTE - Each Bulk_thermophysical_properties shall be related to exactly one Material_amount, Material_-stream, or Specific_phase.

4.3.32 Bulk_thermophysical_properties to Mixture

Each Bulk_thermophysical_properties may be composition data of exactly one Mixture. Each Mixture has composition data of zero or one Bulk_thermophysical_properties.

4.3.33 Bulk_thermophysical_properties to Reference_state

Each Bulk_thermophysical_properties may have a reference state provided by exactly one Reference_-state. Each Reference_state provides reference state for zero, one, or many Bulk_thermophysical_-properties objects.

4.3.34 Bulk_thermophysical_properties to Referenced_object

Each Bulk_thermophysical_properties is zero or one Referenced_object. Each Referenced_object may be exactly one Bulk_thermophysical_properties.

4.3.35 Bulk_thermophysical_properties to Specific_phase

Each Bulk_thermophysical_properties may be a property of exactly one Specific_phase. Each Specific_-phase has composite properties zero or one Bulk_thermophysical_properties.

NOTE - Each Bulk_thermophysical_properties shall be related to exactly one Material_amount, Material_-stream, or Specific_phase.

4.3.36 Bulk_vapour_liquid_equilibrium_properties to Bulk_thermophysical_properties

Each Bulk_vapour_liquid_equilibrium_properties is property of exactly one Bulk_thermophysical_-properties. Each Bulk_thermophysical_properties has properties of zero or one Bulk_vapour_liquid_-equilibrium_properties.

4.3.37 Cap_shape to Bubble_cap_shape

Each Cap_shape composes exactly one Bubble_cap_shape. Each Bubble_cap_shape consists of exactly one Cap_shape.

4.3.38 Cap_shape to Curve

Each Cap_shape may have bottom edge described by exactly one Curve. Each Curve describes the bottom edge of zero or one Cap_shape.

4.3.39 Cap_shape to Bubble_slot_shape

Each Cap_shape may have slot described by exactly one Bubble_slot_shape. Each Bubble_slot_shape describes the slot for zero, one, or many Cap_shape objects.

4.3.40 Cartesian_point to Tray_panel_and_perforation_shape

Each Cartesian_point may be the perforation location for exactly one Tray_panel_and_perforation_-shape. Each Tray_panel_and_perforation_shape has as the perforation location zero, one, or many Cartesian_point objects.

4.3.41 Cartesian_point to Tray_panel_and_slot_shape

Each Cartesian_point may be the slot location for exactly one Tray_panel_and_slot_shape. Each Tray_-panel_and_slot_shape has as the slot location zero, one, or many Cartesian_point objects.

4.3.42 Casing_nozzle to Fluid_transfer_machine

Each Casing_nozzle is a component of exactly one Fluid_transfer_machine. Each Fluid_transfer_-machine has as a component zero, one, or many Casing_nozzle objects.

4.3.43 Cc_balance_piston to Centrifugal_compressor

Each Cc_balance_piston is a component of exactly one Centrifugal_compressor. Each Centrifugal_-compressor has as a component zero or one Cc_balance_piston.

4.3.44 Cc_casing to Centrifugal_compressor

Each Cc_casing is a component of exactly one Centrifugal_compressor. Each Centrifugal_compressor has as a component exactly one Cc_casing.

4.3.45 Cc_diaphragm to Centrifugal_compressor

Each Cc_diaphragm is a component of exactly one Centrifugal_compressor. Each Centrifugal_-compressor has as a component zero, one, or many Cc_diaphragm objects.

4.3.46 Cc_impeller to Centrifugal_compressor_stage

Each Cc_impeller is part of exactly one Centrifugal_compressor_stage. Each Centrifugal_compressor_-stage has zero, one, or many Cc_impeller objects.

4.3.47 Cc_impeller to Centrifugal_compressor

Each Cc_impeller is a component of exactly one Centrifugal_compressor. Each Centrifugal_compressor has as a component zero, one, or many Cc_impeller objects.

4.3.48 Cc_labyrinth to Centrifugal_compressor

Each Cc_labyrinth is a component of exactly one Centrifugal_compressor. Each Centrifugal_compressor has as a component zero, one, or many Cc_labyrinth objects.

4.3.49 Cc_lateral_critical_speed to Centrifugal_compressor

Each Cc_lateral_critical_speed is part of exactly one Centrifugal_compressor. Each Centrifugal_-compressor has zero, one, or many Cc_lateral_critical_speed objects.

4.3.50 Cc_miscellaneous to Centrifugal_compressor

Each Cc_miscellaneous is part of exactly one Centrifugal_compressor. Each Centrifugal_compressor has zero or one Cc_miscellaneous.

4.3.51 Cc_shaft_sleeve to Centrifugal_compressor

Each Cc_shaft_sleeve is a component of exactly one Centrifugal_compressor. Each Centrifugal_-compressor has as a component zero, one, or many Cc_shaft_sleeve objects.

4.3.52 Cc_speed_control_method to Centrifugal_compressor

Each Cc_speed_control_method is part of exactly one Centrifugal_compressor. Each Centrifugal_-compressor has zero, one, or many Cc_speed_control_method objects.

4.3.53 Cc_speed_control_signal to Centrifugal_compressor

Each Cc_speed_control_signal is part of exactly one Centrifugal_compressor. Each Centrifugal_-compressor has zero, one, or many Cc_speed_control_signal objects.

4.3.54 Cc_torsional_critical_speed to Centrifugal_compressor

Each Cc_torsional_critical_speed is part of exactly one Centrifugal_compressor. Each Centrifugal_-compressor has zero, one, or many Cc_torsional_critical_speed objects.

4.3.55 Cc_weights to Centrifugal_compressor

Each Cc_weights is part of exactly one Centrifugal_compressor. Each Centrifugal_compressor has zero or one Cc_weights.

4.3.56 Centrifugal_compressor to Buffer_gas_system

Each Centrifugal_compressor is the shaft seal component for exactly one Buffer_gas_system. Each Buffer_gas_system has as the shaft seal component zero or one Centrifugal_compressor.

4.3.57 Centrifugal_compressor_stage to Centrifugal_compressor

Each Centrifugal_compressor_stage is the component stage for exactly one Centrifugal_compressor. Each Centrifugal_compressor has as component stages zero, one, or many Centrifugal_compressor_stage objects.

4.3.58 Centrifugal_pump to Mechanical_seal

Each Centrifugal_pump has a component of exactly one Mechanical_seal. Each Mechanical_seal is component of exactly one Centrifugal_pump.

4.3.59 Chemical_reaction to Process_design_property_value

Each Chemical_reaction has zero, one, or many Process_design_property_value objects. Each Process_-design_property_value defines property values of zero, one, or many Chemical_reaction objects.

4.3.60 Chemical_reaction to Referenced_object

Each Chemical_reaction is a zero or one Referenced_object. Each Referenced_object may be exactly one Chemical_reaction.

4.3.61 Chemical_reaction to Uo_reactor

Each Chemical_reaction is the chemical reaction for zero, one, or many Uo_reactor objects. Each Uo_-reactor has as a chemical reaction zero, one, or many Chemical_reaction objects.

4.3.62 Chemical_specie to Family

Each Chemical_specie is in family of zero, one, or many Family objects. Each Family specie is family of zero, one, or many Chemical_specie objects.

4.3.63 Chemical_specie_structural_group_relationship to Chemical_specie

Each Chemical_specie_structural_group_relationship has groups of exactly one Chemical_specie. Each Chemical_specie has groups zero, one, or many Chemical_specie_structural_group_relationship objects.

4.3.64 Chemical_specie_structural_group_relationship to Structural_group

Each Chemical_specie_structural_group_relationship has group of exactly one Structural_group. Each Structural_group is group in zero, one, or many Chemical_specie_structural_group_relationship objects.

4.3.65 Citation to Citation_reference

Each Citation is called out in zero, one, or many Citation_reference objects. Each Citation_reference has exactly one Citation.

4.3.66 Citation to Property_note

Each Citation has as a note zero, one, or many Property_note objects. Each Property_note is a note for zero, one, or many Citation objects.

4.3.67 Clock_time to Date

Each Clock_time has as the date exactly one Date. Each Date is the date for one or more Clock_time objects.

4.3.68 Coefficient to Specific_equation

Each Coefficient is value of exactly one Specific_equation. Each Specific_equation has value of zero, one, or many Coefficient objects.

4.3.69 Coefficient to Variable_value

Each Coefficient has values of zero, one, or many Variable_value objects. Each Variable_value is value for exactly one Coefficient.

4.3.70 Component_in_mixture_properties to Chemical_component

Each Component_in_mixture_properties is property of exactly one Chemical_component. Each Chemical_component has properties zero, one, or many Component_in_mixture_properties objects.

4.3.71 Component_in_mixture_properties to Single_phase_thermophysical_-properties

Each Component_in_mixture_properties is property of exactly one Single_phase_thermophysical_-properties. Each Single_phase_thermophysical_properties has properties of zero, one, or many Component_in_mixture_properties objects.

4.3.72 Composition_relationship to Mixture

Each Composition_relationship is contained by exactly one Mixture. Each Mixture contains zero, one, or many Composition_relationship objects. If a Mixture has a Composition_relationship specified, it shall have at least two Composition_relationships.

4.3.73 Composition_relationship to Referenced_object

Each Composition_relationship is zero or one Referenced_object. Each Referenced_object may be exactly one Composition_relationship.

4.3.74 Composition_relationship to Substance

Each Composition_relationship contains exactly one Substance. Each Substance is part of zero, one, or many Composition_relationship objects.

4.3.75 Connected_equipment_port to Equipment_port

Each Connected_equipment_port is exactly one Equipment_port. Each Equipment_port is zero or one Connected_equipment_port.

4.3.76 Connected_equipment_port to Equipment_port_connection

Each Connected_equipment_port is connected by exactly one Equipment_port_connection. Each Equipment_port_connection connects exactly two Connected_equipment_port objects.

4.3.77 Connected_process_port to Process_port

Each Connected_process_port is exactly one Process_port. Each Process_port is the port for zero, one, or many Connected_process_port objects.

4.3.78 Connected_process_port to Process_port_connection

Each Connected_process_port is used in exactly one Process_port_connection. Each Process_port_-connection is the connection for exactly two Connected_process_port objects.

4.3.79 Construction_material to Plant_item

Each Construction_material is used in the construction of zero, one, or many Plant_item objects. Each Plant_item is constructed of zero, one, or many Construction_material objects.

4.3.80 Continuous_control_objective to Control_loop

Each Continuous_control_objective is implemented by one or more Control_loop objects. Each Control_-loop implements zero, one, or many Continuous_control_objective objects.

4.3.81 Continuous_control_objective to Process_design_property_value

Each Continuous_control_objective has controlled variables of one or more Process_design_property_-value objects. Each Process_design_property_value is a controlled variable for zero, one, or many Continuous_control_objective objects.

4.3.82 Continuous_control_scheme to Continuous_control_objective

Each Continuous_control_scheme has one or more Continuous_control_objective objects.Each Continuous_control_objective is specified by exactly one Continuous_control_scheme.

4.3.83 Control_adjustment to Process_design_property_value

Each Control_adjustment has manipulated variables of one or more Process_design_property_value objects. Each Process_design_property_value is a manipulated variable for zero, one, or many Control_-adjustment objects.

4.3.84 Control_event to Process_design_property_value

Each Control_event has manipulated variables of one or more Process_design_property_value objects. Each Process_design_property_value is a manipulated variable for zero, one, or many Control_event objects.

4.3.85 Control_logic to Control_event

Each Control_logic is carried out by zero, one, or many Control_event objects. Each Control_event has exactly one Control_logic object.

4.3.86 Control_logic to Control_logic_condition

Each Control_logic may have requirements defined by exactly one Control_logic_condition. Each Control_logic_condition defines requirements for zero, one, or many Control_logic objects.

4.3.87 Control_logic to Process_design_property_value

Each Control_logic has threshold values of zero, one, or many Process_design_property_value objects. Each Process_design_property_value is a threshold value for zero, one, or many Control_logic objects.

4.3.88 Control_logic_condition to Event_sequence

Each Control_logic_condition may have execution governed by exactly one Event_sequence. Each Event_sequence has execution governed by one or more Control_logic_condition objects.

4.3.89 Control_logic_condition to Process_design_property_value

Each Control_logic_condition is evaluated based on one or more Process_design_property_value objects. Each Process_design_property_value participates in the evaluation of zero, one, or many Control_logic_-condition objects.

4.3.90 Control_loop to Control_adjustment

Each Control_loop is carried out by zero, one, or many Control_adjustment objects. Each Control_-adjustment carries out exactly one Control_loop object.

4.3.91 Control_loop to Process_design_property_value

Each Control_loop has measured variables of one or more Process_design_property_value objects. Each Process_design_property_value is a measured variable for zero, one, or many Control_loop objects.

Each Control_loop has setpoints of one or more Process_design_property_value objects. Each Process_-design_property_value is setpoint for zero, one, or many Control_loop objects.

4.3.92 Convergence_block_property_value_usage to Process_design_proper-ty_value

Each Convergence_block_property_value_usage has as value exactly one Process_design_property_-value. Each Process_design_property_value is the value for zero, one, or many Convergence_block_-property_value_usage objects.

4.3.93 Convergence_block_property_value_usage to Stream_convergence_-block

Each Convergence_block_property_value_usage is the value for exactly one Stream_convergence_block. Each Stream_convergence_block uses values of zero, one, or many Convergence_block_property_-value_usage objects.

4.3.94 Corrugation to Tray_panel_shape

Each Corrugation may be the corrugation for exactly one Tray_panel_shape. Each Tray_panel_shape has as corrugation zero or one Corrugation.

4.3.95 Coupling to Fluid_transfer_machine

Each Coupling may be a component of exactly one Fluid_transfer_machine. Each Fluid_transfer_-machine has as a component zero, one, or many Coupling objects.

4.3.96 Cross_baffle to Exchanger_bundle

Each Cross_baffle belongs to exactly one Exchanger_bundle. Each Exchanger_bundle has zero, one, or many Cross_baffle objects.

If there is more than one kind of Cross_baffle for a given Exchanger_bundle, each individual cross_baffle shall be specified. Otherwise, only one cross_baffle instance shall be specified, and the count shall be specified in the number_of_cross_baffles attribute.

4.3.97 Curve to Baffle_and_disengaging_panel_intersection

Each Curve may describe the intersection for exactly one Baffle_and_disengaging_panel_intersection. Each Baffle_and_disengaging_panel_intersection has an intersection description of zero or one Curve.

4.3.98 Curve to Baffle_and_seal_pan_intersection

Each Curve may describe the intersection for exactly one Baffle_and_seal_pan_intersection. Each Baffle_and_seal_pan_intersection has an intersection description of zero or one Curve.

4.3.99 Curve to Baffle_and_tray_panel_intersection

Each Curve may describe the intersection for exactly one Baffle_and_tray_pan_intersection. Each Baffle_and_tray_pan_intersection has an intersection description of zero or one Curve.

4.3.100 Curve to Downcomer_apron_section_shape

Each Curve may describe the bottom edge for exactly one Downcomer_apron_section_shape. Each Downcomer_apron_section_shape has the bottom edge described by zero or one Curve.

4.3.101 Curve to Weir_and_disengaging_panel_intersection

Each Curve may describe the intersection for exactly one Weir_and_disengaging_panel_intersection. Each Weir_and_disengaging_panel_intersection has the intersection described by zero or one Curve.

4.3.102 Curve to Weir_and_seal_pan_intersection

Each Curve may describe the intersection for exactly one Weir_and_seal_pan_intersection. Each Weir_-and_seal_pan_intersection has the intersection described by zero or one Curve.

4.3.103 Curve to Weir_and_tray_panel_intersection

Each Curve may describe the intersection for exactly one Weir_and_tray_pan_intersection. Each Weir_-and_tray_pan_intersection has the intersection described by zero or one Curve.

4.3.104 Curve to Weir_shape

Each Curve may describe the weir top edge for exactly one Weir_shape. Each Weir_shape has weir top edge described by zero or one Curve.

4.3.105 Curve to Corrugation

Each Curve may describe exactly one Corrugation. Each Corrugation is described by zero or one Curve.

4.3.106 Cylindrical_pressure_vessel to Separation_tower

Each Cylindrical_pressure_vessel may compose exactly one Separation_tower. Each Separation_tower is composed of one or more Cylindrical_pressure_vessel objects.

4.3.107 Cylindrical_pressure_vessel_section to Construction_material

Each Cylindrical_pressure_vessel_section may be made from exactly one Construction_material. Each Construction_material is used to make zero, one, or many Cylindrical_pressure_vessel_section objects.

4.3.108 Cylindrical_pressure_vessel_section to Cylindrical_pressure_vessel

Each Cylindrical_pressure_vessel_section may be ordered section of exactly one Cylindrical_pressure_-vessel. Each Cylindrical_pressure_vessel has as ordered sections of zero, one, or many Cylindrical_-pressure_vessel_section objects.

4.3.109 Cylindrical_pressure_vessel_section to Cylindrical_pressure_vessel_-connection

Each Cylindrical_pressure_vessel_section is connected by zero, one, or many Cylindrical_pressure_-vessel_connection objects. Each Cylindrical_pressure_vessel_connection connects exactly two Cylindrical_pressure_vessel_section.

4.3.110 Cylindrical_pressure_vessel_section to External_treatment

Each Cylindrical_pressure_vessel_section may have treatment of exactly one External_treatment. Each External_treatment is treatment for zero, one, or many Cylindrical_pressure_vessel_section objects.

4.3.111 Data_entry to Property_data_set

Each Data_entry is in one or more Property_data_set objects. Each Property_data_set has zero, one, or many Data_entry objects.

4.3.112 Data_source to Citation

Each Data_source may have as a source exactly one Citation. Each Citation has source of zero, one, or many Data_source objects.

4.3.113 Demister_pad to Cylindrical_pressure_vessel

Each Demister_pad may be part of exactly one Cylindrical_pressure_vessel. Each Cylindrical_pressure_-vessel has internally zero, one, or many Demister_pad objects.

4.3.114 Demister_pad to Cylindrical_pressure_vessel_section

Each Demister_pad is contained within zero, one, or many Cylindrical_pressure_vessel_section objects. Each Cylindrical_pressure_vessel_section contains zero, one, or many Demister_pad objects.

4.3.115 Demister_pad to Separation_tower

Each Demister_pad may be part of exactly one Separation_tower. Each Separation_tower has as part of it zero, one, or many Demister_pad objects.

4.3.116 Demister_pad_stack to Cylindrical_pressure_vessel

Each Demister_pad_stack may be part of exactly one Cylindrical_pressure_vessel. Each Cylindrical_-pressure_vessel has internally zero, one, or many Demister_pad_stack objects.

4.3.117 Demister_pad_stack to Cylindrical_pressure_vessel_section

Each Demister_pad_stack is contained within zero, one, or many Cylindrical_pressure_vessel_section objects. Each Cylindrical_pressure_vessel_section contains zero, one, or many Demister_pad_stack objects.

4.3.118 Demister_pad_stack to Separation_tower

Each Demister_pad_stack may be part of exactly one Separation_tower. Each Separation_tower has as part of it zero, one, or many Demister_pad_stack objects.

4.3.119 Density_properties to Bulk_thermophysical_properties

Each Density_properties may be property of exactly one Bulk_thermophysical_properties. Each Bulk_-thermophysical_properties has properties of zero or one Density_properties.

4.3.120 Density_properties to Single_phase_thermophysical_properties

Each Density_properties may be property of exactly one Single_phase_thermophysical_properties. Each Single_phase_thermophysical_properties has properties of zero or one Density_properties.

4.3.121 Density_properties to Transport_properties

Each Density_properties may be property of exactly one Transport_properties. Each Transport_-properties has properties of zero or one Density_properties.

4.3.122 Design_project to PFD_title_block

Each Design_project is displayed on zero, one, or many PFD_title_block objects. Each PFD_title_block displays zero or one Design_project.

4.3.123 Design_project_assignment to Design_project

Each Design_project_assignment has performed in it exactly one Design_project. Each Design_project is performed in zero, one, or many Design_project_assignment objects.

4.3.124 Design_project_assignment to Plant_item

Each Design_project_assignment assigns exactly one Plant_item. Each Plant_item is assigned by zero, one, or many Design_project_assignment objects.

4.3.125 Detuning_plate to Exchanger_bundle

Each Detuning_plate belongs to exactly one Exchanger_bundle. Each Exchanger_bundle has zero or one Detuning_plate.

4.3.126 Discrete_control_objective to Control_logic

Each Discrete_control_objective is implemented by one or more Control_logic objects. Each Control_-logic implements zero, one, or many Discrete_control_objective objects.

4.3.127 Discrete_control_objective to Process_design_property_value

Each Discrete_control_objective controls one or more Process_design_property_value objects. Each Process_design_property_value is controlled by zero, one, or many Continuous_control_objective objects.

4.3.128 Discrete_control_scheme to Discrete_control_objective

Each Discrete_control_scheme has one or more Discrete_control_objective objects. Each Discrete_-control_objective is specified by exactly one Discrete_control_scheme.

4.3.129 Disengaging_panel_opening_shape to Downcomer_apron_shape

Each Disengaging_panel_opening_shape describes the opening of exactly one Downcomer_apron_shape. Each Downcomer_apron_shape has the opening described by one or more Disengaging_panel_opening_-shape objects.

4.3.130 Disengaging_panel_opening_shape to Downcomer_disengaging_panel_shape

Each Disengaging_panel_opening_shape describes the opening of exactly one Downcomer_-disengaging_panel_shape. Each Downcomer_disengaging_panel_shape has the opening described by zero, one, or many Disengaging_panel_opening_shape objects.

4.3.131 Distillation_curve to Petroleum_mixture

Each Distillation_curve may be the curve for exactly one Petroleum_mixture. Each Petroleum_mixture has as a curve zero, one, or many Distillation_curve objects.

4.3.132 Distillation_curve to Pseudo_component

Each Distillation_curve may be the curve for exactly one Pseudo_component. Each Pseudo_component is derived from zero, one, or many Distillation_curve objects.

4.3.133 Distillation_stage_phase to Uo_distillation_stage

Each Distillation_stage_phase is draw for exactly one Uo_distillation_stage. Each Uo_distillation_stage has as draw zero, one, or many Distillation_stage_phase objects.

4.3.134 Distillation_stage_phase to Uo_reactor

Each Distillation_stage_phase may have reactor of exactly one Uo_reactor. Each Uo_reactor is reactor for zero or one Distillation_stage_phase.

4.3.135 Distribution_belt to Exchanger_nozzle

Each Distribution_belt belongs to exactly one Exchanger_nozzle. Each Exchanger_nozzle has zero or one Distribution_belt.

4.3.136 Downcomer to Downcomer_shape

Each Downcomer may be described exactly one by Downcomer_shape. Each Downcomer_shape describes zero, one, or many Downcomer objects.

4.3.137 Downcomer to Downcomer_hydraulics

Each Downcomer may have as the hydraulics exactly one Downcomer_hydraulics. Each Downcomer_-hydraulics is the hydraulics of zero, one, or many Downcomer objects.

4.3.138 Downcomer_apron_section_shape to Downcomer_apron_shape

Each Downcomer_apron_section_shape is part of exactly one Downcomer_apron_shape. Each Downcomer_apron_shape consists of one or more Downcomer_apron_section_shape objects.

4.3.139 Downcomer_apron_shape to Downcomer_shape

Each Downcomer_apron_shape is part of exactly one Downcomer_shape. Each Downcomer_shape consists of zero, one, or many Downcomer_apron_shape objects.

4.3.140 Downcomer_disengaging_panel_shape to Downcomer_shape

Each Downcomer_disengaging_panel_shape is part of exactly one Downcomer_shape. Each Downcomer_shape consists of exactly one Downcomer_disengaging_panel_shape.

4.3.141 Downcomer_liquid_flow_channel_shape to Downcomer_apron_section_shape

Each Downcomer_liquid_flow_channel_shape describes the flow channel for exactly one Downcomer_-apron_section_shape. Each Downcomer_apron_section_shape has the flow channel described by zero or one Downcomer_liquid_flow_channel_shape.

4.3.142 Downcomer_shape to Separation_tray_shape

Each Downcomer_shape is part of exactly one Separation_tray_shape. Each Separation_tray_shape consists of zero, one, or many Downcomer_shape objects.

4.3.143 Equation_group to Citation

Each Equation_group has as a reference exactly one Citation. Each Citation is a reference for zero, one, or many Equation_group objects.

4.3.144 Equation_group to Property_note

Each Equation_group is referenced in zero, one, or many Property_note objects. Each Property_note is about zero, one, or many Equation_group objects.

4.3.145 Equation_group to Thermophysical_property_method

Each Equation_group specifies models for zero, one, or many Thermophysical_property_method objects. Each Thermophysical_property_method is modelled by zero, one, or many Equation_group objects.

4.3.146 Equation_group to Variable_approval_context

Each Equation_group has approval context for zero, one, or many Variable_approval_context objects. Each Variable_approval_context is suitable value for zero, one, or many Equation_group objects.

4.3.147 Equipment_port to Plant_item

Each Equipment_port is the port for one or more Plant_item objects. Each Plant_item has ports of zero, one, or many Equipment_port objects.

4.3.148 Equipment_port to Process_design_property_value

Each Equipment_port has zero, one, or many Process_design_property_value objects. Each Process_-design_property_value defines property values of zero, one, or many Equipment_port objects.

4.3.149 Equipment_port to Referenced_object

Each Equipment_port is zero or one Referenced_object. Each Referenced_object may be exactly one Equipment_port.

4.3.150 Escape_area_shape to Downcomer_shape

Each Escape_area_shape describes the seal pan escape area for exactly one Downcomer_shape. Each Downcomer_shape has as seal pan escape area description zero or one Escape_area_shape.

4.3.151 Escape_area_shape to Seal_pan_shape

Each Escape_area_shape describes the downcomer escape area for exactly one Seal_pan_shape. Each Seal_pan_shape has as downcomer escape area description zero or one Escape_area_shape.

4.3.152 Excess_properties to Reference_state

Each Excess_properties may have reference state provided by exactly one Reference_state. Each Reference_state provides reference state for zero, one, or many Excess_properties objects.

4.3.153 Excess_properties to Single_phase_thermophysical_properties

Each Excess_properties is properties of exactly one Single_phase_thermophysical_properties. Each Single_phase_thermophysical_properties has properties of zero or one Excess_properties.

4.3.154 Exchanger_assembly to Shell_and_tube_heat_exchanger_unit

Each Exchanger_assembly belongs to exactly one Shell_and_tube_heat_exchanger_unit. Each Shell_-and_tube_heat_exchanger_unit has one or more Exchanger_assembly objects.

If there is more than one kind of exchanger_assembly for a given shell_and_tube_heat_exchanger_unit, then each individual exchanger_assembly shall be specified. Otherwise, only one exchanger_assembly instance shall be specified.

4.3.155 Exchanger_bundle to Exchanger_assembly

Each Exchanger_bundle belongs to exactly one Exchanger_assembly. Each Exchanger_assembly has exactly one Exchanger_bundle.

4.3.156 Exchanger_bundle to Tube_type

Each Exchanger_bundle may have as the type exactly one Tube_type. Each Tube_type is the type of one or more Exchanger_bundle objects.

> NOTE - A tube_type has 1 or more exchanger_bundle due to the scope of the AP. With a different scope, the tube_type could be associated with more than just the exchanger_bundle, so the association would change.

4.3.157 Exchanger_design_criteria to Shellside_design

Each Exchanger_design_criteria has exactly one Shellside_design. Each Shellside_design is the shellside design for zero, one, or many Exchanger_design_criteria objects.

4.3.158 Exchanger_design_criteria to Tubeside_design

Each Exchanger_design_criteria has exactly one Tubeside_design. Each Tubeside_design is the tubeside design for zero, one, or many Exchanger_design_criteria objects.

4.3.159 Exchanger_end to End_partition_plate

Each Exchanger_end may have exactly one End_partition_plate. Each End_partition_plate belongs to zero, one, or many Exchanger_end objects.

4.3.160 Exchanger_end to Exchanger_assembly

Each Exchanger_end belongs to exactly one Exchanger_assembly. Each Exchanger_assembly has zero, one, or many Exchanger_end objects.

4.3.161 Exchanger_nozzle to Exchanger_assembly

Each Exchanger_nozzle belongs to exactly one Exchanger_assembly. Each Exchanger_assembly has zero, one, or many Exchanger_nozzle objects.

4.3.162 Exchanger_performance to Exchanger_assembly

Each Exchanger_performance may be the performance for exactly one Exchanger_assembly. Each Exchanger_assembly has as the performance zero or one Exchanger_performance.

4.3.163 Exchanger_shell to Exchanger_assembly

Each Exchanger_shell belongs to exactly one Exchanger_assembly. Each Exchanger_assembly has exactly one Exchanger_shell.

4.3.164 Exchanger_zone to Exchanger_performance

Each Exchanger_zone describes the location for exactly one Exchanger_performance. Each Exchanger_-performance is in zero, one, or many Exchanger_zone objects.

4.3.165 Expansion_joint to Exchanger_shell

Each Expansion_joint belongs to exactly one Exchanger_shell. Each Exchanger_shell has zero or one Expansion_joint.

4.3.166 Extents_specified_chemical_reaction to Chemical_reaction

Each Extents_specified_chemical_reaction is exactly one Chemical_reaction. Each Chemical_reaction is zero or one Extents_specified_chemical_reaction.

4.3.167 Extents_specified_chemical_reaction to Uo_extent_specified_reactor

Each Extents_specified_chemical_reaction is specified by exactly one Uo_extent_specified_reactor. Each Uo_extent_specified_reactor specifies one or more Extents_specified_chemical_reaction objects.

4.3.168 External_circuit_component to Reboiler_piping

Each External_circuit_component belongs to exactly one Reboiler_piping. Each Reboiler_piping has zero, one, or many External_circuit_component objects.

4.3.169 External_classification to Plant_item

Each External_classification classifies zero, one, or many Plant_item objects. Each Plant_item is classified by zero, one, or many External_classification objects.

4.3.170 External_classification to Plant_system

Each External_classification classifies zero, one, or many Plant_system objects. Each Plant_system is classified by zero, one, or many External_classification objects.

4.3.171 External_reference to Plant_item

Each External_reference describes zero, one, or many Plant_item objects. Each Plant_item is described in zero, one, or many External_reference objects.

4.3.172 External_reference to Plant_system

Each External_reference describes zero, one, or many Plant_system objects. Each Plant_system is described in zero, one, or many External_reference objects.

4.3.173 Flow_vibration_analysis to Exchanger_performance

Each Flow_vibration_analysis describes exactly one Exchanger_performance. Each Exchanger_-performance has zero, one, or many Flow_vibration_analysis objects.

4.3.174 Fluid_transfer_performance_data_point to Uo_fluid_transfer

Each Fluid_transfer_performance_data_point is data point of exactly one Uo_fluid_transfer. Each Uo_-fluid_transfer has as data point zero, one, or many Fluid_transfer_performance_data_point objects.

4.3.175 Functional_volume to Plant_item

Each Functional_volume is of exactly one Plant_item. Each Plant_item has functional volume zero, one, or many Functional_volume objects.

4.3.176 Functional_volume_service_case to Functional_volume

Each Functional_volume_service_case has capacity provided by exactly one Functional_volume. Each Functional_volume is the capacity for zero, one, or many Functional_volume_service_case objects.

4.3.177 Functional_volume_service_case to Material_amount

Each Functional_volume_service_case is specified by exactly one Material_amount. Each Material_-amount provides specification for zero or one Functional_volume_service_case.

4.3.178 Functional_volume_service_case to Process_service

Each Functional_volume_service_case is serviced by exactly one Process_service. Each Process_service is service for zero, one, or many Functional_volume_service_case objects.

4.3.179 Gasket to Construction_material

Each Gasket may be the body material for exactly one Construction_material. Each Construction_-material is body material for zero, one, or many Gasket objects.

Each Gasket may be the fill material for exactly one Construction_material. Each Construction_material is fill material for zero, one, or many Gasket objects.

4.3.180 Heat_exchanger_internal_data to Uo_heat_exchanger_side

Each Heat_exchanger_internal_data is internal data for exactly one Uo_heat_exchanger_side. Each Uo_-heat_exchanger_side has as internal data zero, one, or many Heat_exchanger_internal_data objects.

4.3.181 Heat_exchanger_internal_phase to Heat_exchanger_internal_data

Each Heat_exchanger_internal_phase is internal phase for exactly one Heat_exchanger_internal_data. Each Heat_exchanger_internal_data has as internal phase one or more Heat_exchanger_internal_phase objects.

4.3.182 Heat_release_curve to Shellside_design

Each Heat_release_curve may describe the heat characteristics for exactly one Shellside_design. Each Shellside_design has heat characteristics of zero, one, or many Heat_release_curve objects. The heat_-release_curve shall be associated with at least one of tubeside_design or shellside_design.

4.3.183 Heat_release_curve to Tubeside_design

Each Heat_release_curve may describe the heat characteristics for exactly one Tubeside_design. Each Tubeside_design has heat characteristics of zero, one, or many Heat_release_curve objects. The heat_-release_curve shall be associated with at least one of tubeside_design or shellside_design.

4.3.184 Heat_release_point to Heat_release_curve

Each Heat_release_point is a point in exactly one Heat_release_curve. Each Heat_release_curve has zero, one, or many Heat_release_point objects.

4.3.185 Heat_transfer_coefficient to Uo_heat_exchanger

Each Heat_transfer_coefficient is coefficient of exactly one Uo_heat_exchanger. Each Uo_heat_-exchanger has as coefficient zero, one, or many Heat_transfer_coefficient objects.

4.3.186 Impingement_protection to Exchanger_nozzle

Each Impingement_protection belongs to exactly one Exchanger_nozzle. Each Exchanger_nozzle has zero or one Impingement_protection.

4.3.187 Inspection_and_tests to Plant_item

Each Inspection_and_tests is associated with exactly one Plant_item. Each Plant_item has zero or one Inspection_and_tests objects.

4.3.188 Inspection_and_tests to Shop_testing_requirement

Each Inspection_and_tests has zero, one, or many Shop_testing_requirement objects. Each Shop_-testing_requirement has exactly one Inspection_and_tests object.

4.3.189 Internal_stream_phase to Site_standard_conditions

Each Internal_stream_phase may have as reference for standard volume exactly one Site_standard_-conditions. Each Site_standard_conditions is reference for standard volume for zero, one, or many Internal_stream_phase objects.

4.3.190 Interphase_chemical_reaction to Chemical_reaction

Each Interphase_chemical_reaction is exactly one Chemical_reaction. Each Chemical_reaction is zero or one Interphase_chemical_reaction objects.

4.3.191 Interphase_chemical_reaction to Specific_phase

Each Interphase_chemical_reaction has as the first phase exactly one Specific_phase. Each Specific_-phase is the first phase of zero, one, or many Interphase_chemical_reaction objects.

Each Interphase_chemical_reaction has as the second phase exactly one Specific_phase. Each Specific_-phase is the second phase of zero, one, or many Interphase_chemical_reaction objects.

4.3.192 Interphase_thermophysical_properties to Specific_phase

Each Interphase_thermophysical_properties is associated with zero or two Specific_phase objects. Each Specific_phase has zero, one, or many Interphase_thermophysical_properties objects.

4.3.193 Item_property_reference to Referenced_object

Each Item_property_reference is described by exactly one Referenced_object. Each Referenced_object describes one or more Item_property_reference objects.

4.3.194 Location_conditions to Plant_item

Each Location_conditions is associated with exactly one Plant_item. Each Plant_item has zero or one Location_conditions.

4.3.195 Location_in_plant to Plant

Each Location_in_plant is located in zero, one, or many Plant objects. Each Plant contains zero, one, or many Location_in_plant objects.

4.3.196 Location_in_site to Site

Each Location_in_site has as the reference frame for exactly one Site. Each Site is a reference frame for zero, one, or many Location_in_site objects.

4.3.197 Logical_operation to Control_logic_condition

Each Logical_operation has as the first operand exactly one Control_logic_condition. Each Control_-logic_condition is the first operand zero, one, or many Logical_operation objects.

Each Logical_operation has as the second operand exactly one Control_logic_condition. Each Control_-logic_condition is the second operand zero, one, or many Logical_operation objects.

4.3.198 Longitudinal_baffle to Exchanger_bundle

Each Longitudinal_baffle belongs to exactly one Exchanger_bundle. Each Exchanger_bundle has zero, one, or many Longitudinal_baffle objects.

> NOTE - If the type of Exchanger_bundle is Tema-H shell, the number of Longitudinal_baffles is 2, if it is a Tema-G shell, the number is 1, otherwise there are none.

4.3.199 Matched_perimeter_segments to Perimeter_segment

Each Matched_perimeter_segments has as the first match exactly one Perimeter_segment. Each Perimeter_segment is the first match in zero or one Matched_perimeter_segments.

Each Matched_perimeter_segments has as the second match exactly ne Perimeter_segment. Each Perimeter_segment is the second match in zero or one Matched_perimeter_segments.

4.3.200 Material to Process_design_property_value

Each Material has zero, one, or many Process_design_property_value objects. Each Process_design_-property_value defines property values of zero, one, or many Material objects.

4.3.201 Material to Referenced_object

Each Material is zero or one Referenced_object. Each Referenced_object may be exactly one Material.

4.3.202 Material_amount to Process_simulation

Each Material_amount may be part of inventory of zero or one Process_simulation. Each Process_-simulation contains inventory of zero, one, or many Material_amount objects.

4.3.203 Material_amount to Process_unit_operation

Each Material_amount may be part of inventory of exactly one Process_unit_operation. Each Process_-unit_operation contains inventory of zero, one, or many Material_amount objects.

4.3.204 Material_amount_phase to Material_amount

Each Material_amount_phase is phase of exactly one Material_amount. Each Material_amount has as phase zero, one, or many Material_amount_phase objects.

4.3.205 Material_amount_reference_time to Material_amount

Each Material_amount_reference_time is the time reference for exactly one Material_amount. Each Material_amount has time reference of zero, one, or many Material_amount_reference_time objects.

4.3.206 Material_amount_reference_time to Process_design_property_value

Each Material_amount_reference_time has property of zero, one, or many Process_design_property_-value objects. Each Process_design_property_value is applicable at zero or one Material_amount_-reference_time.

4.3.207 Material_amount_reference_time to Time_reference

Each Material_amount_reference_time has assigned exactly one Time_reference. Each Time_reference is assigned to zero, one, or many Material_amount_reference_time objects.

4.3.208 Material_cost to Process_material

Each Material_cost is cost point of exactly one Process_material. Each Process_material has as cost point zero, one, or many Material_cost objects.

4.3.209 Material_cost to Site

Each Material_cost has as the location exactly one Site. Each Site is the location for zero, one, or many Material_cost objects.

4.3.210 Material_cost to Site_standard_conditions

Each Material_cost may have as the reference condition exactly one Site_standard_conditions. Each Site_standard_conditions is the reference condition for zero, one, or many Material_cost objects.

4.3.211 Material_cost to Thermodynamic_condition

Each Material_cost may have temperature and pressure of exactly one Thermodynamic_condition. Each Thermodynamic_condition is temperature and pressure for zero or one Material_cost objects.

4.3.212 Material_stream to Distillation_stage_phase

Each Material_stream may be feed of exactly one Distillation_stage_phase. Each Distillation_stage_-phase has as feed zero, one, or many Material_stream objects.

4.3.213 Material_stream to Site_standard_conditions

Each Material_stream may have as reference for standard volume exactly one Site_standard_conditions. Each Site_standard_conditions is reference for standard volume for zero or one Material_stream.

4.3.214 Material_stream to Uo_distillation_stage

Each Material_stream may be the feed of exactly one Uo_distillation_stage. Each Uo_distillation_stage has as feed zero, one, or many Material_stream objects.

4.3.215 Material_stream_phase to Material_stream

Each Material_stream_phase is a phase of exactly one Material_stream. Each Material_stream has as a phase of zero, one, or many Material_stream_phase objects.

4.3.216 Mechanical_seal to Centrifugal_pump

Each Mechanical_seal is a component of exactly one Centrifugal_pump. Each Centrifugal_pump has as a component exactly one Mechanical_seal.

4.3.217 Mechanical_seal to Fluid_transfer_machine

Each Mechanical_seal is the shaft seal component for exactly one Fluid_transfer_machine. Each Fluid_-transfer_machine has as the shaft seal component zero, one, or many Mechanical_seal objects.

4.3.218 Noise_specification to Plant_item

Each Noise_specification is associated with exactly one Plant_item. Each Plant_item has zero or one Noise_specification.

4.3.219 Nozzle to Material_port

Each Nozzle is a nozzle for exactly one Material_port. Each Material_port has zero or one Nozzle.

4.3.220 Nozzle_dome to Exchanger_nozzle

Each Nozzle_dome belongs to exactly one Exchanger_nozzle. Each Exchanger_nozzle exactly one Nozzle_dome.

4.3.221 Nozzle_location_for_pressure_vessel_cylinder_section to Cylindrical_pressure_vessel_cylinder_section

Each Nozzle_location_for_pressure_vessel_cylinder_section is attachment of exactly one Cylindrical_-pressure_vessel_cylinder_section. Each Cylindrical_pressure_vessel_cylinder_section has as attachments of zero, one, or many Nozzle_location_for_pressure_vessel_cylinder_section objects.

4.3.222 Nozzle_location_for_pressure_vessel_cylinder_section to Nozzle_section

Each Nozzle_location_for_pressure_vessel_cylinder_section has as child part exactly one Nozzle_-section. Each Nozzle_section is child part for zero or one Nozzle_location_for_pressure_vessel_-cylinder_section.

4.3.223 Nozzle_location_for_pressure_vessel_head_section to Cylindrical_-pressure_vessel_head_section

Each Nozzle_location_for_pressure_vessel_head_section is attachment of exactly one Cylindrical_-pressure_vessel_head_section. Each Cylindrical_pressure_vessel_head_section has as attachments of zero, one, or many Nozzle_location_for_pressure_vessel_head_section objects.

4.3.224 Nozzle_location_for_pressure_vessel_head_section to Nozzle_section

Each Nozzle_location_for_pressure_vessel_head_section has as child part exactly one Nozzle_section. Each Nozzle_section is child part for zero or one Nozzle_location_for_pressure_vessel_head_section.

4.3.225 Nozzle_performance to Exchanger_nozzle

Each Nozzle_performance may be the performance for exactly one Exchanger_nozzle. Each Exchanger_-nozzle has performance of zero or one Nozzle_performance.

4.3.226 Nozzle_performance to Exchanger_performance

Each Nozzle_performance describes exactly one Exchanger_performance. Each Exchanger_performance has zero, one, or many Nozzle_performance objects.

4.3.227 Nozzle_section to Construction_material

Each Nozzle_section may be made from exactly one Construction_material. Each Construction_material is used to make zero, one, or many Nozzle_section objects.

4.3.228 Nozzle_section to External_treatment

Each Nozzle_section may have as treatment exactly one External_treatment. Each External_treatment is treatment for zero, one, or many Nozzle_section objects.

4.3.229 Nozzle_section to Nozzle

Each Nozzle_section may be ordered component for exactly one Nozzle. Each Nozzle has as ordered components zero, one, or many Nozzle_section objects.

4.3.230 Nozzle_section to Nozzle_section_connection

Each Nozzle_section is a section for zero, one, or many Nozzle_section_connection objects. Each Nozzle_section_connection has as section exactly two Nozzle_section objects.

4.3.231 Nozzle_section_connection to Gasket

Each Nozzle_section_connection may contain exactly one Gasket. Each Gasket is part of zero, one, or many Nozzle_section_connection objects.

4.3.232 Packaging to Plant_item

Each Packaging is associated with exactly one Plant_item. Each Plant_item has zero or one Packaging.

4.3.233 Pad_and_pad_stack to Demister_pad

Each Pad_and_pad_stack is the stack for exactly one Demister_pad. Each Demister_pad is in the stack of zero or one Pad_and_pad_stack.

4.3.234 Pad_and_pad_stack to Demister_pad_stack

Each Pad_and_pad_stack is the pads for exactly one Demister_pad_stack. Each Demister_pad_stack has as pads one or more Pad_and_pad_stack objects.

4.3.235 Particle_fraction to Particle_size_distribution_values

Each Particle_fraction is part of ordered distribution of exactly one Particle_size_distribution_values. Each Particle_size_distribution_values has ordered distribution of zero, one, or many Particle_fraction objects.

4.3.236 Particle_size to Particle_size_distribution

Each Particle_size specifies ordered intervals of exactly one Particle_size_distribution. Each Particle_-size_distribution has ordered intervals specified by one or more Particle_size objects.

4.3.237 Passlane to Exchanger_bundle

Each Passlane belongs to exactly one Exchanger_bundle. Each Exchanger_bundle has zero or one Passlane.

4.3.238 Pattern to Perforation_shape

Each Pattern is the pattern for one or more Perforation_shape objects. Each Perforation_shape describes the perforations for zero, one, or many Pattern objects.

4.3.239 Perforation_cover to Perforation_cover_shape

Each Perforation_cover may be described by exactly one Perforation_cover_shape. Each Perforation_-cover_shape describes zero, one, or many Perforation_cover objects.

4.3.240 Perforation_cover_shape to Active_area_shape

Each Perforation_cover_shape describes the cover for exactly one Active_area_shape. Each Active_-area_shape has as the cover description zero, one, or many Perforation_cover_shape objects.

4.3.241 Performance_curve to Plant_item

Each Performance_curve may be of exactly one Plant_item. Each Plant_item has as curve zero, one, or many Performance_curve objects.

4.3.242 Performance_curve to Process_service

Each Performance_curve may be the curve for exactly one Process_service. Each Process_service has as a curve zero, one, or many Performance_curve objects.

4.3.243 Performance_curve to Process_unit_operation

Each Performance_curve may be for exactly one Process_unit_operation. Each Process_unit_operation has as curve zero, one, or many Performance_curve objects.

4.3.244 Performance_map_curve to Performance_curve

Each Performance_map_curve is family of exactly one Performance_curve. Each Performance_curve is part of dependent curve family of zero or one Performance_map_curve.

4.3.245 Performance_map_curve to Performance_map

Each Performance_map_curve is part of exactly one Performance_map. Each Performance_map consists of zero, one, or many Performance_map_curve objects.

4.3.246 Performance_map_curve to Process_design_property_value_usage

Each Performance_map_curve uses exactly one Process_design_property_value_usage. Each Process_-design_property_value_usage may be used by exactly one Performance_map_curve.

4.3.247 Performance_point to Process_design_property_value_usage

Each Performance_point uses one or more Process_design_property_value_usage objects. Each Process_design_property_value_usage may be used by exactly one Performance_map_curve. For each Performance_point, exactly one of the Process_design_property_value_usage objects is an independent value and all of the others are dependent values.

4.3.248 Performance_point to Simple_performance_curve

Each Performance_point is part of exactly one Simple_performance_curve. Each Simple_performance_-curve consists of zero, one, or many Performance_point objects.

4.3.249 Perimeter to Active_area_shape

Each Perimeter may bound exactly one Active_area_shape. Each Active_area_shape is bounded by zero or one Perimeter.

4.3.250 Perimeter to Blinding_strip_shape

Each Perimeter may bound exactly one Blinding_strip_shape. Each Blinding_strip_shape is bounded by zero or one Perimeter.

4.3.251 Perimeter to Bubble_slot_shape

Each Perimeter may bound exactly one Bubble_slot_shape. Each Bubble_slot_shape is bounded by zero or one Perimeter.

4.3.252 Perimeter to Cap_shape

Each Perimeter may bound the cap base of exactly one Cap_shape. Each Cap_shape has the cap base bounded by zero or one Perimeter.

4.3.253 Perimeter to Disengaging_panel_opening_shape

Each Perimeter may bound exactly one Disengaging_panel_opening_shape. Each Disengaging_panel_-opening_shape is bounded by zero or one Perimeter.

4.3.254 Perimeter to Downcomer_disengaging_panel_shape

Each Perimeter may bound exactly one Downcomer_disengaging_panel_shape. Each Downcomer_-disengaging_panel_shape is bounded by zero or one Perimeter.

4.3.255 Perimeter to Downcomer_liquid_flow_channel_shape

Each Perimeter may bound the bottom of the channel of exactly one Downcomer_liquid_flow_channel_-shape. Each Downcomer_liquid_flow_channel_shape has the bottom of the channel bounded by zero or one Perimeter.

Each Perimeter may bound the top of the channel of exactly one Downcomer_liquid_flow_channel_-shape. Each Downcomer_liquid_flow_channel_shape has the top of the channel bounded by zero or one Perimeter.

4.3.256 Perimeter to Escape_area_shape

Each Perimeter may bound exactly one Escape_area_shape. Each scape_area_shape is bounded by zero or one Perimeter.

4.3.257 Perimeter to Perforation_shape

Each Perimeter may bound exactly one Perforation_shape. Each Perforation_shape is bounded by zero or one Perimeter.

4.3.258 Perimeter to Pressure_equalization_channel_shape

Each Perimeter may describe the cross section of exactly one Pressure_equalization_channel_shape. Each Pressure_equalization_channel_shape has the cross section described by zero or one Perimeter.

4.3.259 Perimeter to Riser_shape

Each Perimeter may bound the riser flow channel of exactly one Riser_shape. Each Riser_shape has the riser flow channel bounded by zero or one Perimeter.

Each Perimeter may bound the riser base of exactly one Riser_shape. Each Riser_shape has the riser base bounded by zero or one Perimeter.

4.3.260 Perimeter to Seal_pan_recess_shape

Each Perimeter may bound exactly one Seal_pan_recess_shape. Each Seal_pan_recess_shape is bounded by zero or one Perimeter.

4.3.261 Perimeter to Seal_pan_shape

Each Perimeter may bound exactly one Seal_pan_shape. Each Seal_pan_shape is bounded by zero or one Perimeter.

4.3.262 Perimeter to Separation_tray_shape

Each Perimeter may bound exactly one Separation_tray_shape. Each Separation_tray_shape is bounded by zero or one Perimeter.

4.3.263 Perimeter to Tray_panel_shape

Each Perimeter may bound exactly one Tray_panel_shape. Each Tray_panel_shape is bounded by zero or one Perimeter.

4.3.264 Perimeter to Tray_slot_shape

Each Perimeter may be the horizontal projection for exactly one Tray_slot_shape. Each Tray_slot_shape has as the horizontal projection zero or one Perimeter.

Each Perimeter may be the slot opening for exactly one ray_slot_shape. Each Tray_slot_shape has as the slot opening zero or one Perimeter.

4.3.265 Perimeter_segment to Curve

Each Perimeter_segment has the perimeter described by exactly one Curve. Each Curve describes the perimeter of zero, one, or many Perimeter_segment objects.

4.3.266 Perimeter_segment to Perimeter

Each Perimeter_segment is part of exactly one Perimeter. Each Perimeter consists of one or more Perimeter_segment objects.

4.3.267 PFD to Process_definition

Each Process_definition is represented by zero, one, or many PFD objects. Each PFD represents one or more Process_definition objects.

4.3.268 PFD_element to Equipment_port

Each PFD_element depicts zero, one, or many Equipment_port objects. Each Equipment_port is depicted by zero, one, or many PFD_element objects.

4.3.269 PFD_element to Item_property_reference

Each PFD_element depicts zero, one, or many Item_property_reference objects. Each Item_property_-reference is depicted by zero, one, or many PFD_element objects.

4.3.270 PFD_element to PFD_presentation_component

Each PFD_element is organized by exactly one PFD_presentation_component. Each PFD_presentation_-component organizes zero, one, or many PFD_element objects.

4.3.271 PFD_element to Process_design_property_value

Each PFD_element depicts zero, one, or many Process_design_property_value objects. Each Process_-design_property_value is depicted by zero, one, or many PFD_element objects.

4.3.272 PFD_element to Process_equipment

Each PFD_element depicts zero, one, or many Process_equipment objects. Each Process_equipment is depicted by zero, one, or many PFD_element objects.

4.3.273 PFD_element to Process_port

Each PFD_element depicts zero, one, or many Process_port objects. Each Process_port is depicted by zero, one, or many PFD_element objects.

4.3.274 PFD_element to Process_unit_operation

Each PFD_element depicts zero, one, or many Process_unit_operation objects. Each Process_unit_-operation is depicted by zero, one, or many PFD_element objects.

4.3.275 PFD_element to Stream

Each PFD_element depicts zero, one, or many Stream objects. Each Stream is depicted by zero, one, or many PFD_element objects.

4.3.276 PFD_element to Utility_material_service

Each PFD_element depicts zero, one, or many Utility_material_service objects. Each Utility_material_-service is depicted by zero, one, or many PFD_element objects.

4.3.277 PFD_element to Utility_service_stream_demand

Each PFD_element depicts zero, one, or many Utility_service_stream_demand objects. Each Utility_-service_stream_demand is depicted by zero, one, or many PFD_element objects.

4.3.278 PFD_presentation_component to PFD

Each PFD_presentation_component is part of exactly one PFD. Each PFD is comprised of one or more PFD_presentation_component objects.

4.3.279 PFD_presentation_component_composition to PFD_presentation_-component

Each PFD_presentation_component_composition has as the child exactly one PFD_presentation_-component. Each PFD_presentation_component is the child in zero, one, or many PFD_presentation_-component_composition objects.

Each PFD_presentation_component_composition has as the parent exactly one PFD_presentation_-component. Each PFD_presentation_component is the parent in zero, one, or many PFD_presentation_-component_composition objects.

4.3.280 PFD_symbol_definition to PFD_curve

Each PFD_symbol_definition has zero, one, or many PFD_curve objects. Each PFD_curve is an element of zero, one, or many PFD_symbol_definition objects.

4.3.281 PFD_symbol_definition to PFD_point

Each PFD_symbol_definition has zero, one, or many PFD_point objects. Each PFD_point is an element of zero, one, or many PFD_symbol_definition objects.

4.3.282 PFD_symbol_definition to PFD_symbol_occurrence

Each PFD_symbol_definition has zero, one, or many PFD_symbol_occurrence objects. Each PFD_-symbol_occurrence is an element of zero, one, or many PFD_symbol_definition objects.

4.3.283 PFD_symbol_definition to PFD_text

Each PFD_symbol_definition has zero, one, or many PFD_text objects. Each PFD_text is an element of zero, one, or many PFD_symbol_definition objects.

4.3.284 PFD_symbol_occurrence to PFD_symbol_definition

Each PFD_symbol_occurrence may be the placement of exactly one PFD_symbol_definition. Each PFD_symbol_definition is placed on the pfd as zero, one, or many PFD_symbol_occurrence objects.

4.3.285 PFD_title_block to PFD

Each PFD_title_block defines the title information for exactly one PFD. Each PFD has title information defined in zero, one, or many PFD_title_block objects.

4.3.286 Phase to Chemical_reaction

Each Phase allows to take place zero, one, or many Chemical_reaction objects. Each Chemical_reaction may occur in zero, one, or many Phase objects.

4.3.287 Phase to Particle_size_distribution_values

Each Phase may be particle limiting phase for exactly one Particle_size_distribution_values. Each Particle_size_distribution_values is particle limiting phase for zero, one, or many Phase objects.

4.3.288 Phase to Process_design_property_value

Each Phase has zero, one, or many Process_design_property_value objects. Each Process_design_-property_value defines property values of zero, one, or many Phase objects.

4.3.289 Phase to Referenced_object

Each Phase is zero or one Referenced_object. Each Referenced_object may be exactly one Phase.

4.3.290 Phase to Trace_component_specification

Each Phase is applicable by zero, one, or many Trace_component_specification objects. Each Trace_-component_specification applies to zero, one, or many Phase objects.

4.3.291 Phase_distribution_coefficient to Chemical_component

Each Phase_distribution_coefficient is distribution for exactly one Chemical_component. Each Chemical_component has distribution of zero, one, or many Phase_distribution_coefficient objects.

4.3.292 Phase_distribution_coefficient to Specific_phase

Each Phase_distribution_coefficient has heavy phase of exactly one Specific_phase. Each Specific_phase is heavy phase for zero, one, or many Phase_distribution_coefficient objects.

Each Phase_distribution_coefficient has light phase of exactly one Specific_phase. Each Specific_phase is light phase for zero, one, or many Phase_distribution_coefficient objects.

4.3.293 Phase_fraction to Bulk_thermophysical_properties

Each Phase_fraction is part of exactly one Bulk_thermophysical_properties. Each Bulk_thermophysical_-properties has as parts of zero, one, or many Phase_fraction objects.

4.3.294 Phase_fraction to Single_phase_thermophysical_properties

Each Phase_fraction has as part exactly one Single_phase_thermophysical_properties. Each Single_-phase_thermophysical_properties is part of zero, one, or many Phase_fraction objects.

4.3.295 Phase_properties to Heat_release_point

Each Phase_properties provides properties for exactly one Heat_release_point. Each Heat_release_point has zero, one, or many Phase_properties objects.

4.3.296 Phase_region to Phase

Each Phase_region may have a physical state of exactly one Phase. Each Phase is the physical state for zero, one, or many Phase_region objects.

4.3.297 Phase_region to Process_property_curve

Each Phase_region contains properties of zero, one, or many Process_property_curve objects. Each Process_property_curve has properties within zero, one, or many Phase_region objects.

4.3.298 Piping_connector to Construction_material

Each Piping_connector may be made of exactly one Construction_material. Each Construction_material is used to make zero, one, or many Piping_connector objects.

4.3.299 Plant to Process_definition

Each Plant has as definition zero, one, or many Process_definition objects. Each Process_definition defines zero, one, or many Plant objects.

4.3.300 Plant to Process_design_property_value

Each Plant has zero, one, or many Process_design_property_value objects. Each Process_design_-property_value defines property values of zero, one, or many Plant objects.

4.3.301 Plant_item to Plant

Each Plant_item is assigned to zero, one, or many Plant objects. Each Plant contains zero, one, or many Plant_item objects.

4.3.302 Plant_item to Process_definition

Each Plant_item carries out zero, one, or many Process_definition objects. Each Process_definition is carried out by zero, one, or many Plant_item objects.

> EXAMPLE 70 - The plant_item type separation_tray carries out the process described by the application object uo_distillation_stage. This relationship is accessed by following the type hierarchy from plant_item to process_equipment to mass_ transfer_equipment to separation_tower_internal and finally to separation_tray on the plant_item side, and from process_definition to process_unit_operation to uo_separation to uo_distillation_stage on the process_definition side.

4.3.303 Plant_item to Process_design_property_value

Each Plant_item has zero, one, or many Process_design_property_value objects. Each Process_design_-property_value defines property values of zero, one, or many Plant_item objects.

4.3.304 Plant_item to Referenced_object

Each Plant_item is zero or one Referenced_object. Each Referenced_object may be exactly one Plant_-item.

4.3.305 Plant_item_connector to Plant_item

Each Plant_item_connector is connector for zero, one, or many Plant_item objects. Each Plant_item has as ordered connectors of zero, one, or many Plant_item_connector objects.

4.3.306 Plant_item_group_relationship to Plant_item

Each Plant_item_group_relationship is exactly one Plant_item. Each Plant_item is a group of zero, one, or many Plant_item_group_relationship objects.

Each Plant_item_group_relationship is of exactly one Plant_item. Each Plant_item is an element in zero, one, or many Plant_item_group_relationship objects.

4.3.307 Plant_item_location to Plant_item

Each Plant_item_location locates exactly one Plant_item. Each Plant_item is located by zero, one, or many Plant_item_location objects.

4.3.308 Plant_item_reference_time to Plant_item

Each Plant_item_reference_time is the time reference for exactly one Plant_item. Each Plant_item has time reference of zero, one, or many Plant_item_reference_time objects.

4.3.309 Plant_item_reference_time to Process_design_property_value

Each Plant_item_reference_time has property of zero, one, or many Process_design_property_value objects. Each Process_design_property_value is applicable at zero or one Plant_item_reference_time.

4.3.310 Plant_item_reference_time to Time_reference

Each Plant_item_reference_time has assigned exactly one Time_reference. Each Time_reference is assigned to zero, one, or many Plant_item_reference_time objects.

4.3.311 Plant_system to Plant

Each Plant_system is part of exactly one Plant. Each Plant consists of zero, one, or many Plant_system objects.

4.3.312 Plant_system to Plant_item

Each Plant_system is composed of zero, one, or many Plant_item objects. Each Plant_item is part of zero, one, or many Plant_system objects.

4.3.313 Plant_system to Process_definition

Each Plant_system carries out zero, one, or many Process_definition objects. Each Process_definition is carried out by zero, one, or many Plant_system objects.

4.3.314 Plant_system to Process_design_property_value

Each Plant_system has zero, one, or many Process_design_property_value objects. Each Process_-design_property_value defines property values of zero, one, or many Plant_system objects.

4.3.315 Plant_system to Referenced_object

Each Plant_system is zero or one Referenced_object. Each Referenced_object may be exactly one Plant_system.

4.3.316 Plant_system_assembly to Plant_system

Each Plant_system_assembly has as the sub-system exactly one Plant_system. Each Plant_system is the sub-system in zero, one, or many Plant_system_assembly objects.

Each Plant_system_assembly has as the super-system exactly one Plant_system. Each Plant_system is the super-system in zero, one, or many Plant_system_assembly objects.

4.3.317 Port_service_case to Equipment_port

Each Port_service_case has flow point provided by exactly one Equipment_port. Each Equipment_port is the flow point for zero, one, or many Port_service_case objects.

4.3.318 Port_service_case to Process_design_case

Each Port_service_case is part of zero, one, or many Process_design_case objects. Each Process_-design_case consists of zero, one, or many Port_service_case objects.

4.3.319 Port_service_case to Process_service

Each Port_service_case is serviced by exactly one Process_service. Each Process_service is service for zero, one, or many Port_service_case objects.

4.3.320 Port_service_case to Stream

Each Port_service_case specified by exactly one Stream. Each Stream provides the specification for zero or one Port_service_case.

4.3.321 Pressure_equalization_channel_shape to Downcomer_apron_section_shape

Each Pressure_equalization_channel_shape describes the pressure equalization channel for zero, one, or many Downcomer_apron_section_shape objects. Each Downcomer_apron_section_shape has pressure equalization channel described by exactly one Pressure_equalization_channel_shape.

4.3.322 Process_control_unit to Process_train

Each Process_control_unit is part of exactly one Process_train. Each Process_train contains zero, one, or many Process_control_unit objects.

4.3.323 Process_definition to External_reference

Each Process_definition is described by zero, one, or many External_reference objects. Each External_-reference carries out zero, one, or many Process_definition objects.

4.3.324 Process_definition to Plant_item

Each Process_definition is carried out by zero, one, or many Plant_item objects. Each Plant_item carries out zero, one, or many Process_definition objects.

4.3.325 Process_definition to Plant_system

Each Process_definition is carried out by zero, one, or many Plant_system objects. Each Plant_system carries out zero, one, or many Process_definition objects.

4.3.326 Process_definition to Simulated_process_definition

Each Process_definition is simulated by zero, one, or many Simulated_process_definition objects. Each Simulated_process_definition may be one Process_definition object.

4.3.327 Process_definition to Trigger

Each Process_definition is a process definition to zero or one Trigger objects. Each Trigger is specified by exactly one Process_definition.

4.3.328 Process_definition_reference_time to Process_definition

Each Process_definition_reference_time is the time reference for exactly one Process_definition. Each Process_definition has time reference of zero, one, or many Process_definition_reference_time objects.

4.3.329 Process_definition_reference_time to Process_design_property_value

Each Process_definition_reference_time has property of zero, one, or many Process_design_property_-value objects. Each Process_design_property_value is applicable at zero or one Process_definition_-reference_time.

4.3.330 Process_definition_reference_time to Time_reference

Each Process_definition_reference_time has assigned exactly one Time_reference. Each Time_reference is assigned to zero, one, or many Process_definition_reference_time objects.

4.3.331 Process_definition_relationship to Process_definition

Each Process_definition_relationship has as the related process definition exactly one Process_definition. Each Process_definition is the related process definition in zero, one, or many Process_definition_-relationship objects.

Each Process_definition_relationship has as the relating process definition exactly one Process_-definition. Each Process_definition is the relating process definition in zero, one, or many Process_-definition_relationship objects.

4.3.332 Process_design_case to Conditional_property

Each Process_design_case is part of zero, one, or many Conditional_property objects. Each Conditional_property consists of zero, one, or many Process_design_case objects.

4.3.333 Process_design_case to Conditional_property_value

Each Process_design_case is a part of zero, one, or many Conditional_property_value objects. Each Conditional_property_value consists of zero, one, or many Process_design_case objects.

4.3.334 Process_design_case to Plant_item

Each Process_design_case is design criteria for zero, one, or many Plant_item objects. Each Plant_item has design criteria of zero, one, or many Process_design_case objects.

4.3.335 Process_design_case to Process_definition

Each Process_design_case may provide process characteristics for exactly one Process_definition. Each Process_definition provides process characteristics for zero, one, or many Process_design_case objects.

4.3.336 Process_design_case_relationship to Process_design_case

Each Process_design_case_relationship has as the related design case exactly one Process_design_case. Each Process_design_case is the related design case for zero, one, or many Process_design_case_-relationship objects.

Each Process_design_case_relationship has as the relating design case exactly one Process_design_case. Each Process_design_case is the relating design case for zero, one, or many Process_design_case_-relationship objects.

4.3.337 Process_design_property_value to Process_definition

Each Process_design_property_value defines property values of zero or one Process_definition objects. Each Process_definition has zero, one, or many Process_design_property_value objects.

4.3.338 Process_design_property_value to Process_simulation

Each Process_design_property_value defines property value of zero or one Process_simulation objects. Each Process_simulation has zero, one, or many Process_design_property_value objects.

4.3.339 Process_design_property_value to Process_unit_operation

Each Process_design_property_value defines property value for zero, one, or many Process_unit_-operation objects. Each Process_unit_operation has zero or one Process_design_property_value objects.

4.3.340 Process_design_property_value to Site_reference_time

Each Process_design_property_value is applicable to zero, one, or many Site_reference_time objects. Each Site_reference_time has property of zero or one Process_design_property_value objects.

4.3.341 Process_design_property_value to Variable_adjustment_specification

Each Process_design_property_value is the adjusted variable for zero, one, or many Variable_-adjustment_specification objects. Each Variable_adjustment_specification may be used in exactly one Process_design_property_value objects.

4.3.342 Process_design_property_variable_usage to Item_property_reference

Each Process_design_property_variable_usage may use exactly one Item_property_reference. Each Item_property_reference is used in zero, one, or many Process_design_property_variable_usage objects.

4.3.343 Process_design_property_variable_usage to Process_design_property_value

Each Process_design_property_variable_usage may use exactly one Process_design_property_value. Each Process_design_property_value is used in zero, one, or many Process_design_property_variable_-usage objects.

4.3.344 Process_design_property_variable_usage to Process_property_-curve_point

Each Process_design_property_variable_usage may be used by exactly one Process_property_curve_-point. Each Process_property_curve_point uses one or more Process_design_property_variable_usage objects.

4.3.345 Process_design_property_value_usage to Process_design_property_-value

Each Process_design_property_value_usage uses exactly one Process_design_property_value. Each Process_design_property_value is used in zero, one, or many Process_design_property_value_usage objects.

4.3.346 Process_vessel_level to Bin_section

Each Process_vessel_level may be associated with exactly one Bin_section. Each Bin_section has zero, one, or many Process_vessel_level objects.

4.3.347 Process_vessel_level to Boot

Each Process_vessel_level may be associated with exactly one Boot. Each Boot has zero, one, or many Process_vessel_level objects.

4.3.348 Process_vessel_level to Cylindrical_pressure_vessel_section

Each Process_vessel_level may be associated with exactly one Cylindrical_pressure_vessel_section. Each Cylindrical_pressure_vessel_section has zero, one, or many Process_vessel_level objects.

4.3.349 Process_vessel_level to Process_vessel

Each Process_vessel_level may be associated with exactly one Process_vessel. Each Process_vessel has zero, one, or many Process_vessel_level objects.

4.3.350 Process_material to Material_amount

Each Process_material is in zero, one, or many Material_amount objects. Each Material_amount may be in exactly one Process_material.

4.3.351 Process_material to Material_stream

Each Process_material is in zero or one Material_stream. Each Material_stream may be in exactly one Process_material.

4.3.352 Process_material to Specific_phase

Each Process_material is in zero or one Specific_phase. Each Specific_phase may be in exactly one Process_material.

4.3.353 Process_material to Substance

Each Process_material is characterized by zero or one Substance. Each Substance characterizes zero, one, or many Process_material objects.

4.3.354 Process_material_reference_time to Material

Each Process_material_reference_time is the time reference for exactly one Material. Each Material has time reference of zero, one, or many Process_material_reference_time objects.

4.3.355 Process_material_reference_time to Process_design_property_value

Each Process_material_reference_time has property of zero, one, or many Process_design_property_-value objects. Each Process_design_property_value is applicable at zero or one Process_material_-reference_time.

4.3.356 Process_material_reference_time to Time_reference

Each Process_material_reference_time has assigned exactly one Time_reference. Each Time_reference is assigned to zero, one, or many Process_material_reference_time objects.

4.3.357 Process_port to Equipment_port

Each Process_port has physical requirements fulfilled by zero, one, or many Equipment_port objects. Each Equipment_port fulfills requirements for zero, one, or many Process_port objects.

4.3.358 Process_port to Process_definition

Each Process_port is the port for one or more Process_definition objects. Each Process_definition has as a port zero, one, or many Process_port objects.

4.3.359 Process_port_connection to Stream

Each Process_port_connection is contained in exactly one Stream. Each Stream is zero or one Process_-port_connection objects.

4.3.360 Process_port_stream_case to Process_port

Each Process_port_stream_case is contained by exactly one Process_port. Each Process_port contains zero, one, or many Process_port_stream_case objects.

4.3.361 Process_port_stream_case to Stream

Each Process_port_stream_case is exactly one Stream. Each Stream is zero or one Process_port_stream_-case objects.

4.3.362 Process_property_curve to Material_stream

Each Process_property_curve may be curve for exactly one Material_stream. Each Material_stream has curves of zero, one, or many Process_property_curve objects.

4.3.363 Process_property_curve to Process_design_property_variable_usage

Each Process_property_curve uses zero, one, or many Process_design_property_variable_usage objects. Each Process_design_property_variable_usage may have exactly one Process_property_curve.

4.3.364 Process_property_curve to Process_material

Each Process_property_curve may be curve exactly one Process_material. Each Process_material has curves of zero, one, or many Process_property_curve objects.

4.3.365 Process_property_curve to Process_property_curve_point

Each Process_property_curve consists of two or more Process_property_curve_point objects. Each Process_property_curve_point belongs to exactly one Process_property_curve.

4.3.366 Process_property_curve to Process_unit_operation

Each Process_property_curve may be curve for exactly one Process_unit_operation. Each Process_unit_-operation has curves of zero, one, or many Process_property_curve objects.

4.3.367 Process_property_curve to Uo_heat_exchanger_fluid

Each Process_property_curve may be heating cooling curve of exactly one Uo_heat_exchanger_fluid. Each Uo_heat_exchanger_fluid has as heating cooling curve zero or one Process_property_curve.

4.3.368 Process_simulation to Algorithm_type_parameter

Each Process_simulation has parameters of zero, one, or many Algorithm_type_parameter objects. Each Algorithm_type_parameter is parameter for one or more Process_simulation objects.

4.3.369 Process_simulation to Externally_defined_simulation_algorithm

Each Process_simulation employs zero, one, or many Externally_defined_simulation_algorithm objects. Each Externally_defined_simulation_algorithm is used for zero, one, or many Process_simulation objects.

4.3.370 Process_simulation to Simulated_process_definition

Each Process_simulation simulates one or more Simulated_process_definition objects. Each Simulated_-process_definition may be exactly one Process_simulation object.

4.3.371 Process_simulation_reference_time to Process_design_property_value

Each Process_simulation_reference_time has property of zero, one, or many Process_design_property_-value objects. Each Process_design_property_value is applicable at zero or one Process_simulation_-reference_time.

4.3.372 Process_simulation_reference_time to Process_simulation

Each Process_simulation_reference_time is the time reference for exactly one Process_simulation. Each Process_simulation has time reference of zero, one, or many Process_simulation_reference_time objects.

4.3.373 Process_simulation_reference_time to Time_reference

Each Process_simulation_reference_time has assigned exactly one Time_reference. Each Time_reference is assigned to zero, one, or many Process_simulation_reference_time objects.

4.3.374 Process_simulation_relationship to Process_simulation

Each Process_simulation_relationship has a related simulation of exactly one Process_simulation. Each Process_simulation is the related simulation in zero, one, or many Process_simulation_relationship objects.

Each Process_simulation_relationship has a relating simulation of exactly one Process_simulation. Each Process_simulation is the relating simulation in zero, one, or many Process_simulation_relationship objects.

4.3.375 Process_unit_operation to Citation_reference

Each Process_unit_operation describes zero, one, or many Citation_reference objects. Each Citation_-reference has exactly one Process_unit_operation object.

4.3.376 Process_unit_operation to Internal_stream_phase

Each Process_unit_operation contains zero, one, or many Internal_stream_phase objects. Each Internal_-stream_phase is contained in zero, one, or many Process_unit_operation objects.

4.3.377 Process_vessel to External_treatment

Each Process_vessel may have as treatment exactly one External_treatment. Each External_treatment is treatment for zero, one, or many Process_vessel objects.

4.3.378 Property_data_group to Property_data_set

Each Property_data_group contains one or more Property_data_set objects. Each Property_data_set may contain exactly one Property_data_group object.

4.3.379 Property_data_set to Citation

Each Property_data_set may have as a reference exactly one Citation. Each Citation is a reference for zero, one, or many Property_data_set objects.

4.3.380 Property_data_set to Specific_equation

Each Property_data_set may be generated by exactly one Specific_equation. Each Specific_equation generates zero, one, or many Property_data_set objects.

4.3.381 Particle_size_distribution_values to Material_amount

Each Particle_size_distribution_values may be psd values of exactly one Material_amount. Each Material_amount has psd values of zero, one, or many Particle_size_distribution_values objects.

4.3.382 Particle_size_distribution_values to Material_stream

Each Particle_size_distribution_values may be psd values of exactly one Material_stream. Each Material_stream has psd values of zero, one, or many Particle_size_distribution_values objects.

4.3.383 Particle_size_distribution_values to Particle_size_distribution

Each Particle_size_distribution_values has intervals specified by exactly one Particle_size_distribution. Each Particle_size_distribution specifies intervals for zero, one, or many Particle_size_distribution_values objects.

4.3.384 Pump_casing to Centrifugal_pump

Each Pump_casing is a component of exactly one Centrifugal_pump. Each Centrifugal_pump has as a component exactly one Pump_casing.

4.3.385 Pump_casing_test to Pump_casing

Each Pump_casing_test is the casing test for exactly one Pump_casing. Each Pump_casing has zero, one, or many Pump_casing_test objects.

4.3.386 Pump_gland to Centrifugal_pump

Each Pump_gland is component of exactly one Centrifugal_pump. Each Centrifugal_pump has as a component exactly one Pump_gland.

4.3.387 Pump_gland_taps to Pump_gland

Each Pump_gland_taps is part of exactly one Pump_gland. Each Pump_gland has zero, one, or many Pump_gland_taps objects.

4.3.388 Pump_impeller to Centrifugal_pump

Each Pump_impeller is a component of exactly one Centrifugal_pump. Each Centrifugal_pump has as a component exactly one Pump_impeller.

4.3.389 Pump_packing to Centrifugal_pump

Each Pump_packing is a component of exactly one Centrifugal_pump. Each Centrifugal_pump is a component of exactly one Pump_packing.

4.3.390 Radial_bearing to Fluid_transfer_machine

Each Radial_bearing is a component of exactly one Fluid_transfer_machine. Each Fluid_transfer_machine has as a component zero, one, or many Radial_bearing objects.

4.3.391 Reaction_order to Reaction_rate

Each Reaction_order is ordered with substances for exactly one Reaction_rate. Each Reaction_rate has substances with order of zero, one, or many Reaction_order objects.

4.3.392 Reaction_order to Substance

Each Reaction_order is used for exactly one Substance. Each Substance is used in zero, one, or many Reaction_order objects.

4.3.393 Reaction_parametric_data to Chemical_reaction

Each Reaction_parametric_data is the data set for exactly one Chemical_reaction. Each Chemical_-reaction has as data set zero, one, or many Reaction_parametric_data objects.

4.3.394 Reaction_rate to Chemical_reaction

Each Reaction_rate is the rate for exactly one Chemical_reaction. Each Chemical_reaction has as rate zero, one, or many Reaction_rate objects.

4.3.395 Reaction_rate to Phase

Each Reaction_rate is the rate for exactly one Phase. Each Phase has rate defined by zero, one, or many Reaction_rate objects.

4.3.396 Reaction_rate to Process_design_property_value

Each Reaction_rate has zero, one, or many Process_design_property_value objects. Each Process_-design_property_value defines property values of zero, one, or many Reaction_rate objects.

4.3.397 Reaction_rate to Referenced_object

Each Reaction_rate is a zero or one Referenced_object object. Each Referenced_object may be exactly one Reaction_rate.

4.3.398 Reaction_rate to Substance

Each Reaction_rate has as key component exactly one Substance. Each Substance is the key component for zero, one, or many Reaction_rate objects.

4.3.399 Reactor_yield to Phase

Each Reactor_yield is rate for exactly one Phase. Each Phase has rate of zero, one, or many Reactor_-yield objects.

4.3.400 Reactor_yield to Substance

Each Reactor_yield has substance exactly one Substance. Each Substance is substance for zero, one, or many Reactor_yield objects.

4.3.401 Reactor_yield to Uo_specified_yield_reactor

Each Reactor_yield is yield for exactly one Uo_specified_yield_reactor. Each Uo_specified_yield_-reactor has as yield zero, one, or many Reactor_yield objects.

4.3.402 Reboiler_piping to Exchanger_assembly

Each Reboiler_piping belongs to exactly one Exchanger_assembly. Each Exchanger_assembly has zero or one Reboiler_piping.

4.3.403 Reciprocating_compressor_stage to Reciprocating_compressor

Each Reciprocating_compressor_stage is a component stage for exactly one Reciprocating_compressor. Each Reciprocating_compressor has as a component stage zero, one, or many Reciprocating_-compressor_stage objects.

4.3.404 Reference_state to Variable

Each Reference_state is reference state for zero, one, or many Variable objects. Each Variable has reference state of zero, one, or many Reference_state objects.

4.3.405 Reference_time_relationship to Time_reference

Each Reference_time_relationship has as the preceding time exactly one Time_reference. Each Time_-reference is the preceding time in zero, one, or many Reference_time_relationship objects.

Each Reference_time_relationship has as the succeeding time exactly one Time_reference. Each Time_-reference is the succeeding time in zero, one, or many Reference_time_relationship objects.

4.3.406 Relative_time_reference to Absolute_time_reference

Each Relative_time_reference may have as the basis exactly one Absolute_time_reference. Each Absolute_time_reference is the basis for zero, one, or many Relative_time_reference objects.

4.3.407 Riser_and_tray_panel_shape to Riser_shape

Each Riser_and_tray_panel_shape has the riser described by exactly one Riser_shape. Each Riser_shape describes the riser for one or more Riser_and_tray_panel_shape objects.

4.3.408 Riser_and_tray_panel_shape to Tray_panel_shape

Each Riser_and_tray_panel_shape describes the riser for exactly one Tray_panel_shape. Each Tray_-panel_shape has as the riser description zero or one Riser_and_tray_panel_shape.

4.3.409 Riser_shape to Bubble_cap_shape

Each Riser_shape is part of exactly one Bubble_cap_shape. Each Bubble_cap_shape consists of exactly one Riser_shape.

4.3.410 Seal_pan to Seal_pan_shape

Each Seal_pan may be described by exactly one Seal_pan_shape. Each Seal_pan_shape describes zero, one, or many Seal_pan objects.

4.3.411 Seal_pan_recess_shape to Seal_pan_shape

Each Seal_pan_recess_shape describes the recess for exactly one Seal_pan_shape. Each Seal_pan_shape has recess described by zero, one, or many Seal_pan_recess_shape objects.

4.3.412 Seal_pan_shape to Separation_tray_shape

Each Seal_pan_shape is part of exactly one Separation_tray_shape. Each Separation_tray_shape consists of zero, one, or many Seal_pan_shape objects.

4.3.413 Separation_packing to Packing_stack

Each Separation_packing is packing in zero, one, or many Packing_stack objects. Each Packing_stack is a part of exactly one Separation_packing.

4.3.414 Separation_packing to Separation_efficiency

Each Separation_packing may have as the efficiency exactly one Separation_efficiency. Each Separation_efficiency is the efficiency for zero, one, or many Separation_packing objects.

4.3.415 Separation_packing_stack to Packing_stack

Each Separation_packing_stack has as packing zero, one, or many Packing_stack objects. Each Packing_-stack is a part of exactly one Separation_packing_stack.

4.3.416 Separation_tower_internal to Cylindrical_pressure_vessel

Each Separation_tower_internal may be part of exactly one Cylindrical_pressure_vessel. Each Cylindrical_pressure_vessel has internally zero, one, or many Separation_tower_internal objects.

4.3.417 Separation_tower_internal to Cylindrical_pressure_vessel_section

Each Separation_tower_internal is contained within zero, one, or many Cylindrical_pressure_vessel_-section objects. Each Cylindrical_pressure_vessel_section contains zero or one Separation_tower_-internal.

4.3.418 Separation_tower_internal to Separation_tower

Each Separation_tower_internal may be part of exactly one Separation_tower. Each Separation_tower has as part of it zero, one, or many Separation_tower_internal objects.

4.3.419 Separation_tray to Separation_efficiency

Each Separation_tray may have as the efficiency exactly one Separation_efficiency. Each Separation_-efficiency is the efficiency for zero, one, or many Separation_tray objects.

4.3.420 Separation_tray to Separation_tray_hydraulics

Each Separation_tray may have as the hydraulics exactly one Separation_tray_hydraulics. Each Separation_tray_hydraulics is the hydraulics for zero, one, or many Separation_tray objects.

4.3.421 Separation_tray to Separation_tray_shape

Each Separation_tray may be described by exactly one Separation_tray_shape. Each Separation_tray_-shape describes zero, one, or many Separation_tray objects.

4.3.422 Separation_tray_baffle to Separation_tray_baffle_shape

Each Separation_tray_baffle may be described by exactly one Separation_tray_baffle_shape. Each Separation_tray_baffle_shape describes zero, one, or many Separation_tray_baffle objects.

4.3.423 Separation_tray_baffle_shape to Separation_tray_shape

Each Separation_tray_baffle_shape is part of exactly one Separation_tray_shape. Each Separation_tray_-shape consists of zero, one, or many Separation_tray_baffle_shape objects.

4.3.424 Separation_tray_component to Separation_tray

Each Separation_tray_component is a component of exactly one Separation_tray. Each Separation_tray has as components one or more Separation_tray_component objects.

4.3.425 Separation_tray_structural_component to Separation_tray

Each Separation_tray_structural_component is part of exactly one Separation_tray. Each Separation_tray contains zero, one, or many Separation_tray_structural_component objects.

4.3.426 Service_connections to Fluid_transfer_machine

Each Service_connections is a component of exactly one Fluid_transfer_machine. Each Fluid_transfer_-machine has as a component exactly one Service_connections.

4.3.427 Shaft to Fluid_transfer_machine

Each Shaft is a component of exactly one Fluid_transfer_machine. Each Fluid_transfer_machine has as a component exactly one Shaft.

4.3.428 Shell_and_tube_heat_exchanger_unit to Exchanger_design_criteria

Each Shell_and_tube_heat_exchanger_unit has exactly one Exchanger_design_criteria. Each Exchanger_design_criteria is the criteria for zero, one, or many Shell_and_tube_heat_exchanger_unit objects.

4.3.429 Shell_and_tube_heat_exchanger_unit to Exchanger_performance

Each Shell_and_tube_heat_exchanger_unit has zero, one, or many Exchanger_performance objects. Each Exchanger_performance is the performance for zero, one, or many Shell_and_tube_heat_exchanger_unit.

4.3.430 Shellside_performance to Exchanger_performance

Each Shellside_performance describes exactly one Exchanger_performance. Each Exchanger_-performance has exactly one Shellside_performance.

4.3.431 Simulation_polytropic_compressor_stage to Simulation_polytropic_-compressor

Each Simulation_polytropic_compressor_stage is stage of exactly one Simulation_polytropic_-compressor. Each Simulation_polytropic_compressor has as stages zero, one, or many Simulation_-polytropic_compressor_stage objects.

4.3.432 Single_phase_thermophysical_properties to Material_amount

Each Single_phase_thermophysical_properties may be phase property of exactly one Material_amount. Each Material_amount has phase properties of zero, one, or many Single_phase_thermophysical_-properties objects.

4.3.433 Single_phase_thermophysical_properties to Material_stream

Each Single_phase_thermophysical_properties may be phase property of exactly one Material_stream. Each Material_stream has phase properties zero, one, or many Single_phase_thermophysical_properties objects.

4.3.434 Single_phase_thermophysical_properties to Mixture

Each Single_phase_thermophysical_properties may be composition data of exactly one Mixture. Each Mixture has composition data of zero, one, or many Single_phase_thermophysical_properties objects.

4.3.435 Single_phase_thermophysical_properties to Phase

Each Single_phase_thermophysical_properties has phase of exactly one Phase. Each Phase is phase of zero, one, or many Single_phase_thermophysical_properties objects.

4.3.436 Single_phase_thermophysical_properties to Specific_phase

Each Single_phase_thermophysical_properties may be phase property of exactly one Specific_phase. Each Specific_phase has phase properties of zero, one, or many Single_phase_thermophysical_properties objects.

4.3.437 Site to Process_design_property_value

Each Site has zero, one, or many Process_design_property_value objects. Each Process_design_-property_value defines property values of zero, one, or many Site objects.

4.3.438 Site to Referenced_object

Each Site is zero or one Referenced_object. Each Referenced_object may be exactly one Site.

4.3.439 Site to Site_reference_time

Each Site has reference time of zero, one, or many Site_reference_time objects. Each Site_reference_-time references exactly one Site.

4.3.440 Site_standard_conditions to Site

Each Site_standard_conditions has as custody transfer exactly one Site. Each Site is the custody transfer for zero, one, or many Site_standard_conditions objects.

4.3.441 Site_utility_service to Site

Each Site_utility_service is the utility services for exactly one Site. Each Site has utility services of zero, one, or many Site_utility_service objects.

4.3.442 Sited_plant to Plant

Each Sited_plant is exactly one Plant. Each Plant is used as zero, one, or many Sited_plant objects.

4.3.443 Sited_plant to Site

Each Sited_plant is located on exactly one Site. Each Site has located on it one or more Sited_plant objects.

4.3.444 Space_requirements to Plant_item

Each Space_requirements is for exactly one Plant_item. Each Plant_item has zero, one, or many Space_-requirements objects.

4.3.445 Spare_item_relationship to Plant_item

Each Spare_item_relationship is in-service for exactly one Plant_item. Each Plant_item is in-service item for zero, one, or many Spare_item_relationship objects.

Each Spare_item_relationship is space for exactly one Plant_item. Each Plant_item is spare item for zero, one, or many Spare_item_relationship objects.

4.3.446 Specific_equation to Citation

Each Specific_equation has as a reference exactly one Citation. Each Citation is a reference for zero, one, or many Specific_equation objects.

4.3.447 Specific_equation to Equation_group

Each Specific_equation is a part of zero, one, or many Equation_group objects. Each Equation_group consists of zero, one, or many Specific_equation objects.

4.3.448 Specific_equation to Phase

Each Specific_equation is equation for exactly one Phase. Each Phase has equation of zero, one, or many Specific_equation objects.

4.3.449 Specific_equation to Variable

Each Specific_equation has one or more Variable objects. Each Variable is specified by exactly one Specific_equation.

4.3.450 Specific_equation to Variable_approval_context

Each Specific_equation has is suitable value for zero, one, or many Variable_approval_context objects. Each Variable_approval_context has approval context for zero, one, or many Specific_equation objects.

4.3.451 Specific_phase to Phase

Each Specific_phase may have physical state of exactly one Phase. Each Phase is physical state for zero, one, or many Specific_phase objects.

4.3.452 Specific_phase to Phases_in_equilibrium

Each Specific_phase may be in equilibrium in exactly one Phases_in_equilibrium object. Each Phases_-in_equilibrium has two or more Specific_phase objects.

4.3.453 Specific_phase to Phase_region

Each Specific_phase may contain points of exactly one Phase_region. Each Phase_region has points within zero, one, or many Specific_phase objects.

4.3.454 Specific_phase to Process_design_property_value

Each Specific_phase has zero, one, or many Process_design_property_value objects. Each Process_-design_property_value defines property values of zero, one, or many Specific_phase objects.

4.3.455 Specific_phase to Process_material

Each Specific_phase is made from exactly one Process_material. Each Process_material is used to make zero or one Specific_phase.

4.3.456 Specific_phase to Referenced_object

Each Specific_phase is zero or one Referenced_object. Each Referenced_object may be exactly one Specific_phase.

4.3.457 Spheroidal_pressure_vessel to Bounded_curve

Each Spheroidal_pressure_vessel has outside shape of exactly one Bounded_curve. Each Bounded_curve is outside shape of zero, one, or many Spheroidal_pressure_vessel objects.

4.3.458 Stage_column_section to Uo_distillation

Each Stage_column_section is section of exactly one Uo_distillation. Each Uo_distillation has as sections zero, one, or many Stage_column_section objects.

4.3.459 Stoichiometric_coefficient to Chemical_reaction

Each Stoichiometric_coefficient is the stoichiometric_coefficient for exactly one Chemical_reaction. Each Chemical_reaction has two or more Stoichiometric_coefficient objects.

4.3.460 Stoichiometric_coefficient to Substance

Each Stoichiometric_coefficient may be the stoichiometric_coefficient for exactly one Substance. Each Substance participates in reaction described by zero, one, or many Stoichiometric_coefficient objects.

4.3.461 Stream to Process_design_property_value

Each Stream has zero, one, or many Process_design_property_value objects. Each Process_design_-property_value defines property values of zero, one, or many Stream objects.

4.3.462 Stream to Process_simulation

Each Stream may be simulated by exactly one Process_simulation.
Each Process_simulation simulates zero, one, or many Stream objects.

4.3.463 Stream to Referenced_object

Each Stream is zero or one Referenced_object. Each Referenced_object may be exactly one Stream.

4.3.464 Stream to Stream_convergence_block

Each Stream is affected by zero, one, or many Stream_convergence_block objects. Each Stream_-convergence_block affects zero, one, or many Stream objects.

Each Stream is tear stream for zero, one, or many Stream_convergence_block objects. Each Stream_-convergence_block has tear streams of zero, one, or many Stream objects.

4.3.465 Stream to Variable_convergence_block

Each Stream is affected by zero, one, or many Variable_convergence_block objects. Each Variable_-convergence_block affects zero, one, or many Stream objects.

4.3.466 Stream_convergence_block to Simulation_block

Each Stream_convergence_block has ordered block sequence of zero, one, or many Simulation_block objects. Each Simulation_block is in block sequence for zero, one, or many Stream_convergence_block objects.

4.3.467 Stream_reference_time to Process_design_property_value

Each Stream_reference_time has property of zero, one, or many Process_design_property_value objects. Each Process_design_property_value is applicable at zero or one Stream_reference_time.

4.3.468 Stream_reference_time to Stream

Each Stream_reference_time is the time reference for exactly one Stream. Each Stream has time reference of zero, one, or many Stream_reference_time objects.

4.3.469 Stream_reference_time to Time_reference

Each Stream_reference_time has assigned exactly one Time_reference. Each Time_reference is assigned to zero, one, or many Stream_reference_time objects.

4.3.470 Stream_separation_specification to Material_stream

Each Stream_separation_specification may have inlet of exactly one Material_stream. Each Material_-stream is inlet for zero, one, or many Stream_separation_specification objects.

4.3.471 Stream_separation_specification to Material_stream_phase

Each Stream_separation_specification may have outlet of exactly one Material_stream_phase.
Each Material_stream_phase is outlet for zero, one, or many Stream_separation_specification objects.

4.3.472 Stream_separation_specification to Site_standard_conditions

Each Stream_separation_specification may have reference of exactly one Site_standard_conditions. Each Site_standard_conditions is reference for standard volume zero, one, or many Stream_separation_-specification objects.

4.3.473 Stream_separation_specification to Substance

Each Stream_separation_specification specifies exactly one Substance. Each Substance is substance for zero, one, or many Stream_separation_specification objects.

4.3.474 Stream_separation_specification to Uo_substance_split

Each Stream_separation_specification is specification for exactly one Uo_substance_split. Each Uo_-substance_split has as specification zero, one, or many Stream_separation_specification objects.

4.3.475 Stream_split_specification to Material_stream

Each Stream_split_specification may have inlet of exactly one Material_stream. Each Material_stream is inlet for zero, one, or many Stream_split_specification objects.

Each Stream_split_specification has outlet of exactly one Material_stream. Each Material_stream is outlet for zero, one, or many Stream_split_specification objects.

4.3.476 Stream_split_specification to Site_standard_conditions

Each Stream_split_specification may have as reference for standard volume exactly one Site_standard_-conditions. Each Site_standard_conditions is reference for standard volume for zero or one Stream_-split_specification.

4.3.477 Stream_split_specification to Uo_stream_split

Each Stream_split_specification is specification for exactly one Uo_stream_split. Each Uo_stream_split has as specification zero, one, or many Stream_split_specification objects.

4.3.478 Sub_plant_relationship to Plant

Each Sub_plant_relationship is contained within exactly one Plant. Each Plant contains zero, one, or many Sub_plant_relationship objects.

Each Sub_plant_relationship has as the sub-plant exactly one Plant. Each Plant is used in zero, one, or many Sub_plant_relationship objects.

4.3.479 Substance to Particle_size_distribution

Each Substance has psd of zero, one, or many Particle_size_distribution objects. Each Particle_size_-distribution is psd for one or more Substance objects.

4.3.480 Substance to Process_design_property_value

Each Substance has zero, one, or many Process_design_property_value objects. Each Process_design_-property_value defines property values of zero, one, or many Substance objects.

4.3.481 Substance to Referenced_object

Each Substance is zero or one Referenced_object. Each Referenced_object may be exactly one Substance.

4.3.482 Substance to Trace_component_specification

Each Substance is considered by zero, one, or many Trace_component_specification objects. Each Trace_component_specification considers zero, one, or many Substance objects.

4.3.483 Substance_name to Substance

Each Substance_name is alias for zero, one, or many Substance objects. Each Substance has as alias zero, one, or many Substance_name objects.

4.3.484 Thermophysical_property_method_option to Process_simulation

Each Thermophysical_property_method_option may be a default value of exactly one Process_-simulation. Each Process_simulation has default values of one or more Thermophysical_property_-method_option objects.

4.3.485 Thermophysical_property_method_option to Thermophysical_property_method

Each Thermophysical_property_method_option has method of exactly one Thermophysical_property_-method. Each Thermophysical_property_method is method for zero, one, or many Thermophysical_-property_method_option objects.

4.3.486 Thermodynamic_condition to Material_amount

Each Thermodynamic_condition applies to zero or one Material_amount. Each Material_amount is at exactly one Thermodynamic_condition.

4.3.487 Thermodynamic_condition to Material_stream

Each Thermodynamic_condition applies to zero or one Material_stream. Each Material_stream is at exactly one Thermodynamic_condition.

4.3.488 Thermodynamic_condition to Process_design_property_value

Each Thermodynamic_condition has zero, one, or many Process_design_property_value objects. Each Process_design_property_value defines property values of zero, one, or many Thermodynamic_condition objects.

4.3.489 Thermodynamic_condition to Process_property_curve

Each Thermodynamic_condition may be fixed TPH value for exactly one Process_property_curve. Each Process_property_curve has as fixed TPH values of zero or one Thermodynamic_condition.

4.3.490 Thermodynamic_condition to Referenced_object

Each Thermodynamic_condition is zero or one Referenced_object. Each Referenced_object may be exactly one Thermodynamic_condition.

4.3.491 Thermodynamic_condition to Specific_phase

Each Thermodynamic_condition applies to zero or one Specific_phase. Each Specific_phase is at exactly one Thermodynamic_condition.

4.3.492 Thermodynamic_properties to Chemical_component

Each Thermodynamic_properties is property of exactly one Chemical_component. Each Chemical_-component has properties zero, one, or many Component_in_mixture_properties objects.

4.3.493 Thermodynamic_properties to Heat_release_point

Each Thermodynamic_properties describes exactly one Heat_release_point. Each Heat_release_point has exactly one Thermodynamic_properties.

4.3.494 Thermodynamic_properties to Reference_state

Each Thermodynamic_properties may have reference state provided by exactly one Reference_state. Each Reference_state provides reference state for zero, one, or many Thermodynamic_properties objects.

4.3.495 Thermodynamic_properties to Single_phase_thermophysical_properties

Each Thermodynamic_properties is property of exactly one Single_phase_thermophysical_properties. Each Single_phase_thermophysical_properties has properties of zero, one, or many Thermodynamic_properties objects.

4.3.496 Thrust_bearing to Fluid_transfer_machine

Each Thrust_bearing is a component of exactly one Fluid_transfer_machine. Each Fluid_transfer_machine has as a component zero or one Thrust_bearing.

4.3.497 Tie_rod to Tubesheet

Each Tie_rod belongs to exactly one Tubesheet. Each Tubesheet has zero, one, or many Tie_rod objects.

If there is more than one kind of tie_rod for a given tubesheet, each individual tie_rod shall be specified. Otherwise, only one tie_rod instance shall be specified, and the count shall be specified in the number_of_tie_rods attribute.

4.3.498 Tie_rod_spacer to Tie_rod

Each Tie_rod_spacer belongs to exactly one Tie_rod. Each Tie_rod has zero, one, or many Tie_rod_spacer objects.

If there is more than one kind of Tie_rod_spacer for a given Tie_rod, each individual Tie_rod_spacer shall be specified. Otherwise, only one Tie_rod_spacer instance shall be specified, and the count shall be specified in the number_of_spacers attribute.

4.3.499 Time_reference to Clock_time

Each Time_reference may have assigned exactly one Clock_time. Each Clock_time is assigned to zero, one, or many Time_reference objects.

4.3.500 Time_reference to Site_reference_time

Each Time_reference is assigned to zero, one, or many Site_reference_time objects. Each Site_reference_time specifies exactly one Time_reference.

4.3.501 Trace_component_specification to Stream_convergence_block

Each Trace_component_specification is trace component spec for zero, one, or many Stream_convergence_block objects. Each Stream_convergence_block has trace component spec of zero, one, or many Trace_component_specification objects.

4.3.502 Transport_properties to Bulk_thermophysical_properties

Each Transport_properties is property of exactly one Bulk_thermophysical_properties. Each Bulk_-thermophysical_properties has properties of zero or one Transport_properties.

4.3.503 Transport_properties to Single_phase_thermophysical_properties

Each Transport_properties is property of exactly one Single_phase_thermophysical_properties. Each Single_phase_thermophysical_properties has properties of zero or one Transport_properties.

4.3.504 Tray_and_tray_stack to Separation_tray

Each Tray_and_tray_stack has as the tray exactly one Separation_tray. Each Separation_tray is the tray in zero or one Tray_and_tray_stack.

4.3.505 Tray_and_tray_stack to Separation_tray_stack

Each Tray_and_tray_stack is the trays for exactly one Separation_tray_stack. Each Separation_tray_stack has as trays one or more Tray_and_tray_stack objects.

4.3.506 Tray_cascade to Curve

Each Tray_cascade may be described by exactly one Curve. Each Curve describes zero or one Tray_-cascade.

4.3.507 Tray_cascade to Separation_tray_shape

Each Tray_cascade is the cascade for exactly one Separation_tray_shape. Each Separation_tray_shape has as the cascade zero, one, or many Tray_cascade objects.

4.3.508 Tray_panel to Separation_efficiency

Each Tray_panel may have as the efficiency exactly one Separation_efficiency. Each Separation_-efficiency is efficiency for zero, one, or many Tray_panel objects.

4.3.509 Tray_panel to Tray_panel_hydraulics

Each Tray_panel may have as the hydraulics exactly one Tray_panel_hydraulics. Each Tray_panel_-hydraulics is the hydraulics of zero, one, or many Tray_panel objects.

4.3.510 Tray_panel to Tray_panel_shape

Each Tray_panel may be described by exactly one Tray_panel_shape. Each Tray_panel_shape describes zero, one, or many Tray_panel objects.

4.3.511 Tray_panel_and_perforation_shape to Perforation_shape

Each Tray_panel_and_perforation_shape has the perforation described by exactly one Perforation_shape. Each Perforation_shape describes the perforation for zero, one, or many Tray_panel_and_perforation_-shape objects.

4.3.512 Tray_panel_and_perforation_shape to Tray_panel_shape

Each Tray_panel_and_perforation_shape describes the perforation for exactly one Tray_panel_shape. Each Tray_panel_shape has as the perforation description zero, one, or many Tray_panel_and_-perforation_shape objects.

4.3.513 Tray_panel_and_slot_shape to Tray_panel_shape

Each Tray_panel_and_slot_shape describes the slot for exactly one Tray_panel_shape. Each Tray_-panel_shape has as the slot description zero, one, or many Tray_panel_and_slot_shape objects.

4.3.514 Tray_panel_and_slot_shape to Tray_slot_shape

Each Tray_panel_and_slot_shape has the slot described by exactly one Tray_slot_shape. Each Tray_-slot_shape describes the slot for zero, one, or many one or more Tray_panel_and_slot_shape objects.

4.3.515 Tray_panel_shape to Separation_tray_shape

Each Tray_panel_shape is part of exactly one Separation_tray_shape. Each Separation_tray_shape consists of one or more Tray_panel_shape objects.

4.3.516 Tray_support to Cylindrical_pressure_vessel_cylinder_section

Each Tray_support has exactly one Cylindrical_pressure_vessel_cylinder_section. Each Cylindrical_-pressure_vessel_cylinder_section is part of zero, one, or many Tray_support objects.

4.3.517 Tray_support to Separation_tray

Each Tray_support supports exactly one Separation_tray. Each Separation_tray is supported by zero, one, or many Tray_support objects.

4.3.518 Tray_support to Tray_support_shape

Each Tray_support may be described by exactly one Tray_support_shape. Each Tray_support_shape describes zero, one, or many Tray_support objects.

4.3.519 Tube_external_characteristics to Tube_type

Each Tube_external_characteristics describes exactly one Tube_type. Each Tube_type has zero or one Tube_external_characteristics.

4.3.520 Tube_internal_characteristics to Tube_type

Each Tube_internal_characteristics describes exactly one Tube_type. Each Tube_type has zero or one Tube_internal_characteristics.

4.3.521 Tubesheet to Exchanger_bundle

Each Tubesheet belongs to exactly one Exchanger_bundle. Each Exchanger_bundle has zero, one, or many Tubesheet objects.

4.3.522 Tubesheet to Partition_seal_rod

Each Tubesheet may have exactly one Partition_seal_rod. Each Partition_seal_rod is part of zero, one, or many Tubesheet objects.

4.3.523 Tubeside_performance to Exchanger_performance

Each Tubeside_performance describes exactly one Exchanger_performance. Each Exchanger_-performance has exactly one Tubeside_performance.

4.3.524 Substance_property to Reference_state

Each Substance_property may have reference state provided by exactly one Reference_state. Each Reference_state provides reference state for zero, one, or many Substance_property objects.

4.3.525 U_bend_support to Exchanger_bundle

Each U_bend_support belongs to exactly one Exchanger_bundle. Each Exchanger_bundle has zero or one U_bend_support.

4.3.526 Uo_centrifugal_compressor_stage to Uo_centrifugal_compressor

Each Uo_centrifugal_compressor_stage is stage of exactly one Uo_centrifugal_compressor. Each Uo_-centrifugal_compressor has as stage zero, one, or many Uo_centrifugal_compressor_stage objects.

4.3.527 Uo_distillation to Substance

Each Uo_distillation may have heavy key of exactly one Substance. Each Substance is heavy key for zero, one, or many Uo_distillation objects.

Each Uo_distillation may have light key of exactly one Substance. Each Substance is light key for zero, one, or many Uo_distillation objects.

4.3.528 Uo_distillation to Uo_complex_distillation

Each Uo_distillation may be a component of exactly one Uo_complex_distillation. Each Uo_complex_-distillation is composed of two or more Uo_distillation objects.

4.3.529 Uo_distillation_stage to Stage_column_section

Each Uo_distillation_stage may have section of exactly one Stage_column_section. Each Stage_-column_section is section for zero, one, or many Uo_distillation_stage objects.

4.3.530 Uo_distillation_stage to Uo_distillation

Each Uo_distillation_stage is a stage of exactly one Uo_distillation. Each Uo_distillation has as a stage zero, one, or many Uo_distillation_stage objects.

4.3.531 Uo_distillation_stage to Uo_heat_exchanger

Each Uo_distillation_stage may have external heat transfer provided by exactly one Uo_heat_exchanger. Each Uo_heat_exchanger provides external heat transfer for zero or one Uo_distillation_stage.

4.3.532 Uo_heat_exchanger_fluid to Stream

Each Uo_heat_exchanger_fluid has material or utility stream of exactly one Stream. Each Stream is the material or utility stream for zero or one Uo_heat_exchanger_fluid.

4.3.533 Uo_heat_exchanger_side to Uo_heat_exchanger

Each Uo_heat_exchanger_side is a side for exactly one Uo_heat_exchanger. Each Uo_heat_exchanger has as sides two or more Uo_heat_exchanger_side objects. Each Uo_heat_exchanger has at least one cold side and at least one hot side.

4.3.534 Uo_heat_exchanger_side to Uo_heat_exchanger_fluid

Each Heat_exchanger_side has one or more Uo_heat_exchanger_fluid objects. Each Uo_heat_-exchanger_fluid is fluid for exactly one Heat_exchanger_side.

4.3.535 Uo_pipeline_node to Uo_pipeline

Each Uo_pipeline_node is node of exactly one Uo_pipeline.
Each Uo_pipeline has as node zero, one, or many Uo_pipeline_node objects.

4.3.536 Uo_pipeline_node to Uo_pipeline_segment

Each Uo_pipeline_node may have in node exactly one Uo_pipeline_segment.
Each Uo_pipeline_segment has as in node exactly one Uo_pipeline_node.

Each Uo_pipeline_node may have as out node exactly one Uo_pipeline_segment.
Each Uo_pipeline_segment has as out node exactly one Uo_pipeline_node.

4.3.537 Uo_pipeline_segment to Uo_pipeline

Each Uo_pipeline_segment is segment of exactly one Uo_pipeline. Each Uo_pipeline has as segment zero, one, or many Uo_pipeline_segment objects.

4.3.538 Uo_positive_displacement_compressor_stage to Uo_positive_displacement_compressor

Each Uo_positive_displacement_compressor_stage is stage of exactly one Uo_positive_displacement_compressor. Each uo_positive_displacement_compressor has as stage zero, one, or many Uo_positive_displacement_compressor_stage objects.

4.3.539 Uo_separation to Separation_efficiency

Each Uo_separation may have as the efficiency exactly one Separation_efficiency. Each Separation_efficiency is efficiency for zero, one, or many Uo_separation objects.

4.3.540 Uo_countercurrent_solids_decant to Substance

Each Uo_countercurrent_solids_decant may have heavy key of exactly one Substance. Each Substance is heavy key for zero, one, or many Uo_countercurrent_solids_decant objects.

Each Uo_countercurrent_solids_decant may have light key of exactly one Substance. Each Substance is light key for zero, one, or many Uo_countercurrent_solids_decant objects.

4.3.541 Uo_solids_decant_stage to Uo_countercurrent_solids_decant

Each Uo_solids_decant_stage is stage of exactly one Uo_countercurrent_solids_decant.
Each Uo_countercurrent_solids_decant has as stages zero, one, or many Uo_solids_decant_stage objects.

4.3.542 Utility_service_stream_demand to Stream

Each Utility_service_stream_demand demands exactly one Stream. Each Stream is demanded by zero, one, or two Utility_service_stream_demand objects.

4.3.543 Utility_service_stream_demand to Utility_material_service

Each Utility_service_stream_demand is demanded by exactly one Utility_material_service. Each Utility_material_service has demands of zero, one, or two Utility_service_stream_demand objects.

4.3.544 Vapour_belt to Exchanger_shell

Each Vapour_belt belongs to exactly one Exchanger_shell. Each Exchanger_shell has zero or one Vapour_belt.

4.3.545 Variable_adjustment_specification to Variable_convergence_block

Each Variable_adjustment_specification is a specification for exactly one Variable_convergence_block. Each Variable_convergence_block has one or more Variable_adjustment_specification objects.

4.3.546 Variable_convergence_specification to Variable_convergence_block

Each Variable_convergence_specification is a specification for exactly one Variable_convergence_block. Each Variable_convergence_block has as specification of zero, one, or many Variable_convergence_-specification objects.

4.3.547 Variable_value to Citation

Each Variable_value may have as a reference exactly one Citation. Each Citation is a reference for zero, one, or many Variable_value objects.

4.3.548 Variable_value to Data_entry

Each Variable_value may be the dependent variable value for exactly one Data_entry. Each Data_entry has as dependent variable values one or more Variable_value objects.

Each Variable_value may be the independent variable value for exactly one Data_entry. Each Data_entry has as independent variable values one or more Variable_value objects.

Each Variable_value may be the fixed variable value for exactly one Data_entry. Each Data_entry has as fixed variable values zero, one, or many Variable_value objects.

4.3.549 Variable_value to Data_quality

Each Variable_value may have quality of exactly one Data_quality. Each Data_quality is quality of zero, one, or many Variable_value objects.

4.3.550 Variable_value to Phase

Each Variable_value may have context of exactly one Phase. Each Phase is context for zero, one, or many Variable_value objects.

4.3.551 Variable_value to Substance

Each Variable_value has property value of exactly one Substance. Each Substance has property value zero, one, or many Variable_value objects.

4.3.552 Variable_value to Variable

Each Variable_value is value of exactly one Variable. Each Variable has values of zero, one, or many Variable_value objects.

4.3.553 Variable_value to Variable_approval_context

Each Variable_value has approval context of zero, one, or many Variable_approval_context objects. Each Variable_approval_context is context for zero, one, or many Variable_value objects.

4.3.554 Vibration_detector to Centrifugal_compressor

Each Vibration_detector may be a component of exactly one Centrifugal_compressor. Each Centrifugal_-compressor has as a component zero or one Vibration_detector.

4.3.555 Weir to Weir_shape

Each Weir may be described by exactly one Weir_shape. Each Weir_shape describes zero, one, or many Weir objects.

4.3.556 Weir_and_disengaging_panel_intersection to Downcomer_disengaging_panel_shape

Each Weir_and_disengaging_panel_intersection is intersected by exactly one Downcomer_disengaging_-panel_shape. Each Downcomer_disengaging_panel_shape intersects zero, one, or many Weir_and_-disengaging_panel_intersection objects.

4.3.557 Weir_and_disengaging_panel_intersection to Weir_shape

Each Weir_and_disengaging_panel_intersection is intersected by exactly one Weir_shape. Each Weir_-shape intersects zero or one Weir_and_disengaging_panel_intersection.

4.3.558 Weir_and_seal_pan_intersection to Seal_pan_shape

Each Weir_and_seal_pan_intersection is intersected by exactly one Seal_pan_shape. Each Seal_pan_-shape intersects zero, one, or many Weir_and_seal_pan_intersection objects.

4.3.559 Weir_and_seal_pan_intersection to Weir_shape

Each Weir_and_seal_pan_intersection is intersected by exactly one Weir_shape. Each Weir_shape intersects zero or one Weir_and_seal_pan_intersection.

4.3.560 Weir_and_tray_panel_intersection to Tray_panel_shape

Each Weir_and_tray_panel_intersection is intersected by exactly one Tray_panel_shape. Each Tray_-panel_shape intersects zero, one, or many Weir_and_tray_panel_intersection objects.

4.3.561 Weir_and_tray_panel_intersection to Weir_shape

Each Weir_and_tray_panel_intersection is intersected by exactly one Weir_shape. Each Weir_shape intersects zero or one Weir_and_tray_panel_intersection.

4.3.562 Weir_shape to Separation_tray_shape

Each Weir_shape is part of exactly one Separation_tray_shape. Each Separation_tray_shape consists of zero, one, or many Weir_shape objects.

5 Application interpreted model

5.1 Mapping table

This clause contains the mapping table that shows how each UoF and application object of this part of ISO 10303 (see clause 4) maps to one or more AIM constructs (see annex A). The mapping table is organized in five columns.

Column 1) Application element: Name of an application element as it appears in the application object definition in 4.2. Application object names are written in uppercase. Attribute names and assertions are listed after the application object to which they belong and are written in lower case.

Column 2) AIM element: Name of an AIM element as it appears in the AIM (annex A), the term 'IDENTICAL MAPPING', or the term 'PATH'. AIM entities are written in lower case. Attribute names of AIM entities are referred to as <entity name.attribute name>. The mapping of an application element may result in several related AIM elements. Each of these AIM elements requires a line of its own in the table. The term 'IDENTICAL MAPPING' indicates that both application objects of an application assertion map to the same AIM element. The term 'PATH' indicates that the application assertion maps to the entire reference path.

Column 3) Source: For those AIM elements that are interpreted from the integrated resources or the application interpreted constructs, this is the number of the corresponding part of ISO 10303. For those AIM elements that are created for the purpose of this part of ISO 10303, this is the number of this part. Entities or types that are the defined within the integrated resources have an AIC as the source reference if the use of the entity or type for the mapping is within the scope of the AIC.

Column 4) Rules: One or more numbers may be given that refer to rules that apply to the current AIM element or reference path. For rules that are derived from relationships between application objects, the same rule is referred to by the mapping entries of all the involved AIM elements. The expanded names of the rules are listed after the table.

Column 5) Reference path: To describe fully the mapping of an application object, it may be necessary to specify a reference path through several related AIM elements. The reference path column documents the role of an AIM element relative to the AIM element in the row succeeding it. Two or more such related AIM elements define the interpretation of the integrated resources that satisfies the requirement specified by the application object. For each AIM element that has been created for use within this part of ISO 10303, a reference path up to its supertype from an integrated resource is specified.

For the expression of reference paths and the relationships between AIM elements the following notational conventions apply:

a) []: enclosed section constrains multiple AIM elements or sections of the reference path are required to satisfy an information requirement;

b) (): enclosed section constrains multiple AIM elements or sections of the reference path are identified as alternatives within the mapping to satisfy an information requirement;

c) {}: enclosed section constrains the reference path to satisfy an information requirement;

d) <>: enclosed section constrains at one or more required reference path;

e) ||: enclosed section constrains the supertype entity;

f) ->: attribute references the entity or select type given in the following row;

g) <-: entity or select type is referenced by the attribute in the following row:

h) [i]: attribute is an aggregation of which a single member is given in the following row;

i) [n]: attribute is an aggregation of which member n is given in the following row;

j) =>: entity is a supertype of the entity given in the following row;

k) <=: entity is a subtype of the entity given in the following row;

l) =: the string, select, or enumeration type is constrained to a choice or value;

m) \: the reference path expression continues on the next line.

Lines of text in the reference path are bolded to highlight population constraints:

— structural constraints;

EXAMPLE 71 - How the ARM type hierarchy is specified in the AIM.

— instantiation value constraints.

EXAMPLE 72 - Required values for attributes in a mapping.

These bolded constraints are different from the global rules listed in the rules column of the mapping table. The global rules apply to every instance of the AIM construct for which it is written.

Table 1 - Mapping table for chemical_reaction_data UoF

Application element	AIM element	Source	Rules	Reference PATH
ARRHENIUS_REACTION	representation	43	11, 16, 24	**{representation [representation.name = `reaction rate'] [classified_item = representation classified_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group ->** group **group.name = `arrhenius reaction']}**
arrhenius_activation_-energy	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item representation_item.name = `arrhenius activation energy'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
arrhenius_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item representation_item.name = `arrhenius coefficient'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
arrhenius_pre-exponential	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item representation_item.name = `arrhenius pre-exponential'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 1 - Mapping table for chemical_reaction_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CHEMICAL_REACTION	product_definition_process	49		
reaction_name	action.name	41		product_definition_process <= action action.name
chemical_reaction to process_design_-property_value	PATH		16	product_definition_process <= action characterized_action_definition = action characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation
EXTENTS_SPECIFIED_-CHEMICAL_REACTION	product_definition_process	49	11, 24	**{product_definition_process <= action classified_item = action classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `extents specified chemical reaction'}**

Table 1 - Mapping table for chemical_reaction_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
amount_of_reaction_- extent	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	product_definition_process <= action characterized_action_definition = action characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `amount of reaction extent'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 1 - Mapping table for chemical_reaction_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
key_component_- conversion	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	product_definition_process <= action characterized_action_definition = action characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `key component conversion'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 1 - Mapping table for chemical_reaction_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reaction_temperature_- offset	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	product_definition_process <= action characterized_action_definition = action characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `reaction temperature offset'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
extents_specified_- chemical_reaction to chemical_reaction	IDENTICAL MAPPING			

Table 1 - Mapping table for chemical_reaction_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
extents_specified_- chemical_reaction to uo_- extent_specified_reactor	PATH			product_definition_process <= action action.chosen_method -> action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo extent specified reactor'}**
INTERPHASE_- CHEMICAL_REACTION	product_definition_process	49	11, 24	**{product_definition_process <=** **action** **classified_item = action** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `interphase chemical reaction'}**
interphase_chemical_- reaction to chemical_- reaction	IDENTICAL MAPPING			
interphase_chemical_- reaction to specific_phase	PATH		8	product_definition_process <= action supported_item = action supported_item <- action_resource.usage[i] action_resource => specific_phase

Table 1 - Mapping table for chemical_reaction_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
REACTION_ORDER	representation_item	43		**{representation_item representation_item.name = `reaction order'}**
order_value	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		representation_item => measure_representation_item <= **{measure_with_unit measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
reaction_order to reaction_rate	PATH		16	representation_item <- representation.items[i] representation **{representation** **representation.name = `reaction rate'}**

Table 1 - Mapping table for chemical_reaction_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reaction_order to substance	PATH		7, 13, 14, 16, 24	representation_item <- representation.items[i] **{representation** **representation.name = `reaction rate'}** representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = process_product_association process_product_association process_product_association.defined_product -> characterized_product_definition characterized_product_definition = product_definition product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `substance'}**
REACTION_-PARAMETRIC_DATA	representation	43	16	**{representation** **representation.name = `reaction parametric data'}**

Table 1 - Mapping table for chemical_reaction_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reaction_parametric_data to chemical_reaction	PATH		7, 16	representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = action action => product_definition_process
REACTION_RATE	representation	43	16	**{representation representation.name = `reaction rate'}**
description	descriptive_representation_-item.description	45	16	representation representation.items[i] -> representation_item <= descriptive_representation_item descriptive_representation_item.description
reaction_constant	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item representation_item.name = `reaction constant'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
reaction_rate to chemical_reaction	PATH		7, 16	representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = process_product_association process_product_association process_product_association.process -> product_definition_process

Table 1 - Mapping table for chemical_reaction_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reaction_rate to phase	PATH			representation grouped_item = representation grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group => phase
reaction_rate to process_-design_property_value	PATH		16	representation <- representation_relationship.rep_1 representation_relationship representation_relationship.rep_2 -> representation => process_design_property_value
STOICHIOMETRIC_-COEFFICIENT	representation	43	16	**{representation representation.name = `stoichiometric coefficient'}**
value	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item representation_item.name = `number of molecules'}** representation_item => measure_representation_item <= **{measure_with_unit measure_with_unit.value_component -> measure_value measure_value = count_measure count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 1 - Mapping table for chemical_reaction_data UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
stoichiometric_coefficient to chemical_reaction	PATH		7, 16	representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = process_product_association process_product_association process_product_association.process -> product_definition_process
stoichiometric_coefficient to substance	PATH		7, 11, 13, 14, 16, 24	representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = process_product_association process_product_association process_product_association.defined_product -> characterized_product_definition characterized_product_definition = product_definition product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `substance'}**

Table 2 - Mapping table for control_strategy UoF

Application element	AIM element	Source	Rules	Reference PATH
CONTINUOUS_- CONTROL_OBJECTIVE	control_objective	231	28	control_objective <= [characterized_object] [action_request_solution **{action_request_solution** **action_request_solution.request ->** **versioned_action_request** **versioned_action_request.description = `continuous'}**]
description	action_request_solution. description	41	28	control_objective <= action_request_solution action_request_solution.description
objective_name	action_request_solution.name	41	28	control_objective <= action_request_solution action_request_solution.name
operating_state	characterized_object.name	41	9	control_objective <= characterized_object characterized_object.name
continuous_control_- objective to continuous_- control_scheme	PATH		28	control_objective <= action_request_solution action_request_solution.request -> **{versioned_action_request** **versioned_action_request.description = `continuous'}** versioned_action_request => control_scheme

Table 2 - Mapping table for control_strategy UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
continuous_control_- objective to process_- design_property_value	PATH		9, 15, 16	control_objective <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation
CONTINUOUS_- CONTROL_SCHEME	control_scheme	231	28	control_scheme <= versioned_action_request **{versioned_action_request** **versioned_action_request.description = `continuous'}**
scheme_id	versioned_action_request.id	41	28	control_scheme <= versioned_action_request versioned_action_request.id
type	versioned_action_request. purpose	41	28	control_scheme <= versioned_action_request versioned_action_request.purpose
CONTROL_- ADJUSTMENT	action_method	41	5, 11, 24	**{action_method** **grouped_item = action_method** **group_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `control adjustment'}**

Table 2 - Mapping table for control_strategy UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
control_adjustment to control_loop	PATH		5, 6, 11, 24	action_method <- action_method_relationship.related_method action_method_relationship action_method_relationship.relating_method -> action_method **{action_method** **grouped_item = action_method** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `control loop'}**
control_adjustment to stream	PATH		5	action_method supported_item = action_method supported_item <- action_resource.usage[i] action_resource => stream
CONTROL_EVENT	action_method	41	5, 11, 24	**{action_method** **grouped_item = action_method** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `control event'}**

Table 2 - Mapping table for control_strategy UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
control_event to control_-logic	PATH		5, 6, 11, 24	action_method <- action_method_relationship.related_method action_method_relationship action_method_relationship.relating_method -> action_method **{action_method** **grouped_item = action_method** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `control logic'}**
control_event to stream	PATH		5	action_method supported_item = action_method supported_item <- action_resource.usage[i] action_resource => stream
CONTROL_LOGIC	action_method	41	5, 11, 24	**{action_method** **grouped_item = action_method** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `control logic'}**
algorithm_name	action_resource.name	41	5, 8	action_method supported_item = action_method supported_item <- action_resource.usage[i] action_resource action_resource.name

Table 2 - Mapping table for control_strategy UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
algorithm_source	external_source	41	5, 10	action_method supported_item = action_method supported_item <- action_resource.usage[i] action_resource => externally_defined_action_resource <= externally_defined_item externally_defined_item.source -> external_source
description	action_method.description	41		
logic_id	action_method.name	41		
control_logic to control_- logic_condition	PATH		5, 7	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property **{action_property** **action_property.description = `control logic condition'}**
control_logic to discrete_- control_objective	PATH		28	action_method <- action_request_solution.method **{action_request_solution** **action_request_solution.request ->** **versioned_action_request** **versioned_action_request.description = `discrete'}** action_request_solution => control_objective
CONTROL_LOGIC_- CONDITION	action_property	41	7	**{action_property** **action_property.description = `control logic condition'}**
name	action_property.name	41		

Table 2 - Mapping table for control_strategy UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
control_logic_condition to event_sequence_with_-condition	PATH		5, 7	action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method => (concurrent_action_method) (serial_action_method) (serial_action_method => sequential_method) (event_sequence_with_condition)
CONTROL_LOOP	action_method	41	5, 11, 24	**{action_method grouped_item = action_method grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `control loop'}**
algorithm_name	action_resource.name	41	5, 8	action_method supported_item = action_method supported_item <- action_resource.usage[i] action_resource action_resource.name
algorithm_source	external_source	41	5, 8, 10	action_method supported_item = action_method supported_item <- action_resource.usage[i] action_resource => externally_defined_action_resource <= externally_defined_item externally_defined_item.source -> external_source
description	action_method.description	41		

Table 2 - Mapping table for control_strategy UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
loop_id	action_method.name	41		
control_loop to continuous_control_-objective	PATH		28	action_method <- action_request_solution.method **{action_request_solution** **action_request_solution.request ->** **versioned_action_request** **versioned_action_request.description = `continuous'}** action_request_solution => control_objective
DISCRETE_CONTROL_-OBJECTIVE	control_objective	231	28	control_objective <= [characterized_object] [action_request_solution] **{action_request_solution** **action_request_solution.request ->** **versioned_action_request** **versioned_action_request.description = `discrete'}**
description	action_request_solution. description	41	28	control_objective <= action_request_solution action_request_solution.description
objective_name	action_request_solution.name	41	28	control_objective <= action_request_solution action_request_solution.name
operating_state	characterized_object.name	41	9	control_objective <= characterized_object characterized_object.name
discrete_control_objective to discrete_control_-scheme	PATH		28	control_objective <= action_request_solution action_request_solution.request -> **{versioned_action_request** **versioned_action_request.description = `discrete control scheme'}** versioned_action_request => control_scheme

Table 2 - Mapping table for control_strategy UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
discrete_control_objective to process_design_- property_value	PATH		9, 15, 16	control_objective <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation
DISCRETE_CONTROL_- SCHEME	control_scheme	231	28	control_scheme <= versioned_action_request **{versioned_action_request versioned_action_request.description = `discrete'}**
scheme_id	versioned_action_request.id	41	28	control_scheme <= versioned_action_request versioned_action_request.id
type	versioned_action_request. purpose	41	28	control_scheme <= versioned_action_request versioned_action_request.purpose
LOGICAL_OPERATION	logical_operation	231	7	logical_operation <= [action_property] [action_property_relationship] **{action_property action_property.description = `control logic condition'}**
logical_operator	action_property_relationship. name	49	7	logical_operation <= action_property_relationship action_property_relationship.name

Table 2 - Mapping table for control_strategy UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
logical_operation to control_logic_condition (as first operand)	PATH		7	logical_operation <= action_property_relationship action_property_relationship.relating_action_property ->action_property **{action_property** **action_property.description = `control logic condition'}**
logical_operation to control_logic_condition (as second operand)	PATH		7	logical_operation <= action_property_relationship action_property_relationship.related_action_property ->action_property **{action_property** **action_property.description = `control logic condition'}**
TRIGGER	trigger	231	7	trigger <= action_property **{action_property** **action_property.description = `control logic condition'}**
status	action_property.name	49	7	trigger <= action_property action_property.name
trigger to process_-definition	PATH		5, 7	trigger <= action_property action_property.definition ->characterized_action_definition characterized_action_definition = action_method action_method

Table 3 - Mapping table for heat_transfer_equipment_data UoF

Application element	AIM element	Source	Rules	Reference PATH
AIR_COOLED_HEAT_-EXCHANGER_UNIT	heat_transfer_equipment	41	11, 13, 14, 24	heat_transfer_equipment <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `air cooled heat exchanger unit'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CROSS_BAFFLE	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cross baffle'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cut_out_of_window	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cut-out-of-window'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `yes')** **(descriptive_representation_item.description = `no')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `baffle diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
distance_from_- tubesheet_face	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `distance from tubesheet face'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
elastic_modulus	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `elastic modulus'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless']}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
orientation	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `orientation'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `none')** **(descriptive_representation_item.description = `parallel')** **(descriptive_representation_item.description = `perpendicular')** **(descriptive_representation_item.description = `rotated')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outer_ring_width	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outer ring width'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
percent_diameter_first_- cut	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `percent diameter first cut'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
percent_diameter_- second_cut	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `percent diameter second cut'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
percent_diameter_third_-cut	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `percent diameter third cut'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thermal_conductivity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thermal conductivity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thickness_at_tube_hole	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thickness at tube hole'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cross baffle type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `disk_and_donut')** **(descriptive_representation_item.description = `double_segmental')** **(descriptive_representation_item.description = `full_support')** **(descriptive_representation_item.description = `no_baffles')** **(descriptive_representation_item.description = `rod')** **(descriptive_representation_item.description = `single_segmental')** **(descriptive_representation_item.description = `strip')** **(descriptive_representation_item.description = `triple_segmental')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cross_baffle to exchanger_bundle	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `exchanger bundle cross baffle']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger bundle'}** product_definition => heat_exchanger_component

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
DETUNING_PLATE	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cross baffle'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
distance_from_shell_- centre	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `distance from shell centre'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
width	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `width'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
detuning_plate to exchanger_bundle	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `exchanger bundle detuning plate']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger bundle'}** product_definition => heat_exchanger_component

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
DISTRIBUTOR_BELT	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `distributor belt'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
radial_clearance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `radial clearance'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
slot_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `slot area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `distributor belt type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `gap')** **(descriptive_representation_item.description = `slot')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
distributor_belt to exchanger_nozzle	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `exchanger nozzle distributor belt']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger nozzle'}** product_definition => nozzle

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
END_PARTITION_- PLATE	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `end partition plate'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
distance_from_centre	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `distance from center'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
orientation	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `orientation'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `horizontal')** **(descriptive_representation_item.description = `vertical')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
width	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `width'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
EXCHANGER_-ASSEMBLY	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger assembly'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
dry_weight	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `exchanger assembly dry weight'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
wet_weight	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `exchanger assembly wet weight'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit}** **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
exchanger_assembly to shell_and_tube_heat_-exchanger_unit	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `exchange unit component assembly']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `shell and tube heat exchanger unit'}** product_definition => heat_transfer_equipment

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
EXCHANGER_BUNDLE	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger bundle'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
baffle_inlet_spacing	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `baffle inlet spacing'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
baffle_outlet_spacing	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `baffle outlet spacing'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
baffle_to_shell_clearance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `baffle-to-shell clearance'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bundle_to_shell_- clearance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `bundle-to-shell clearance'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bundle_weight	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `bundle weight'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
effective_area_in_ubends	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `effective area in u-bends'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
floating_head_support_-type	descriptive_representation_-item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `floating head support type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `full support plate')** **(descriptive_representation_item.description = `none')** **(descriptive_representation_item.description = `support with opening')** **(descriptive_representation_item.description = `two supports with vertical cut windows')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
kettle_tuberows_- removed_at_bottom	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `kettle tuberows removed at bottom'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
kettle_tuberows_- removed_at_top	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `kettle tuberows removed at top'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nominal_baffle_spacing	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `nominal baffle spacing'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_inlet_- intermediate_supports	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number inlet intermediate supports'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_midspace_- intermediate_supports	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number midspace intermediate supports'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_cross_baffles	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of cross baffles'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_seal_strip_-pairs	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of seal-strip pairs'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_tube_- passes_shell	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of tube passes shell'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_tubes_in_- window	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of tubes in window'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_outlet_- intermediate_supports	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number outlet intermediate supports'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outer_tube_limit	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outer tube limit'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
percent_baffle_overlap	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `percent baffle overlap'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
total_number_of_tubes	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `total number of tubes'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tube_to_baffle_clearance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tube-to-baffle clearance'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tubes_in_windows	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tubes in window'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `present')** **(descriptive_representation_item.description = `not present')** **(descriptive_representation_item.description = `not specified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
exchanger_bundle to exchanger_assembly	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `exchanger assembly bundle']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger assembly'}** product_definition => heat_exchanger_component

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
exchanger_bundle to tube_type	PATH		13, 14, 24	heat_exchanger_component <= product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `tube type'}** group_assignment group_assignment.assigned_group -> group => tube_type

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
EXCHANGER_DESIGN_-CRITERIA	property_definition	41	11, 13, 14, 15, 24	**{property_definition [property_definition.name = `exchanger design criteria'] [property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition {product_definition => heat_transfer_equipment} product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `equipment type'} group_assignment group_assignment.assigned_group -> group group.name = `shell and tube heat exchanger unit'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
code_requirement	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `code requirement'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `Ad merkblatter')** **(descriptive_representation_item.description = `Asme')** **(descriptive_representation_item.description = `Codap')** **(descriptive_representation_item.description = `other')** **(descriptive_representation_item.description = `unspecified')}**
condensation_option	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `condensation option'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `normal')** **(descriptive_representation_item.description = `knockback reflux')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
condensing_correlation	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->
representation representation.items[i] ->
{representation_item **representation_item.name = `condensing correlation'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `mass transfer film model')** **(descriptive_representation_item.description = `modified proration model')** **(descriptive_representation_item.description = `not specified')}**
dimensional_standard	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->
representation representation.items[i] ->
{representation_item **representation_item.name = `dimensional standard'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
dry_wall_desuperheating	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `dry wall desuperheating'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `present')** **(descriptive_representation_item.description = `not present')** **(descriptive_representation_item.description = `not specified')}**
fraction_entrainment	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `fractional entrainment'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_fluid_allocation	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hot fluid allocation'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `shell')** **(descriptive_representation_item.description = `tube')** **(descriptive_representation_item.description = `unspecified')}**
material_standard	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `material standard'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_heat_flux	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum heat flux'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_shells_in_- parallel	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum shells in parallel'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_shells_in_- series	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum shells in series'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
minimum_excess_surface	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `minimum excess surface'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
minimum_lmtd_- correction_factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `minimum log mean temperature differential correction factor'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
minimum_shells_in_- parallel	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `minimum shells in parallel'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
minimum_shells_in_-series	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `minimum shells in series'}** representation_item => measure_representation_item <=**{measure_with_unit** **measure_with_unit.value_component ->measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
minimum_temperature_-approach	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `minimum temperature approach'}** representation_item => measure_representation_item <=**{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mode_of_operation	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mode of operation'}** representation_item => descriptive_representation_item descriptive_representation_item.description
nucleate_boiling	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `nucleate boiling'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `present')** **(descriptive_representation_item.description = `not present')** **(descriptive_representation_item.description = `not specified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
service_class	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `service class'}** representation_item => descriptive_representation_item descriptive_representation_item.description
tema_class	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `Tema class'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `B')** **(descriptive_representation_item.description = `C')** **(descriptive_representation_item.description = `code_only')** **(descriptive_representation_item.description = `R')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vapourization_option	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `vapourization option'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `falling film')** **(descriptive_representation_item.description = `forced circulation')** **(descriptive_representation_item.description = `pool boiling')** **(descriptive_representation_item.description = `thermosiphon')** **(descriptive_representation_item.description = `unspecified')}**
exchanger_design_- criteria to shellside_- design	PATH		15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation **{representation** **representation.name = `shellside design'}**
exchanger_design_- criteria to tubeside_- design	PATH		15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation **{representation** **representation.name = `tubeside design'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
EXCHANGER_END	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger end'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
body_flange_type	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `body flange type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `integral straight hub')** **(descriptive_representation_item.description = `integral tapered hub')** **(descriptive_representation_item.description = `lap joint')** **(descriptive_representation_item.description = `none')** **(descriptive_representation_item.description = `ring')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
head_cover_inside_- diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `head cover inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
head_cover_outside_- diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15,16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `head cover outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
head_cover_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `head cover thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
head_cover_type	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `head cover type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `cone')** **(descriptive_representation_item.description = `dished')** **(descriptive_representation_item.description = `elbow')** **(descriptive_representation_item.description = `ellipsoidal')** **(descriptive_representation_item.description = `flat')** **(descriptive_representation_item.description = `bolted')** **(descriptive_representation_item.description = `flat welded')** **(descriptive_representation_item.description = `hemispherical')** **(descriptive_representation_item.description = `torispherical')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
head_cylinder_inside_-diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `head cylinder inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
head_cylinder_outside_- diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `head cylinder outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
head_cylinder_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `head cylinder thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
head_type	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `head type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `A')** **(descriptive_representation_item.description = `B')** **(descriptive_representation_item.description = `C')** **(descriptive_representation_item.description = `D')** **(descriptive_representation_item.description = `L')** **(descriptive_representation_item.description = `M')** **(descriptive_representation_item.description = `N')** **(descriptive_representation_item.description = `P')** **(descriptive_representation_item.description = `R')** **(descriptive_representation_item.description = `S')** **(descriptive_representation_item.description = `T')** **(descriptive_representation_item.description = `U')** **(descriptive_representation_item.description = `unspecified')** **(descriptive_representation_item.description = `W')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
location	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `location'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `front of heat exchanger')** **(descriptive_representation_item.description = `rear of heat exchanger')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
exchanger_end to end_- partition_plate	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.relating_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `exchanger end partition plate']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.related_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `end partition plate'}** product_definition => heat_exchanger_component

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
exchanger_end to exchanger_assembly	PATH		11,13 14,24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship product_definition_relationship.name = `exchanger assembly end'] [product_definition_relationship => product_definition_usage => assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition -> **{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `equipment component type'} group_assignment group_assignment.assigned_group -> group group.name = `exchanger assembly'}** product_definition => heat_exchanger_component

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
EXCHANGER_NOZZLE	nozzle	231	11, 13, 14, 24	nozzle <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger nozzle'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
angle	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14,15 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `angle'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **plane_angle_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
axial_location	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `axial location'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
distance_from_tubesheet	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `distance from tubesheet'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
distribution_type	descriptive_representation_- item.description	45	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `distribution type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `distributor')** **(descriptive_representation_item.description = `impingement')** **(descriptive_representation_item.description = `none')** **(descriptive_representation_item.description = `plain')** **(descriptive_representation_item.description = `sparge')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
entrance_type	descriptive_representation_- item.description	45	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `entrance type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `axial')** **(descriptive_representation_item.description = `elbow')** **(descriptive_representation_item.description = `radial')** **(descriptive_representation_item.description = `tangential')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
exchanger_side	descriptive_representation_- item.description	45	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `exchanger side'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `shell')** **(descriptive_representation_item.description = `tube')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
flange_design	group.name	41	11, 14, 24	nozzle <= product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `flange design'}** group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `Ansi')** **(group.name = `Din')** **(group.name = `Iso')** **(group.name = `optimized design')** **(group.name = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
flange_facing	descriptive_representation_- item.description	45	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `flange facing'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `ANSI')** **(descriptive_representation_item.description = `DIN')** **(descriptive_representation_item.description = `ISO')** **(descriptive_representation_item.description = `optimized design')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
flange_rating	descriptive_representation_item. description	45	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `flange rating'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
flange_type	descriptive_representation_item. description	45	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `flange type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `lap weld')** **(descriptive_representation_item.description = `long weld neck')** **(descriptive_representation_item.description = `self-reinforce neck')** **(descriptive_representation_item.description = `slip-on')** **(descriptive_representation_item.description = `unspecified')** **(descriptive_representation_item.description = `weld neck'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
function	group.name	41	11, 14, 24	nozzle <= product_definition classified_item = product_definition classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `exchanger nozzle function'}** group_assignment group_assignment.assigned_group ->** group **{(group.name = `drain')** **(group.name = `inlet')** **(group.name = `inspection port')** **(group.name = `liquid inlet')** **(group.name = `manhole')** **(group.name = `outlet')** **(group.name = `safety valve')** **(group.name = `sparge')** **(group.name = `unspecified')** **(group.name = `vapour outlet')** **(group.name = `vent')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
height_under_nozzle	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `height under nozzle'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nominal_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `nominal diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
exchanger_nozzle to exchanger_assembly	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `exchanger assembly nozzle']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger assembly'}** product_definition => heat_exchanger_component
EXCHANGER_-PERFORMANCE	property_definition	41	15	**{property_definition** **property_definition.name = `exchanger performance'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
effective_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `effective area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
effective_temperature_- difference	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `effective temperature difference'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `heat duty'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
lmtd_correction_factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `log mean temperature differential correction factor'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
overall_heat_transfer_-coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `overall heat transfer coefficient'}** representation_item => measure_representation_item <=**{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
total_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `total area'}** representation_item => measure_representation_item <=**{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
exchanger_performance to exchanger_assembly	PATH		11, 13, 14, 24	[property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition = product_definition product_definition => heat_exchanger_component **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger assembly'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
EXCHANGER_SHELL	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component => product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger shell'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
body_flange_type	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `body flange type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `integral straight hub')** **(descriptive_representation_item.description = `integral tapered hub')** **(descriptive_representation_item.description = `lap joint')** **(descriptive_representation_item.description = `none')** **(descriptive_representation_item.description = `ring')** **(descriptive_representation_item.description = `weld neck')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
entrance_construction	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `entrance construction'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
exit_construction	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `exit construction'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
kettle_inside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `kettle inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
kettle_outside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `kettle outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
kettle_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `kettle thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
kettle_type	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `kettle type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `enlarged shell with eccentric reducer')** **(descriptive_representation_item.description = `an enlarged shell with formed head')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_shell_passes	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of shell passes'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
shell_cover_type	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `shell cover type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `ellipsoidal')** **(descriptive_representation_item.description = `flat bolted')** **(descriptive_representation_item.description = `flat welded')** **(descriptive_representation_item.description = `torispherical')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tema_shell_type	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `Tema shell type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `E')** **(descriptive_representation_item.description = `F')** **(descriptive_representation_item.description = `G')** **(descriptive_representation_item.description = `H')** **(descriptive_representation_item.description = `I')** **(descriptive_representation_item.description = `J')** **(descriptive_representation_item.description = `K')** **(descriptive_representation_item.description = `none')** **(descriptive_representation_item.description = `unspecified')** **(descriptive_representation_item.description = `V')** **(descriptive_representation_item.description = `X')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
exchanger_shell to exchanger_assembly	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `exchanger assembly shell']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger assembly'}** product_definition => heat_exchanger_component

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
EXCHANGER_ZONE	exchanger_zone	231	11, 13, 14, 15, 18, 24	exchanger_zone <= shape_aspect **{shape_aspect.of_shape ->** **product_definition_shape <=** **property_definition** **property_definition.definition ->** **characterized_definition** **characterized_product_definition = characterized_definition** **characterized_product_definition** **characterized_product_definition = product_definition** **product_definition =>** **heat_exchanger_component** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger assembly'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_bulk_film_- coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cold bulk film coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_bulk_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->
representation representation.items[i] -> **{representation_item** **representation_item.name = `cold bulk temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_clean_pressure_- drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cold clean pressure drop'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_controlling_regime	group.name	41	11, 18, 24	exchanger_zone <= shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `cold flow regime class'}** group_assignment group_assignment.assigned_group ->** **group group.name

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_dirty_pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `cold dirty pressure drop'}** representation_item => measure_representation_item <=**{measure_with_unit** **[measure_with_unit.value_component ->measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_effective_vapour_- coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cold effective vapour coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure]** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_flow_regime_- parameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cold flow regime parameter'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = parameter_value** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless']}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_liquid_prandtl_- number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cold liquid prandtl number'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_liquid_reynolds_- number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cold liquid reynolds number'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cold pressure'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_sensible_liquid_- coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cold sensible liquid coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_sensible_vapour_- coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cold sensible vapour coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_vapour_phase_- resistance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cold vapour phase resistance'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_vapour_prandtl_- number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cold vapour prandtl number'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_vapour_reynolds_- number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cold vapour reynolds number'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cold_vapour_weight_- fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cold vapour weight fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
cold_wall_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cold wall temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
condensate_film_- coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `condensate film coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
convective_boiling_- coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `convective boiling coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
description	representation.description	43	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.description

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
effective_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `effective area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
film_boiling_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `film boiling coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `heat duty'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_bulk_film_- coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hot bulk film coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_bulk_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->
representation representation.items[i] ->
{representation_item **representation_item.name = `hot bulk temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_clean_pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hot clean pressure drop'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_controlling_regime	group.name	41	11, 18, 24	exchanger_zone <= shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `hot flow regime class'}** group_assignment group_assignment.assigned_group ->** **group group.name

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_dirty_pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->> representation representation.items[i] ->> **{representation_item** **representation_item.name = `hot dirty pressure drop'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_effective_vapour_- coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hot effective vapour coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_flow_regime_- parameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hot flow regime parameter'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = parameter_value** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless']}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_liquid_prandtl_- number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hot liquid prandtl number'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_liquid_reynolds_- number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hot liquid reynolds number'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hot pressure'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_sensible_liquid_- coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hot sensible liquid coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_sensible_vapour_- coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hot sensible vapour coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_vapour_phase_- resistance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hot vapour phase resistance'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_vapour_prandtl_- number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hot vapour prandtl number'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_vapour_reynolds_- number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hot vapour reynolds number'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_vapour_weight_- fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `hot vapour weight fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
hot_wall_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `hot wall temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
local_heat_flux	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `local heat flux'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
local_overall_heat_- transfer_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `local overall heat transfer coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mean_temperature_- difference	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mean temperature difference'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nucleate_boiling_- coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `nucleate boiling coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
shellside_flow_fraction_a	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `shellside flow fraction a'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
shellside_flow_fraction-_b	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `shellside flow fraction b'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
shellside_flow_fraction_c	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `shellside flow fraction c'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
shellside_flow_fraction_e	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `shellside flow fraction e'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
shellside_window_- velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `shellside window velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
shellside_crossflow_- velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `shellside crossflow velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tubeside_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `tubeside velocity'}** representation_item => measure_representation_item <=**{measure_with_unit** **[measure_with_unit.value_component ->measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
x_coordinate	cartesian_point.coordinates[1]	42	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `xyz coordinates'}** representation_item => geometric_representation_item => point => cartesian_point => cartesian_point.coordinates[1]
y_coordinate	cartesian_point.coordinates[2]	42	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `xyz coordinates'}** representation_item => geometric_representation_item => point => cartesian_point => cartesian_point.coordinates[2]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
z_coordinate	cartesian_point.coordinates[3]	42	16, 18	exchanger_zone <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `xyz coordinates'}** representation_item => geometric_representation_item => point => cartesian_point => cartesian_point.coordinates[3]
exchanger_zone to exchanger_performance	PATH		15, 18	exchanger_zone <= shape_aspect shape_aspect.of_shape -> product_definition_shape <= property_definition <- property_definition_relationship.related_property_definition property_definition_relationship property_definition_relationship.relating_property_definition -> property_definition **{property_definition** **property_definition.name = `exchanger performance'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
EXPANSION_JOINT	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `expansion joint'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
location	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `location'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	descriptive_representation_item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `expansion joint type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `flanged and flued')** **(descriptive_representation_item.description = `flanged only')** **(descriptive_representation_item.description = `none')** **(descriptive_representation_item.description = `reinforced bellows')** **(descriptive_representation_item.description = `unreinforced bellows')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
expansion_joint to exchanger_shell	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `exchanger shell expansion joint'** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger shell'}** product_definition => heat_exchanger_component

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
EXTERNAL_CIRCUIT_-COMPONENT	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `external circuit component'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bend_angle	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `bend angle'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **plane_angle_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bend_radius	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `bend radius'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
circuit_location	(descriptive_representation_- item.description) (axis2_placement_2d) (axis2_placement_3d)	45 42 42	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `circuit location'}** representation_item => (descriptive_representation_item descriptive_representation_item.description) (geometric_representation_item => placement => (axis2_placement_2d) (axis2_placement_3d))

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
circuit_position	cartesian_point	42	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `circuit position'}** representation_item => geometric_representation_item => point => cartesian_point

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
component_code	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `component code'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `straight pipe')** **(descriptive_representation_item.description = `bend')** **(descriptive_representation_item.description = `sudden enlargement')** **(descriptive_representation_item.description = `sudden contraction')** **(descriptive_representation_item.description = `globe valve')** **(descriptive_representation_item.description = `gate valve')** **(descriptive_representation_item.description = `thin orifice')** **(descriptive_representation_item.description = `thick orifice')** **(descriptive_representation_item.description = `dummy fitting')** **(descriptive_representation_item.description = `header pipe')** **(descriptive_representation_item.description = `nozzle pipe')** **(descriptive_representation_item.description = `tee')** **(descriptive_representation_item.description = `inside face of the bottom tubesheet')** **(descriptive_representation_item.description = `inside face of the top tubesheet')** **(descriptive_representation_item.description = `bottom inside surface of the shell')** **(descriptive_representation_item.description = `top inside surface of the shell')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
COMPONENT_HEIGHT	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `component height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
component_inside_- diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `component inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
component_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `component length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
contraction_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `contraction coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
extra_equivalent_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `extra equivalent length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
head_flowrate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `head flowrate'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
head_gained	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `head gained'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
orifice_downstream_- diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `orifice downstream diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
piping_design_area_ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `piping design area ratio'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
surface_roughness	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `surface roughness'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
external_circuit_- component to reboiler_- piping	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `reboiler piping external circuit'** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `reboiler piping'}** product_definition => heat_exchanger_component
FLOW_VIBRATION_- ANALYSIS	representation	43	16	**{representation** **representation.name = `flow vibration analysis'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
acoustic_damping_factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `acoustic damping factor'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
acoustic_resonance_-indicator	descriptive_representation_-item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `acoustic resonance indicator'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `present')** **(descriptive_representation_item.description = `not present')** **(descriptive_representation_item.description = `undetermined')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
acoustic_turbulent_- buffeting_ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `acoustic turbulent buffeting ratio'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
acoustic_vortex_- shedding_ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `acoustic vortex shedding ratio'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
added_mass_factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `added mass factor'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
average_crossflow_- velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `average crossflow velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
axial_stress_loading	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `axial stress loading'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
baffle_tip_cross_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `baffle tip cross velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bundle_crossflow_- velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `bundle crossflow velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
bundle_shell_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `bundle shell velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
chen_number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `chen number'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
critical_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `critical velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
crossflow_amplitude	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `crossflow amplitude'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
crossflow_momentum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `crossflow momentum'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
instability_threshold_beta	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `instability threshold beta'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
length_for_natural_- frequency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `length for natural frequency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length_for_tema_max_-span	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `length for tema max span'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
location	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `location'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
log_decrement_for_- damping	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `log decrement for damping'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
number_of_spans	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `number of spans'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
parallel_flow_amplitude	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `parallel flow amplitude'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
shell_acoustic_frequency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `shell acoustic frequency'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tube_gap	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `tube gap'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
tube_natural_frequency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `tube natural frequency'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tube_position	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item representation_item.name = `tube position'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `bottom row') (descriptive_representation_item.description =\ `row inside baffle overlap at bottom') (descriptive_representation_item.description =\ `row inside baffle overlap at top') (descriptive_representation_item.description = `top row') (descriptive_representation_item.description = `row outside baffle overlap') (descriptive_representation_item.description = `undetermined')}**
tube_turbulent_- buffeting_ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item representation_item.name = `tube turbulent buffeting ratio'}** representation_item => measure_representation_item <= **{measure_with_unit => ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
tube_vortex_shedding_- ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item representation_item.name = `tube vortex shedding ratio'}** representation_item => measure_representation_item <= **{measure_with_unit => ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
unsupported_span	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `unsupported span'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
vibration_indicator	descriptive_representation_- item.description	45	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `vibration indicator'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `present')** **(descriptive_representation_item.description = `not present')** **(descriptive_representation_item.description = `undetermined')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
window_parallel_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `window parallel velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
flow_vibration_analysis to exchanger_-performance	PATH		15, 16	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->represented_definition represented_definition = property_definition property_definition **{property_definition** **property_definition.name = `exchanger performance'}**
HEAT_RELEASE_-CURVE	representation	43	16	**{representation** **representation.name = `heat release curve'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
independent_variable	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `independent variable'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `equal duty')** **(descriptive_representation_item.description = `equal fraction of vapour')** **(descriptive_representation_item.description = `equal temperature')** **(descriptive_representation_item.description = `unspecified')}**
isobaric_curve	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `isobaric curve'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `no')** **(descriptive_representation_item.description = `unspecified')** **(descriptive_representation_item.description = `yes')}**
non_condensables	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `non-condensables'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `present')** **(descriptive_representation_item.description = `not present')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_components	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `number of components'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
number_of_liquids	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `number of liquids'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
phase_change	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `phase change'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `liquid')** **(descriptive_representation_item.description = `two-phase')** **(descriptive_representation_item.description = `vapour')** **(descriptive_representation_item.description = `unspecified')}**
single_component	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `single component'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `no')** **(descriptive_representation_item.description = `unspecified')** **(descriptive_representation_item.description = `yes')}**
super_critical	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `super critical'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `no')** **(descriptive_representation_item.description = `unspecified')** **(descriptive_representation_item.description = `yes')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_release_curve to shellside_design	PATH		16	representation <- representation_relationship.rep_2 representation_relationship representation_relationship.rep_1 -> representation **{representation** **representation.name = `shellside design'}**
heat_release_curve to tubeside_design	PATH		16	representation <- representation_relationship.rep_2 representation_relationship representation_relationship.rep_1 -> representation **{representation** **representation.name = `tubeside design'}**
HEAT_RELEASE_POINT	representation	43	16	**{representation** **representation.name = `heat release point'}**
bubble_point	descriptive_representation_-item.description	45	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `bubble point'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `available')** **(descriptive_representation_item.description = `not available')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
dew_point	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `dew point'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `available')** **(descriptive_representation_item.description = `not available')** **(descriptive_representation_item.description = `unspecified')}**
number_of_phases	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `number of phases'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `pressure'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
specific_enthalpy_mass_-basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `specific enthalpy mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
specific_enthalpy_mole_-basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `specific enthalpy mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vapour_mass_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `vapour mass fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
vapour_mole_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `vapour mole fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
heat_release_point to heat_release curve	PATH		16	representation <- representation_relationship.rep_2 representation_relationship representation_relationship.rep_1 ->**{representation** **representation.name = `heat release curve'}**
HEAT_TRANSFER_-EQUIPMENT	heat_transfer_equipment	41		heat_transfer_equipment <= product_definition

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_transfer_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `heat transfer coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation ->
product_definition_formation product_definition_formation.of_product ->
product classified_item = product classified_item <-
classification_assignment.items[i] classification_assignment <=
{group_assignment **group_assignment.role ->**
group_role **group_role.name = `equipment type'}**
group_assignment.assigned_group ->
group group.name **{group <-**
group_relationship.related_group **group_relationship**
group_relationship.relating_group ->
group **group.name = `heat transfer equipment'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
IMPINGEMENT_-PROTECTION	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `impingement protection'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
location	descriptive_representation_item. description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `location'}** {representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `as in the nozzle dome')** **(descriptive_representation_item.description = `on the bundle')** **(descriptive_representation_item.description = `tubeside')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_rod_rows	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> {representation_item representation_item.name = `number of rod rows'} representation_item => measure_representation_item <= {measure_with_unit measure_with_unit.value_component -> measure_value measure_value = count_measure count_measure} measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_rods	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> {representation_item representation_item.name = `number of rods'} representation_item => measure_representation_item <= {measure_with_unit measure_with_unit.value_component -> measure_value measure_value = count_measure count_measure} measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
rod_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> {representation_item representation_item.name = `rod diameter'} representation_item => measure_representation_item <= {measure_with_unit => length_measure_with_unit} measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
rod_layout_angle	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> {representation_item representation_item.name = `rod layout angle'} representation_item => measure_representation_item <= {measure_with_unit => plane_angle_measure_with_unit} measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> {representation_item representation_item.name = `thickness'} representation_item => measure_representation_item <= {measure_with_unit => length_measure_with_unit} measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> {representation_item representation_item.name = `impingement protection type'} representation_item => descriptive_representation_item descriptive_representation_item.description {(descriptive_representation_item.description = `none') (descriptive_representation_item.description = `circular plate') (descriptive_representation_item.description = `rectangular plate') (descriptive_representation_item.description = `rod') (descriptive_representation_item.description = `unspecified')}

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
width	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> {representation_item representation_item.name = `width'} representation_item => measure_representation_item <= {measure_with_unit => length_measure_with_unit} measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
impingement_protection to exchanger_nozzle	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition {[product_definition_relationship product_definition_relationship.name = `exchanger nozzle impingement protection' [product_definition_relationship => product_definition_usage => assembly_component_usage]} product_definition_relationship product_definition_relationship.relating_product_definition -> {product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `equipment component type'} group_assignment group_assignment.assigned_group -> group group.name = `exchanger nozzle'} product_definition => nozzle

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
LONGITUDINAL_- BAFFLE	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component => product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **[group_assignment.assigned_group ->** **group** **group.name = `longitudinal baffle'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
baffle_to_shell_clearance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `baffle to shell clearance'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
elastic_modulus	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `elastic modulus'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless']}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
insulated	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `insulated'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
leakage	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `leakage'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
seal_type	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `longitudinal baffle seal type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `channel strips')** **(descriptive_representation_item.description = `lamiflex')** **(descriptive_representation_item.description = `unspecified')** **(descriptive_representation_item.description = `welded')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thermal_conductivity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thermal conductivity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
width	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `width'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
longitudinal_baffle to exchanger_bundle	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `exchanger bundle longitudinal baffle']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger bundle'}** product_definition => heat_exchanger_component

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
NOZZLE_DOME	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component => product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `nozzle dome'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nominal_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `nominal diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nozzle_dome to exchanger_nozzle	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `exchanger nozzle dome']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger nozzle'}** product_definition => nozzle
NOZZLE_-PERFORMANCE	property_definition	41	15	**{property_definition** **property_definition.name = `nozzle performance'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure drop'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
rhov2	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `rho v squared'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
nozzle_performance to exchanger_performance	PATH		15	property_definition <- property_definition_relationship.related_property_definition property_definition_relationship property_definition_relationship.relating_property_definition -> property_definition **{property_definition** **property_definition.name = `exchanger performance'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nozzle_performance to exchanger_nozzle	PATH		11, 13, 14, 15, 24	property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger nozzle'}** product_definition => nozzle

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PARTITION_SEAL_ROD	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `partition seal rod'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
horizontal_distance_- from_tubesheet_centre	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `horizontal distance from tubesheet centre'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vertical_distance_from_- tubesheet_centre	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `vertical distance from tubesheet centre'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PASSLANE	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **[group_assignment.assigned_group ->** **group** **group.name = `passlane'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
location	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `location'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_seal_rods	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of seal rods'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
orientation	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `passline orientation'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `horizontal')** **(descriptive_representation_item.description = `vertical')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
width	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `width'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
passlane to exchanger_-bundle	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `exchanger bundle passlane']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger bundle'}** product_definition => heat_exchanger_component
PHASE_PROPERTIES	representation	43	16	**{representation** **representation.name = `phase properties'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
density_mass_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `density mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
density_mole_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `density mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
mole_fractions	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `mole fractions'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
molecular_weight	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `molecular weight'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
phase	descriptive_representation_- item.description	45	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `phase'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `liquid_1')** **(descriptive_representation_item.description = `liquid_1_volatile')** **(descriptive_representation_item.description = `liquid_2')** **(descriptive_representation_item.description = `liquid_2_volatile')** **(descriptive_representation_item.description = `mixed')** **(descriptive_representation_item.description = `unspecified')** **(descriptive_representation_item.description = `vapour')** **(descriptive_representation_item.description = `vapour_condensable')** **(descriptive_representation_item.description = `vapour non-condensable')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
specific_enthalpy_mass_-basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `specific enthalpy mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
specific_enthalpy_mole_-basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `specific enthalpy mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
specific_heat_capacity_- constant_pressure_- mass_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `specific heat capacity constant pressure mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
specific_heat_capacity_- constant_pressure_- mole_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `specific heat capacity constant pressure mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
surface_tension	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `surface tension'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless']}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
thermal_conductivity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `thermal conductivity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
viscosity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `viscosity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless']}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
phase_properties to heat_release_point	PATH		16	representation <- representation_relationship.rep_2 representation_relationship representation_relationship.rep_1 ->representation **{representation** **representation.name = `heat release point'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
REBOILER_PIPING	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `reboiler piping'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
fraction_delta_pressure_- across_inlet_valve	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `fraction delta pressure across inlet valve'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_feed_lines_- from_column	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of feed lines from column'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_return_lines_- to_column	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of return lines to column'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
offset_to_reference_level	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `offset to reference level'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reboiler_piping_type	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `reboiler piping type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `forced flow reboiler with pump')** **(descriptive_representation_item.description = `thermosiphon reboiler')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
total_inlet_change_in_- height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `total inlet change in height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
total_inlet_equivalent_- length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `total inlet equivalent length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
total_outlet_change_in_-height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `total outlet change in height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
total_outlet_equivalent_-length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `total outlet equivalent length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reboiler_piping to exchanger_assembly	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `exchanger assembly reboiler piping']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger assembly'}** product_definition => heat_exchanger_component

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SHELL_AND_TUBE_- HEAT_EXCHANGER_- UNIT	heat_transfer_equipment	231	11, 13, 14, 24	heat_transfer_equipment <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `shell and tube heat exchanger unit'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
angle	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `angle'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **plane_angle_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bottoms_drawoff_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `bottoms drawoff rate'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
clean_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `clean coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless']}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
dirty_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `dirty coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless']}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
discharge_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `discharge pressure'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
effective_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `effective area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
effective_temperature_- difference	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `effective temperature difference'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
flow_direction	descriptive_representation_- item.description	45	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `flow direction'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `cocurrent')** **(descriptive_representation_item.description = `countercurrent')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `heat duty'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
liquid_height_in_column	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `liquid height in column'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_shell_passes	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of shell passes'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_shells_in_- parallel	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of shells in parallel'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_shells_in_series	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of shells in series'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_tube_passes	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of tube passes'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_at_liquid_level	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure at liquid level'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
program	descriptive_representation_- item.description	45	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `program'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
service_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `service coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless']}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
shellside_fouling_factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `shellside fouling factor'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
total_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `total area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
total_number_of_shells	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `total number of shells'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tubeside_fouling_factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tubeside fouling factor'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
shell_and_tube_heat_-exchanger_unit to exchanger_design_-criteria	PATH		14, 15	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition **{property_definition** **property_definition.name = `exchanger design criteria'}**
shell_and_tube_heat_-exchanger_unit to exchanger_performance	PATH		14, 15	heat_transfer_equipment <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition **{property_definition** **property_definition.name = `exchanger performance'}**
SHELLSIDE_DESIGN	representation	43	15, 16	**{[representation** **representation.name = `shellside design']** **[representation <-** **property_definition_representation.used_representation** **property_definition_representation** **property_definition_representation.definition ->** **represented_definition** **represented_definition = property_definition** **property_definition** **property_definition.name = `exchanger design criteria']}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
allow_baffles_under_-nozzles	descriptive_representation_-item.description	45	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `allow baffles under nozzles'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `yes')** **(descriptive_representation_item.description = `no')** **(descriptive_representation_item.description = `unspecified')}**
allowable_number_of_-baffles	descriptive_representation_-item.description	45	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `allowable number of baffles'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `even')** **(descriptive_representation_item.description = `odd')** **(descriptive_representation_item.description = `any')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
allowable_pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `allowable pressure drop'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
coefficient_method	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `coefficient method'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `clean')** **(descriptive_representation_item.description = `dirty')** **(descriptive_representation_item.description = `service')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
corrosion_allowance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `corrosion allowance'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
cut_proportional_to_-spacing	descriptive_representation_-item.description	45	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `cut proportional to spacing'}** representation_item => descriptive_representation_item descriptive_representation_item.description
cylinders_for_small_-shells	descriptive_representation_-item.description	45	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `cylinders for small shells'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
design_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `design pressure'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
design_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `design temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
expansion_joint_- indicator	descriptive_representation_- item.description	45	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `expansion joint indicator'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
film_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `film coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
film_coefficient_- multiplier	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `film coefficient multiplier'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
front_head_reference	descriptive_representation_- item.description	45	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `front head reference'}** representation_item => descriptive_representation_item descriptive_representation_item.description
maximum_baffle_spacing	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum baffle spacing'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
maximum_shell_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum shell diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
minimum_baffle_spacing	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `minimum baffle spacing'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
minimum_shell_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `minimum shell diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
minimum_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `minimum velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_drop_multiplier	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure drop multiplier'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
shell_diameter_increment	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `shell diameter increment'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
test_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `test pressure'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
vacuum_service_design_- pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `vacuum service design pressure'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SHELLSIDE_- PERFORMANCE	representation	43	16	**{representation** **representation.name = `shellside performance'}**
average_skin_- temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `average skin temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
beta_correction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `beta correction'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bulk_film_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `bulk film coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
bundle_entrance_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `bundle entrance area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bundle_entrance_rhov2	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `bundle entrance rho v squared'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
bundle_exit_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `bundle exit area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bundle_exit_rhov2	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `bundle exit rho v squared'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
clean_pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `clean pressure drop'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
crossflow_nominal_- velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `crossflow nominal velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
dirty_pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `dirty pressure drop'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
end_correction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `end correction'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
fin_correction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `fin correction'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
fin_efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `fin efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
fouling_resistance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `fouling resistance'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
fouling_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `fouling thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
gamma_correction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `gamma correction'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
long_baffle_bulk_film_-coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `long baffle bulk film coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
longitudinal_baffle_-correction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `longitudinal baffle correction'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
midpoint_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `midpoint velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
outlet_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `outlet temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_drop_in_- baffle_window	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `pressure drop in baffle window'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
pressure_drop_in_- crossflow	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `pressure drop in crossflow'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_drop_in_ends	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `pressure drop in ends'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
shell_entrance_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `shell entrance area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
shell_entrance_rhov2	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `shell entrance rho v squared'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
shell_exit_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `shell exit area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
shell_exit_rhov2	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `shell exit rho v squared'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
thermal_resistance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `thermal resistance'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
total_heat_transfer_- correction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `total heat transfer correction'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
wall_film_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `wall film coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
wall_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `wall temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
shellside_performance to exchanger_performance	PATH		15, 16	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->> represented_definition represented_definition = property_definition property_definition **{property_definition** **property_definition.name = `exchanger performance'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
TIE_ROD	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `tie rod'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
horizontal_distance_- from_tubesheet_centre	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `horizontal distance from tubesheet centre'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_spacers	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of spacers'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vertical_distance_from_- tubesheet_centre	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `vertical distance from tubesheet centre'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tie_rod to tubesheet	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** {product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `tubesheet'}** product_definition => heat_exchanger_component

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
TIE_ROD_SPACER	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **[group_assignment.assigned_group ->** **group** **group.name = `tie rod spacer'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
distance_from_front_face	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `distance from front face'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tie_rod_spacer to tie_rod	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `tie rod'}** product_definition => heat_exchanger_component
TUBE_EXTERNAL_-CHARACTERISTICS	representation	43	16	**{representation** **representation.name = `tube external characteristics'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
base_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `base thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
bond_resistances	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `bond resistances'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
distance_unfinned_- under_baffle	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `distance unfinned under baffle'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
fin_pitch	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `fin pitch'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
finned_section_wall_- thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `finned section wall thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
outer_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `outer diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_area_per_unit_- length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `outside area per unit length'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
root_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `root diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thermal_conductivity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `thermal conductivity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
tip_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `tip thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `tube external characteristics type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `corrugated')** **(descriptive_representation_item.description = `enhanced boiling')** **(descriptive_representation_item.description = `longitudinal fin')** **(descriptive_representation_item.description = `plain')** **(descriptive_representation_item.description = `sintered')** **(descriptive_representation_item.description = `spiral fin')** **(descriptive_representation_item.description = `unspecified')}**
unfinned_under_baffles	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `unfinned under baffles'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
width	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `width'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tube_external_- characteristics to tube_- type	PATH		9, 15, 16	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_object characterized_object => tube_type
TUBE_INTERNAL_- CHARACTERISTICS	representation	43	16	**{representation representation.name = `tube internal characteristics'}**
base_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item representation_item.name = `base thickness'}** representation_item => measure_representation_item <= **{measure_with_unit => length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item representation_item.name = `diameter'}** representation_item => measure_representation_item <= **{measure_with_unit => length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
inside_area_per_unit_- length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `inside area per unit length'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_cross_section	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `inside cross section'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
internal_hydraulic_- diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `internal hydraulic diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_internal_fins	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `number of internal fins'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
spiral_fin_helix_angle	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `tube internal characteristics spiral fin helix angle'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **plane_angle_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thermal_conductivity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `thermal conductivity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
tip_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `tip thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
twisted_tape_pitch	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `twisted tape pitch'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
twisted_tape_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `twisted tape thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
type	descriptive_representation_- item.description	45	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `tube internal characteristics type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `corrugated')** **(descriptive_representation_item.description = `longitudinal fin')** **(descriptive_representation_item.description = `plain')** **(descriptive_representation_item.description = `plug')** **(descriptive_representation_item.description = `spiral fin')** **(descriptive_representation_item.description = `twisted tape')** **(descriptive_representation_item.description = `wire loop')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
width	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `width'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
tube_internal_- characteristics to tube_- type	PATH		9, 15, 16	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_object characterized_object => tube_type
TUBE_TYPE	tube_type	231		tube_type <= [group] [characterized_object]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
effective_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	9, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `effective length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
elastic_modulus	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	9, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `elastic modulus'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless']}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
fin_area_per_unit_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	9, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `fin area per unit length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
finned_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	9, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `finned length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heated_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	9, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `heated length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	9, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	9, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
straight_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	9, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `straight length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tapered_ends	descriptive_representation_- item.description	45	9, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tapered ends'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `present')** **(descriptive_representation_item.description = `not present')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thermal_conductivity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	9, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thermal conductivity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thermal_resistance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	9, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thermal resistance'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
total_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	9, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `total length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tube_construction	descriptive_representation_- item.description	45	9, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tube construction'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `seamless')** **(descriptive_representation_item.description = `welded')** **(descriptive_representation_item.description = `not specified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tube_material_density	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	9, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tube material density'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
wall_specification	descriptive_representation_- item.description	45	9, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `wall specification'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `average')** **(descriptive_representation_item.description = `minimum')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
wall_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	9, 14, 15, 16	tube_type <= characterized_object characterized_definition = characterized_object characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `wall thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
TUBESHEET	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `tubesheet'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
centreline_offset_from_- shell_centreline	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `centreline offset from shell centreline'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
degree_of_symmetry	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `degree of symmetry'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `non-symmetrical to centreline')** **(descriptive_representation_item.description = `symmetrical to centreline')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
elastic_modulus	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `elastic modulus'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless']}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
extension_outside_- diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `extension outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
location	descriptive_representation_item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `location'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `front')** **(descriptive_representation_item.description = `rear')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
longitudinal_tube_pitch	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `longitudinal tube pitch'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_tie_rods	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of tie rods'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_tubes_removed	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of tubes removed'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_tubes_- removed_under_nozzles	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of tubes removed under nozzles'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thermal_conductivity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thermal conductivity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
transverse_tube_pitch	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `transverse tube pitch'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tube_alignment	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tube alignment'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `full alignment')** **(descriptive_representation_item.description = `none')** **(descriptive_representation_item.description = `semi alignment')** **(descriptive_representation_item.description = `u_tube')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tube_pass_layout_type	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tube pass layout type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `mixed or H-banded')** **(descriptive_representation_item.description = `quadrant')** **(descriptive_representation_item.description = `ribbon')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tube_pattern	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tube pattern'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `rotated square')** **(descriptive_representation_item.description = `rotated triangle')** **(descriptive_representation_item.description = `square')** **(descriptive_representation_item.description = `triangular')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tube_to_tubesheet_joint	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tube to tubesheet joint'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `expanded only')** **(descriptive_representation_item.description = `expanded and seal welded')** **(descriptive_representation_item.description = `expanded and strength welded')** **(descriptive_representation_item.description = `seal welded only')** **(descriptive_representation_item.description = `strength welded only')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tubes_per_pass_deviation	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tubes per pass deviation'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tubesheet type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `double integral')** **(descriptive_representation_item.description = `double with gap')** **(descriptive_representation_item.description = `single')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tubesheet to exchanger_-bundle	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `exchanger bundle tubesheet']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger bundle'}** product_definition => heat_exchanger_component

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tubesheet to partition_-seal_rod	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.relating_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `tubesheet partition rod']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.related_product_definition ->** **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `partition seal rod'}** product_definition => heat_exchanger_component

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
TUBESIDE_DESIGN	representation	43	15, 16	**{[representation representation.name = `tubeside design'] [representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->** **represented_definition** **represented_definition = property_definition** **property_definition** **property_definition.name = `exchanger design criteria']}**
allowable_pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `allowable pressure drop'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
allowable_tubesheet_- stress	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `allowable tubesheet stress'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
coefficient_method	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `coefficient method'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `clean')** **(descriptive_representation_item.description = `dirty')** **(descriptive_representation_item.description = `service conditions')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
corrosion_allowance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `corrosion allowance'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
design_degree_of_- symmetry	descriptive_representation_- item.description	45	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `design degree of design symmetry'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `non-symmetrical to centreline')** **(descriptive_representation_item.description = `symmetrical to centreline')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
design_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `design pressure'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
design_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `design temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
design_tube_alignment	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item representation_item.name = `design tube alignment'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `full_alignment') (descriptive_representation_item.description = `none') (descriptive_representation_item.description = `semi_alignment') (descriptive_representation_item.description = `u-tube') (descriptive_representation_item.description = `unspecified')}**
film_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item representation_item.name = `film coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit [measure_with_unit.value_component ->** **measure_value measure_value = numeric_measure numeric_measure] [measure_with_unit.unit_component ->** **unit unit = named_unit named_unit => context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
film_coefficient_- multiplier	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `film coefficient multiplier'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
maximum_deviation_- tubes_per_pass	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `maximum deviation per pass'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_tube_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum tube length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
maximum_tube_passes	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum tube passes'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `maximum velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
minimum_tube_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `minimum tube length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
minimum_tube_passes	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `minimum tube passes'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
minimum_ubend_- diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `minimum u-bend diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
minimum_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `minimum velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
pressure_drop_multiplier	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure drop multiplier'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
test_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `test pressure'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
tube_length_increment	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `tube length increment'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tube_pass_increment	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item representation_item.name = `tube pass increment'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `any') (descriptive_representation_item.description = `even') (descriptive_representation_item.description = `odd') (descriptive_representation_item.description = `unspecified')}**
vacuum_service_design_- pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item representation_item.name = `vacuum service design pressure'}** representation_item => measure_representation_item <= **{measure_with_unit [measure_with_unit.value_component ->** **measure_value measure_value = ratio_measure ratio_measure] [measure_with_unit.unit_component ->** **unit unit = derived_unit derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
TUBESIDE_- PERFORMANCE	representation	43	16	**{representation representation.name = `tubeside performance'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
average_skin_- temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `average skin temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
bulk_film_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `bulk film coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
clean_pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `clean pressure drop'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
dirty_pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `dirty pressure drop'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
fouling_resistance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `fouling resistance'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
fouling_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `fouling thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inlet_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `inlet velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
midpoint_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `midpoint velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outlet_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `outlet temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
outlet_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `outlet velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thermal_resistance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `thermal resistance'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
wall_film_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `wall film coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
wall_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `wall temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
tubeside_performance to exchanger_performance	PATH		15, 16	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->> represented_definition represented_definition = property_definition property_definition **{property_definition** **property_definition.name = `exchanger performance'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
U_BEND_SUPPORT	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **[group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `u-bend support'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
angle	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `angle'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **plane_angle_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	descriptive_representation_- item.description	45	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `u-bend support type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `full support')** **(descriptive_representation_item.description = `none')** **(descriptive_representation_item.description = `two supports with vertical cut windows')** **(descriptive_representation_item.description = `vibration support')** **(descriptive_representation_item.description = `unspecified')}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
u_bend_support to exchanger_bundle	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `exchanger bundle u-bend support']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger bundle'}** product_definition => heat_exchanger_component

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
VAPOUR_BELT	heat_exchanger_component	231	11, 13, 14, 24	heat_exchanger_component <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `vapour belt'}**

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
radial_clearance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `radial clearance'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
slot_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	heat_exchanger_component <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `slot area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 3 - Mapping table for heat_transfer_equipment_data UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
vapour_belt to exchanger_shell	PATH		11, 13, 14, 24	heat_exchanger_component <= product_definition <- product_definition_relationship.related_product_definition product_definition_relationship product_definition_relationship.relating_product_definition -> **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `exchanger shell'}** product_definition => heat_exchanger_component

Table 4 - Mapping table for major_process_equipment_data UoF

Application element	AIM element	Source	Rules	Reference PATH
BUFFER_GAS_SYSTEM	product_definition	41	11, 13, 14, 24	**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `buffer gas system'}**
pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure drop'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
required_for	product_definition_context.life_cycle_-stage	41	4, 14	product_definition product_definition.frame_of_reference -> product_definition_context product_definition_context.life_cycle_stage **{(product_definition_context.life_cycle_stage = `air run-in')** **(product_definition_context.life_cycle_stage = `other')** **(product_definition_context.life_cycle_stage = `startup')}**
CASING_NOZZLE	shape_aspect_relationship	41	11, 14, 15, 18, 24	**{[shape_aspect_relationship** **classified_item = shape_aspect_relationship** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `casing nozzle']** **[shape_aspect_relationship** **shape_aspect_relationship.related_shape_aspect ->** **shape_aspect** **shape_aspect.of_shape ->** **product_definition_shape <=** **property_definition** **property_definition.definition ->** **characterized_definition** **characterized_definition = characterized_product_definition** **characterized_product_definition** **characterized_product_definition = product_definition** **product_definition =>** **nozzle]}**

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
allowable_force	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	shape_aspect_relationship shape_definition = shape_aspect_relationship shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `allowable force'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
allowable_moment	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	shape_aspect_relationship shape_definition = shape_aspect_relationship shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `allowable moment'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
flange_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	shape_aspect_relationship shape_definition = shape_aspect_relationship shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `flange velocity'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
position	descriptive_representation_item.description	45	15, 16	shape_aspect_relationship shape_definition = shape_aspect_relationship shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.description = `position'}** representation_item => descriptive_representation_item (descriptive_representation_item.name = `discharge') (descriptive_representation_item.name = `inlet') (descriptive_representation_item.name = `other')}

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
casing_nozzle to fluid_-transfer_machine	PATH		11, 13, 14, 18, 24	shape_aspect_relationship shape_aspect_relationship.relating_shape_aspect ->shape_aspect shape_aspect.of_shape ->product_definition_shape <=property_definition property_definition.definition ->characterized_definition characterized_definition = characterized_product_definitioncharacterized_product_definition characterized_product_definition = product_definitionproduct_definition **{product_definition** **product_definition.formation ->product_definition_formation** **product_definition_formation.of_product ->product** **classified_item = product** **classified_item <-classification_assignment.items[i]** **classification_assignment <=group_assignment** **group_assignment.assigned_group ->group** **group.name = `fluid transfer machine'}**

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
ELBOW_NOZZLE_-SECTION	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product [classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `elbow nozzle section'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `nozzle section']}**

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bend_radius	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `bend radius'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
included_angle	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `included angle'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **plane_angle_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
EXTERNAL_- TREATMENT	property_definition	41	15, 16	**{[property_definition** **[property_definition.name = `surface finish']** **[property_definition** **[represented_definition = property_definition** **represented_definition <-** **property_definition_representation.definition** **property_definition_representation** **property_definition_representation.used_representation ->** **representation** **representation.name = `external treatment']}**

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_tracing_required	group.name	41	11, 15, 24	property_definition grouped_item = property_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `heat tracing required')** **(group.name = `heat tracing not required')}**
insulation_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name `insulation thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
insulation_type	group.description	41	11, 15, 24	property_definition grouped_item = property_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> **{group** **group.name = `insulation type'}** group group.description
jacket_required	group.name	41	11, 15, 24	property_definition grouped_item = property_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `jacket required')** **(group.name = `jacket not required')}**

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
paint_specification	document.id	41	15, 23	property_definition document_reference_item = property_definition document_reference_item <- applied_document_reference.items[i] applied_document_reference <= **{document_reference** **document_reference.role ->** **document_role** **document_role.name = `paint specification reference'}** document_reference document_reference.assigned_document ->**{document** **document.kind ->** **document_type** **document_type.product_data_type = `paint specification'}** document document.id
NOZZLE	nozzle	231	2	nozzle <= product_definition

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
entrance_type	group.name	41	11, 14, 18, 24	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition => product_definition_shape <- shape_aspect.of_shape **{shape_aspect** **shape_aspect.name = `entrance'}** shape_aspect grouped_item = shape_aspect grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `axial')** **(group.name = `elbow')** **(group.name = `radial')** **(group.name = `tangential')** **(group.name = `unspecified')}**

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
function	group.name	41	11, 14, 24	nozzle <= product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `drain')** **(group.name = `inlet')** **(group.name = `inspection port')** **(group.name = `liquid inlet')** **(group.name = `manhole')** **(group.name = `outlet')** **(group.name = `safety valve')** **(group.name = `sparge')** **(group.name = `unspecified')** **(group.name = `vapour outlet')** **(group.name = `vent')}**

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nominal_size	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `nominal size'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_rating	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure rating'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
tag	identification_assignment.assigned_id	41	14, 25	nozzle <= product_definition identified_item = product_definition identified_item <- applied_identification_assignment.items[i] applied_identification_assignment <= **{identification_assignment** **identification_assignment.role ->** **identification_role** **identification_role.name = `tag'}** identification_assignment identification_assignment.assigned_id

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
temperature_rating	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name `temperature rating'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
vortex_breaker	group.name	41	11, 14, 24	nozzle <= product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `vortex breaker required')** **(group.name = `vortex breaker not required')}**

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
wall_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `wall thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nozzle to material_port	PATH		11, 14, 18, 24	nozzle <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_product_definition = characterized_definition characterized_definition <- property_definition.definition property_definition => product_definition_shape <- shape_aspect.of_shape **{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `signal port'}** shape_aspect => equipment_port
NOZZLE_SECTION	product_definition	41	14	**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product <-** **product_related_product_category.products[i]** **product_related_product_category <=** **product_category** **product_category.name = `nozzle section'}**

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> **{representation** **representation.name = `nozzle section dimensional shape'}** representation representation.items[i] -> **{representation_item** **representation_item.name `inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nominal_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> **{representation** **representation.name = `nozzle section dimensional shape'}** representation representation.items[i] -> **{representation_item** **representation_item.name `nominal diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> **{representation** **representation.name = `nozzle section dimensional shape'}** representation representation.items[i] -> **{representation_item** **representation_item.name `outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pipe_schedule	document_usage_constraint.subject_-element_value	41	14, 15, 23	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition property_definition.name -> product_definition_shape document_reference_item = product_definition_shape document_reference_item <- applied_document_reference.items[i] applied_document_reference <= document_reference document_reference.assigned_document -> document <- document_usage_constraint.source document_usage_constraint document_usage_constraint.subject_element_value

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
wall_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> **{representation** **representation.name = `nozzle section dimensional shape'}** representation representation.items[i] -> **{representation_item** **representation_item.name `wall thickness'}** representation_item => measure_representation_item <= **{measure_with_unit ->** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nozzle_section to external_treatment	PATH		14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_definition.name = `surface finish'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation **{representation** **representation.name = `external treatment'}**
nozzle_section to nozzle	PATH		14	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship** **product_definition_relationship.name = `composition'}** product_definition_relationship product_definition_relationship.relating_product_definition -> product_definition => nozzle

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nozzle_section to nozzle_section_-connection	PATH		14	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition => product_definition_shape <- shape_aspect.of_shape shape_aspect <- [shape_aspect_relationship.related_shape_aspect] [shape_aspect_relationship.relating_shape_aspect] shape_aspect_relationship
NOZZLE_SECTION_-CONNECTION	shape_aspect_relationship	41	11, 13, 14, 18, 24	**{shape_aspect_relationship [shape_aspect_relationship.related_shape_aspect ->] [shape_aspect_relationship.relating_shape_aspect ->] shape_aspect shape_aspect.of_shape ->** **product_definition_shape <=** **property_definition** **property_definition.definition ->** **characterized_definition** **characterized_definition = characterized_product_definition** **characterized_product_definition** **characterized_product_definition = product_definition** **product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `nozzle section'}**

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
angular_offset	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	shape_aspect_relationship shape_definition = shape_aspect_relationship shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `angular offset'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **plane_angle_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_radius	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	shape_aspect_relationship shape_definition = shape_aspect_relationship shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inside radius'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	shape_aspect_relationship shape_definition = shape_aspect_relationship shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
type	group.name	41	11, 24	shape_aspect_relationship classified_item = shape_aspect_relationship classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `flanged')** **(group.name = `open')** **(group.name = `threaded')** **(group.name = `unspecified')** **(group.name = `welded')}**

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nozzle_section_- connection to gasket	PATH		11, 13, 14, 15, 18, 24	shape_aspect shape_aspect.of_shape ->product_definition_shape <= property_definition property_definition.definition ->characterized_definition characterized_definition = character_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `gasket'}**
PROCESS_EQUIPMENT	product_definition	41	11, 13, 14, 24	**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `equipment'}**

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name product_category.name	41 41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> **{group** **group.name = `process equipment'}** group <- group_relationship.related_group group_relationship group_relationship.relating_group -> (group.name) **{(group.name = `heat transfer equipment')** **(group.name = `mass transfer equipment')** **(group.name = `material transfer equipment')** **(group.name = `process equipment driver')** **(group.name = `process vessel')** **(group.name = `reaction system equipment')** **(group.name = `solids processing equipment)}**

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
water_filled_weight	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `water filled weight'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
PROCESS_- EQUIPMENT_DRIVER	product	41	11, 13, 24	**{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `process equipment driver']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process equipment']}**

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
REACTION_SYSTEM_- EQUIPMENT	product	41	11, 13, 24	{product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->` group.name = `process equipment'] group group.name = `reaction system equipment'] group <- group_relationship.related_group group_relationship group_relationship.relating_group ->` group
REDUCING_NOZZLE_- SECTION	product_definition	41	11, 13, 14, 24	{product_definition product_definition.formation ->` product_definition_formation product_definition_formation.of_product ->` product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->` [group group.name = `reducing nozzle section'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->` group group.name = `nozzle section']}

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
angular_offset_of_- small_circle	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> {representation_item representation_item.name `angular offset of small circle'} representation_item => measure_representation_item <= {measure_with_unit => plane_angle_measure_with_unit} measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
eccentric	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name {(group.name = `eccentric') (group.name = `not eccentric')}

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter2	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> {representation_item representation_item.name `inside diameter2'} representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nominal_diameter2	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> {representation_item representation_item.name `nominal iameter2'} representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter2	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> {representation_item representation_item.name `outside diameter2'} representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
SOLIDS_PROCESSING_- EQUIPMENT	product	41	11, 13, 24	{product [classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `solids processing equipment'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group.name = `process equipment]}

Table 4 - Mapping table for major_process_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
STRAIGHT_NOZZLE_-SECTION	product_definition	41	11, 13, 14, 24	{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `straight nozzle section'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group.name = `nozzle section]}

Table 4 - Mapping table for major_process_equipment_data UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> {representation_item representation_item.name = `pressure drop'} representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Rules:

2 - nozzle must be related to a material port

Table 5 - Mapping table for mass_transfer_equipment_data UoF

Application element	AIM element	Source	Rules	Reference PATH
ACTIVE_AREA_SHAPE	shape_aspect	41	18	shape_aspect **{shape_aspect** **shape_aspect.description = `active area shape'}**
active_area_shape to tray_panel_shape	PATH		11, 13, 14, 15, 18, 24	shape_aspect shape_aspect.of_shape ->* product_definition_shape <= property_definition property_definition.definition ->* characterized_definition characterized_definition = characterized_product_definition characterized_product_definition = product_definition product_definition => **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group <-** **group** **group.name = `tray panel'}** separation_tray_component_definition
BAFFLE_AND_- DISENGAGING_- PANEL_INTERSECTION	shape_aspect	41	18	**{shape_aspect** **shape_aspect.description = `baffle and tray panel intersection'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.unit_component] [measure_with_unit.value_component]	41 41	16, 18	shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
baffle_and_disengaging_-panel_intersection to downcomer_-disengaging_panel_shape	PATH		18	shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship shape_aspect_relationship.relating_shape_aspect ->shape_aspect => **{shape_aspect** **shape_aspect.description = `downcomer disengaging panel'}** separation_tray_component_feature

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
baffle_and_disengaging_-panel_intersection to separation_tray_baffle_-shape	PATH		11, 13, 14, 15, 18, 24	shape_aspect shape_aspect.of_shape -> product_definition_shape <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray baffle'}** product_definition
BAFFLE_AND_SEAL_-PAN_INTERSECTION	shape_aspect	41	18	**{shape_aspect** **shape_aspect.description = `baffle and seal pan intersection'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.unit_component] [measure_with_unit.value_component]	41 41	16, 18	shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
baffle_and_seal_pan_- intersection to seal_pan_- shape	PATH		11, 13, 14, 15, 18, 24	shape_aspect shape_aspect.of_shape ->product_definition_shape <= property_definition property_definition.definition ->characterized_definition characterized_definition = characterized_product_definition characterized_product_definition = product_definition_relationship **{product_definition_relationship => product_definition_usage => assembly_component_usage}** product_definition_relationship product_definition_relationship.related_product_definition ->product_definition => separation_tray_component_definition **{separation_tray_component_definition <= product_definition product_definition.formation ->product_definition_formation product_definition_formation.of_product ->product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->group group.name = `seal pan'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
baffle_and_seal_pan_-intersection to separation_tray_baffle_-shape			11, 13, 14, 15, 18, 24	shape_aspect shape_aspect.of_shape -> product_definition_shape <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition = product_definition product_definition <- product_definition_relationship.relating_product_definition -> **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.related_product_definition -> **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray baffle'}** product_definition
BAFFLE_AND_TRAY_-PANEL_INTERSECTION	shape_aspect	41	18	**{shape_aspect** **shape_aspect.description = `baffle and tray panel intersection'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
baffle_and_tray_panel_-intersection to separation_tray_baffle_-shape	PATH		11, 13, 14, 15, 18, 24	shape_aspect shape_aspect.of_shape -> product_definition_shape <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition = product_definition_relationship **{product_definition_relationship => product_definition_usage => assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition -> **{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `separation tray baffle'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
baffle_and_tray_panel_-intersection to tray_panel_shape	PATH		11, 13, 14, 15, 18, 24	shape_aspect shape_aspect.of_shape -> product_definition_shape <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition = product_definition_relationship **{product_definition_relationship => product_definition_usage => assembly_component_usage}** product_definition_relationship product_definition_relationship.related_product_definition -> **{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `tray panel'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
BLINDING_STRIP	product_definition	41	4, 11, 13, 14, 24	**{product_definition [product_definition.frame_of_reference -> product_definition_context => application_context_element application_context_element.name = `functional occurrence'] [product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `blinding strip'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> group group.name = `separation tray structural component']]}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
blinding_strip to blinding_strip_shape	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship product_definition_relationship.name = `definitional occurrence'}** product_definition_relationship product_definition_relationship.relating_product_definition -> **{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `blinding strip'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
BLINDING_STRIP_-SHAPE	separation_tray_component_definition	231	11, 13, 14, 24	separation_tray_component_definition <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `blinding strip']** **[group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `separation tray structural component']}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
blinding_strip_shape to separation_tray_shape	PATH		11, 13, 14, 24	separation_tray_component_definition <= product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
BUBBLE_CAP	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `bubble cap'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `perforation cover'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tray component'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
BUBBLE_CAP (concluded)				**group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tower internal'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `mass transfer equipment'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> group group.name = `process equipment']}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
BUBBLE_CAP_SHAPE	separation_tray_component_definition	231	11, 13, 14, 24	separation_tray_component_definition <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `bubble cap']** **[group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `perforation cover'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation tray component'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
BUBBLE_CAP_SHAPE (concluded)				**group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group ->{group group.name = `separation tower internal'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group ->{group group.name = `mass transfer equipment'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group ->group group.name = `process equipment']}**
type_code	group.name	41	11, 13, 14, 24	product_definition product_definition.formation ->product_definition_formation product_definition_formation.of_product ->product classified_item = product classified_item <-classification_assignment.items[i] classification_assignment <=group_assignment group_assignment.assigned_group ->group group.name

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type_name	group.description	41	11, 13, 14, 24	product_definition product_definition.formation ->
product_definition_formation product_definition_formation.of_product ->
product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->
group
BUBBLE_SLOT_SHAPE	separation_tray_component_feature	231	18	separation_tray_component_feature <= shape_aspect **{shape_aspect shape_aspect.name = `slot'}**
distance_from_bottom_- of_cap	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->
representation representation.items[i] ->
{representation_item representation_item.name = `length'} representation_item => measure_representation_item <= **{measure_with_unit => length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
CAP_SHAPE	shape_aspect	41	18	**{shape_aspect shape_aspect.description = `cap'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
number_of_bubble_slots	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of bubble slots'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_serrations_- in_bottom_edge	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of serrations in bottom edge'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}**] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cap_shape to bubble_-cap_shape	PATH		11, 13, 14, 15, 18, 24	shape_aspect shape_aspect.of_shape -> product_definition_shape <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `bubble cap'}** product_definition => separation_tray_component_definition
cap_shape to bubble_-slot_shape	PATH		18	shape_aspect shape_aspect.related_shape_aspect shape_aspect_relationship -> shape_aspect_relationship.name = `feature component' shape_aspect_relationship -> shape_aspect_relationship.relating_shape_aspect -> shape_aspect separation_tray_component_feature <= shape_aspect **{shape_aspect** **shape_aspect.name = `slot'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cap_shape to curve	PATH		16, 18	shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `perimeter'}** representation_item => geometric_representation_item => curve => (bounded_curve => (b_spline_curve) (composite_curve) (trimmed_curve)) (conic => (circle) (ellipse))
CARTESIAN_POINT	cartesian_point	42		
cartesian_point to tray_-panel_and_perforation_-shape	PATH		16, 18	cartesian_point <= geometric_representation_item <= representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = shape_aspect **{shape_aspect** **shape_aspect.description = `tray panel and perforation'}** shape_aspect => separation_tray_component_feature

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cartesian_point to tray_- panel_and_slot_shape	PATH		16, 18	cartesian_point <= geometric_representation_item <= representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = shape_aspect **{shape_aspect** **shape_aspect.description = `tray panel and slot'}** shape_aspect => separation_tray_component_feature
CORRUGATION	shape_aspect	41	18	shape_aspect **{shape_aspect ->** **shape_aspect.description = `corrugation'}**
height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
type	group.name	41	11, 18, 24	shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `shape type'}** group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `triangular')** **(group.name = `rectangular')** **(group.name = `sinusoidal')** **(group.name = `other')}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
corrugation to tray_-panel_shape	PATH		11, 13, 14, 15, 18, 24	shape_aspect **{shape_aspect** **shape_aspect.description = `corrugation'}** shape_aspect.of_shape -> product_definition_shape <= property_definition property_definition.definition -> characterized_definition = characterized_product_definition characterized_product_definition = product_definition separation_tray_component_definition <= product_definition {product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group **{group** **group.name = `tray panel'}**
CURVE	(b_spline_curve) (circle) (composite_curve) (ellipse) (trimmed_curve)	42 42 42 42 42		

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
curve to baffle_and_- disengaging_panel_- intersection	PATH		14, 16, 18	((b_spline_curve <=) (composite_curve <=) (trimmed_curve <=) bounded_curve <=) ((circle <=) (ellipse <=) conic <=) curve <= geometric_representation_item <= representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = shape_aspect shape_aspect **{shape_aspect** **shape_aspect.description = `baffle and tray panel intersection'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
curve to baffle_and_- seal_pan_intersection	PATH		14, 16, 18	((b_spline_curve <=) (composite_curve <=) (trimmed_curve <=) bounded_curve <=) ((circle <=) (ellipse <=) conic <=) curve <= geometric_representation_item <= representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = shape_aspect shape_aspect **{shape_aspect** **shape_aspect.description = `baffle and seal pan intersection'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
curve to baffle_and_- tray_panel_intersection	PATH		14, 16, 18	((b_spline_curve <=) (composite_curve <=) (trimmed_curve <=) bounded_curve <=) ((circle <=) (ellipse <=) conic <=) curve <= geometric_representation_item <= representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = shape_aspect shape_aspect **{shape_aspect** **shape_aspect.description = `baffle and tray panel intersection'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
curve to corrugation	PATH		14, 16, 18	((b_spline_curve <=) (composite_curve <=) (trimmed_curve <=) bounded_curve <=) ((circle <=) (ellipse <=) conic <=) curve <= geometric_representation_item <= representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = shape_aspect shape_aspect **{shape_aspect** **shape_aspect.description = `corrugation'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
curve to downcomer_-apron_section_shape	PATH		14, 16, 18	((b_spline_curve <=) (composite_curve <=) (trimmed_curve <=) bounded_curve <=) ((circle <=) (ellipse <=) conic <=) curve <= geometric_representation_item <= representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = shape_aspect **{shape_aspect** **shape_aspect.description = `downcomer apron section'}** shape_aspect => separation_tray_component_feature

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
curve to weir_and_- disengaging_panel_- intersection	PATH		14, 16, 18	((b_spline_curve <=) (composite_curve <=) (trimmed_curve <=) bounded_curve <=) ((circle <=) (ellipse <=) conic <=) curve <= geometric_representation_item <= representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = shape_aspect shape_aspect **{shape_aspect** **shape_aspect.description = `weir and disengaging panel intersection'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
curve to weir_and_seal_-pan_intersection	PATH		14, 16, 18	((b_spline_curve <=) (composite_curve <=) (trimmed_curve <=) bounded_curve <=) ((circle <=) (ellipse <=) conic <=) curve <= geometric_representation_item <= representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = shape_aspect shape_aspect **{shape_aspect** **shape_aspect.description = `weir and seal panel intersection'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
curve to weir_and_tray_-panel_intersection	PATH		14, 16, 18	((b_spline_curve <=) (composite_curve <=) (trimmed_curve <=) bounded_curve <=) ((circle <=) (ellipse <=) conic <=) curve <= geometric_representation_item <= representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = shape_aspect shape_aspect **{shape_aspect** **shape_aspect.description = `weir and tray panel intersection'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
curve to weir_shape	PATH		11, 13, 14, 16, 24	((b_spline_curve <=) (composite_curve <=) (trimmed_curve <=) bounded_curve <=) ((circle <=) (ellipse <=) conic <=) curve <= geometric_representation_item <= representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `weir shape'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
DEMISTER_PAD	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `demister pad'}**
demister_pad to cylindrical_pressure_-vessel	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cylindrical pressure vessel'}** product_definition => cylindrical_pressure_vessel

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
demister_pad to cylindrical_pressure_-vessel_section	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cylindrical pressure vessel section'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
demister_pad to separation_tower	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tower'}**
DEMISTER_PAD_STACK	product_definition	41	11, 13, 14, 24	**{product_definition <-** **product_definition_relationship.related_product_definition** **product_definition_relationship** **product_definition_relationship.relating_product_definition ->** **product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `demister pad stack'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
demister_pad_stack to cylindrical_pressure_-vessel	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cylindrical pressure vessel'}** product_definition => cylindrical_pressure_vessel

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
demister_pad_stack to cylindrical_pressure_-vessel_section	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cylindrical pressure vessel section'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
demister_pad_stack to separation_tower	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tower'}**
DISENGAGING_-PANEL_OPENING_-SHAPE	separation_tray_component_feature	231	18	separation_tray_component_feature <= shape_aspect **{shape_aspect** **shape_aspect.description = `disengaging panel opening'}**
disengaging_panel_-opening_shape to downcomer_apron_shape	PATH		18	separation_tray_component_feature <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship shape_aspect_relationship.relating_shape_aspect ->** **{shape_aspect** **shape_aspect.description = `downcomer apron section'}** shape_aspect => separation_tray_component_feature

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
disengaging_panel_- opening_shape to downcomer_- disengaging_panel_shape	PATH		18	separation_tray_component_feature <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship shape_aspect_relationship.relating_shape_aspect -> **{shape_aspect** **shape_aspect.description = `downcomer disengaging panel'}** shape_aspect => separation_tray_component_feature

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
DOWNCOMER	product_definition	41	11, 13, 14, 24	**{product_definition [product_definition.frame_of_reference -> product_definition_context <= application_context_element application_context_element.name = `functional occurrence'] [product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `downcomer'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tray component'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tower internal'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
DOWNCOMER (concluded)				**group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `mass transfer equipment'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process equipment']]}**
downcomer to downcomer_hydraulics	PATH		14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation **{representation** **representation.name = `downcomer hydraulics'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
downcomer to downcomer_shape	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship** **product_definition_relationship.name = `definitional occurrence'}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `downcomer'}** product_definition => separation_tray_component_definition
DOWNCOMER_-APRON_SECTION_-SHAPE	separation_tray_component_feature	231	18	separation_tray_component_feature <= shape_aspect **{shape_aspect** **shape_aspect.description = `downcomer apron section'}**
apron_section_number_-from_top	shape_aspect.name	41		separation_tray_component_feature <= shape_aspect shape_aspect.name

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
horizontal_pitch	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `horizontal pitch'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **plane_angle_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
vertical_height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
downcomer_apron_- section_shape to downcomer_apron_shape	PATH		18	separation_tray_component_feature <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship shape_aspect_relationship.relating_shape_aspect -> **{shape_aspect** **shape_aspect.description = `downcomer apron section'}** shape_aspect => separation_tray_component_feature
DOWNCOMER_- APRON_SHAPE	separation_tray_component_feature	231	18	separation_tray_component_feature <= shape_aspect **{shape_aspect** **shape_aspect.description = `downcomer apron'}**
number_of_apron_- sections	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of apron sections'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
downcomer_apron_shape to downcomer_shape	PATH		11, 13, 14, 15, 18, 24	separation_tray_component_feature <= shape_aspect shape_aspect.of_shape -> product_definition_shape <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `downcomer'}** product_definition => separation_tray_component_definition
DOWNCOMER_-DISENGAGING_-PANEL_SHAPE	separation_tray_component_feature	231	18	separation_tray_component_feature <= shape_aspect **{shape_aspect** **shape_aspect.description = `downcomer disengaging panel'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
downcomer_- disengaging_panel_shape to downcomer_shape	PATH		11, 13, 14, 15, 18, 24	separation_tray_component_feature <= shape_aspect shape_aspect.of_shape ->product_definition_shape <= property_definition property_definition.definition ->characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `downcomer'}** product_definition => separation_tray_component_definition
DOWNCOMER_- HYDRAULICS	representation	43	15, 16	**{[representation** **representation.name = `downcomer hydraulics']** **[representation <-** **property_definition_representation.used_representation** **property_definition_representation** **property_definition_representation.definition ->** **represented_definition** **represented_definition = property_definition** **property_definition** **property_definition.name = `hydraulics']}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
clear_liquid_height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `clear liquid height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
flooding_safety_factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `flooding safety factor'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
froth_height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `froth height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
liquid_height_at_flood_-point	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `liquid height at flood point'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
liquid_residence_time	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `liquid residence time'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **time_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
liquid_velocity_at_top	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `liquid velocity at top'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
maximum_liquid_height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum liquid height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_liquid_- velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `maximum liquid velocity'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
DOWNCOMER_- LIQUID_FLOW_- CHANNEL_SHAPE	separation_tray_component_feature	231	18	separation_tray_component_feature <= shape_aspect **{shape_aspect** **shape_aspect.description = `downcomer liquid flow channel'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
volume	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `volume'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
downcomer_liquid_-flow_channel_shape to downcomer_apron_-section_shape	PATH		18	separation_tray_component_feature <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship shape_aspect_relationship.relating_shape_aspect ->**{shape_aspect** **shape_aspect.description = `downcomer apron section'}** shape_aspect => separation_tray_component_feature

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
DOWNCOMER_SHAPE	separation_tray_component_definition	231	11, 13, 14, 24	separation_tray_component_definition <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `downcomer']** **[group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation tray component'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation tower internal'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
DOWNCOMER_SHAPE (concluded)				**group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `mass transfer equipment'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process equipment']}**
downcomer_location_-type	group.name	41	11, 14, 24	separation_tray_component_definition <= product_definition product_definition classified_item = product_definition classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `location type'}** group_assignment group_assignment.assigned_group ->** group group.name **{(group.name = `side downcomer')** **(group.name = `centre downcomer')** **(group.name = `off-centre downcomer')}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
downcomer_shape to separation_tray_shape	PATH		11, 13, 14, 24	separation_tray_component_definition <= product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray'}** product_definition => separation_tray_component_definition
ESCAPE_AREA_SHAPE	separation_tray_component_feature	231	18	separation_tray_component_feature <= shape_aspect **{shape_aspect** **shape_aspect.description = `escape area'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
escape_area_shape to downcomer_shape	PATH		11, 13, 14, 15, 18, 24	separation_tray_component_feature <= shape_aspect shape_aspect.of_shape -> product_definition_shape <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `downcomer'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
escape_area_shape to seal_pan_shape	PATH		11, 13, 14, 15, 18, 24	separation_tray_component_feature <= shape_aspect shape_aspect.of_shape -> product_definition_shape <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{[product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `downcomer']** **[product_definition =>** **separation_tray_component_definition]}** product_definition <- product_definition_relationship.relating_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.related_product_definition ->

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
escape_area_shape to seal_pan_shape (concluded)			11, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `seal pan'}** product_definition => separation_tray_component_definition
FLASHING_FEED_-GALLERY	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `flashing feed gallery'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
sparge_opening	descriptive_representation_item.-description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `sparge opening'}** representation_item => descriptive_representation_item descriptive_representation_item.description
MASS_TRANSFER_-EQUIPMENT	product_definition	41	11, 13, 14, 24	**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `mass transfer equipment'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> **{group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `mass transfer equipment'}** group group.name
MATCHED_- PERIMETER_- SEGMENTS	shape_aspect_relationship	41		**{shape_aspect_relationship** **shape_aspect_relationship.name = `matched perimeter segments'}**
matched_perimeter_- segments to perimeter_- segment	PATH		18	shape_aspect_relationship shape_aspect_relationship.relating_shape_aspect -> **{shape_aspect** **shape_aspect.description = `perimeter segment'}** shape_aspect => separation_tray_component_feature_definition
matched_perimeter_- segments to perimeter_- segment	PATH		18	shape_aspect_relationship shape_aspect_relationship.related_shape_aspect -> **{shape_aspect** **shape_aspect.description = `perimeter segment'}** shape_aspect => separation_tray_component_feature_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PACKING_STACK	assembly_component_usage	44		**{assembly_component_usage <= product_definition_usage <= product_definition_relationship product_definition_relationship.name = `packing stack'}**
section_number_from_- bottom_of_stack	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	assembly_component_usage <= product_definition_usage <= product_definition_relationship characterized_product_definition = product_definition_relationship characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition property_definition.name = `stack position'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item representation_item.name = `section number from bottom of stack'}** representation_item => measure_representation_item <= **{measure_with_unit measure_with_unit.value_component -> measure_value measure_value = count_measure count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
section_number_from_- top_of_stack	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	assembly_component_usage <= product_definition_usage <= product_definition_relationship characterized_product_definition = product_definition_relationship characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_definition.name = `stack position'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `section number from top of stack'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
packing_stack to separation_packing	PATH		11, 13, 14, 24	product_definition_relationship product_definition_relationship.related_product_definition -> product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation packing'}**
packing_stack to separation_packing_stack	PATH		11, 13, 14, 24	product_definition_relationship product_definition_relationship.relating_product_definition -> product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation packing stack'}**
PAD_AND_PAD_STACK	assembly_component_usage	44		**{assembly_component_usage <=** **product_definition_usage <=** **product_definition_relationship** **product_definition_relationship.name = `pad and pad stack'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pad_number_from_- bottom_of_stack	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	assembly_component_usage <= product_definition_usage <= product_definition_relationship characterized_product_definition = product_definition_relationship characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_definition.name = `stack position'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pad number from bottom of stack'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pad_number_from_top_-of_stack	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	assembly_component_usage <= product_definition_usage <= product_definition_relationship characterized_product_definition = product_definition_relationship characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_definition.name = `stack position'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pad number from top of stack'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pad_and_pad_stack to demister_pad	PATH		11, 13, 14, 24	product_definition_relationship product_definition_relationship.related_product_definition -> product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `demister pad'}**
pad_and_pad_stack to demister_pad_stack	PATH		11, 13, 14, 24	product_definition_relationship product_definition_relationship.relating_product_definition -> product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `demister pad stack'}**
PATTERN	separation_tray_component_feature_-definition	231	18	separation_tray_component_feature_definition <= shape_aspect **{shape_aspect** **shape_aspect.description = `pattern'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
description	characterized_object.description	41	9, 15, 18	separation_tray_component_feature_definition <= shape_aspect shape_aspect.of_shape -> product_definition_shape <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_object characterized_object characterized_object.description
name	shape_aspect.name	41	18	separation_tray_component_feature_definition <= shape_aspect shape_aspect.name
pitch_separation_distance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature_definition <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `separation pitch distance'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pitch_type	descriptive_representation_item.-description	45	15, 16	separation_tray_component_feature_definition <= shape_aspect shape_aspect.of_shape -> product_definition_shape <= {property_definition property_definition.name = `pattern shape'} property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pitch type'}** representation_item => descriptive_representation_item descriptive_representation_item.description
pattern to perforation_-shape	PATH		18	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship shape_aspect_relationship.relating_shape_aspect -> **{shape_aspect** **shape_aspect.description = `perforation'}** shape_aspect => separation_tray_component_feature_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PERFORATION_COVER	product_definition	41	11, 13, 14, 24	**{product_definition [product_definition.frame_of_reference -> product_definition_context <= application_context_element application_context_element.name = `functional occurrence'] [product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `perforation cover'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tray component'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tower internal'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PERFORATION_COVER (concluded)				**group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `mass transfer equipment'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process equipment']]}**
perforation_cover to perforation_cover_shape	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship** **product_definition_relationship.name = `definitional occurrence'}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `perforation cover shape'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PERFORATION_-COVER_SHAPE	separation_tray_component_definition	231	11, 13, 14, 24	separation_tray_component_definition <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `perforation cover']** **[group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation tray component'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation tower internal'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PERFORATION_- COVER_SHAPE (concluded)				**group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `mass transfer equipment'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process equipment']}**
perforation_cover_shape to active_area_shape	PATH		14, 18	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition => product_definition_shape <- shape_aspect.of_shape shape_aspect **{shape_aspect** **shape_aspect.description = `active area shape'}**
PERFORATION_SHAPE	separation_tray_component_feature_- definition	231	18	separation_tray_component_feature_definition <= shape_aspect **{shape_aspect** **shape_aspect.description = `perforation'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bottom_edge	descriptive_representation_item.-description	45	16, 18	separation_tray_component_feature_definition <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `bottom edge'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `sharp')** **(descriptive_representation_item.description = `smooth')}**
top_edge	descriptive_representation_item.-description	45	16, 18	separation_tray_component_feature_definition <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `top edge'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `sharp')** **(descriptive_representation_item.description = `smooth')}**
PERIMETER	separation_tray_component_feature_-definition	231	18	separation_tray_component_feature_definition <= shape_aspect **{shape_aspect** **shape_aspect.description = `perimeter'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature_definition <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_perimeter_-segments	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature_definition <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of perimeter segments'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
surface_area_enclosed	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature_definition <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `surface area enclosed'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
perimeter to active_area_-shape	PATH		18	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect **{shape_aspect_relationship** **shape_aspect_relationship.name = `cap base boundary'}** shape_aspect_relationship shape_aspect_relationship.relating_shape_aspect -> shape_aspect **{shape_aspect** **shape_aspect.description = `active area shape'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
perimeter to blinding_-strip_shape	PATH		11, 13, 14, 15, 18, 24	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect **{shape_aspect_relationship** **shape_aspect_relationship.name = `boundary'}** shape_aspect_relationship shape_aspect_relationship.relating_shape_aspect ->** shape_aspect shape_aspect.of_shape ->** product_definition_shape <= property_definition property_definition.definition ->** characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `blinding strip'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
perimeter to bubble_-slot_shape	PATH		11, 13, 14, 15, 18, 24	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `boundary'}** shape_aspect_relationship.relating_shape_aspect ->** shape_aspect shape_aspect.of_shape ->** product_definition_shape <= property_definition property_definition.definition ->** characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `bubble cap'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
perimeter to cap_shape	PATH		18	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `cap base boundary'}** shape_aspect_relationship.relating_shape_aspect ->** shape_aspect **{shape_aspect** **shape_aspect.description = `cap'}**
perimeter to disengaging_panel_-opening_shape	PATH		18	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `boundary'}** shape_aspect_relationship.relating_shape_aspect ->** **{shape_aspect** **shape_aspect.description = `disengaging panel opening'}** shape_aspect => separation_tray_component_feature
perimeter to downcomer_-disengaging_panel_shape	PATH		18	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `boundary'}** shape_aspect_relationship.relating_shape_aspect ->** **{shape_aspect** **shape_aspect.description = `downcomer disengaging panel'}** shape_aspect => separation_tray_component_feature

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
perimeter to downcomer_liquid_-flow_channel_shape (has bottom of channel bounded by)	PATH		18	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `bottom of channel boundary'}** shape_aspect_relationship.relating_shape_aspect ->** **{shape_aspect** **shape_aspect.description = `downcomer liquid flow channel'}** shape_aspect => separation_tray_component_feature
perimeter to downcomer_liquid_-flow_channel_shape (has top of channel bounded by)	PATH		18	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `top of channel boundary'}** shape_aspect_relationship.relating_shape_aspect ->** **{shape_aspect** **shape_aspect.description = `downcomer liquid flow channel'}** shape_aspect => separation_tray_component_feature
perimeter to escape_-area_shape	PATH		18	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `boundary'}** shape_aspect_relationship.relating_shape_aspect ->** **{shape_aspect** **shape_aspect.description = `escape area'}** shape_aspect => separation_tray_component_feature

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
perimeter to perforation_-shape	PATH		18	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `boundary'}** shape_aspect_relationship.relating_shape_aspect ->** **{shape_aspect** **shape_aspect.description = `perforation'}** shape_aspect => separation_tray_component_feature_definition
perimeter to pressure_-equalization_channel_-shape	PATH		18	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `cross section'}** shape_aspect_relationship.relating_shape_aspect ->** **{shape_aspect** **shape_aspect.description = `pressure equalization channel'}** shape_aspect => separation_tray_component_feature
perimeter to riser_shape (has riser base bounded by)	PATH		18	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `base boundary'}** shape_aspect_relationship.relating_shape_aspect ->** **{shape_aspect** **shape_aspect.description = `riser'}** shape_aspect => separation_tray_component_feature

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
perimeter to riser_shape (has riser flow channel bounded by)	PATH		18	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `flow channel boundary'}** shape_aspect_relationship.relating_shape_aspect ->** **{shape_aspect** **shape_aspect.description = `riser'}** shape_aspect => separation_tray_component_feature
perimeter to seal_pan_-recess_shape	PATH		18	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `boundary'}** shape_aspect_relationship.relating_shape_aspect ->** **{shape_aspect** **shape_aspect.description = `seal pan recess'}** shape_aspect => separation_tray_component_feature

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
perimeter to seal_pan_-shape	PATH		11, 13, 14, 15, 18, 24	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `boundary'}** shape_aspect_relationship.relating_shape_aspect ->** shape_aspect shape_aspect.of_shape ->** product_definition_shape <= property_definition property_definition.definition ->** characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `seal pan'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
perimeter to separation_-tray_shape	PATH		11, 13, 14, 15, 18, 24	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `boundary'}** shape_aspect_relationship.relating_shape_aspect ->** shape_aspect shape_aspect.of_shape ->** product_definition_shape <= property_definition property_definition.definition ->** characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
perimeter to tray_panel_-shape	PATH		11, 13, 14, 15, 18, 24	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `boundary'}** shape_aspect_relationship.relating_shape_aspect ->** shape_aspect shape_aspect.of_shape ->** product_definition_shape <= property_definition property_definition.definition ->** characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `tray panel'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
perimeter to tray_slot_-shape	PATH		18	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `boundary'}** shape_aspect_relationship.relating_shape_aspect ->** **{shape_aspect** **shape_aspect.description = `tray slot'}** shape_aspect => separation_tray_component_feature
PERIMETER_SEGMENT	separation_tray_component_feature_-definition	231	18	separation_tray_component_feature_definition <= shape_aspect **{shape_aspect** **shape_aspect.description = `perimeter segment'}**
liquid_flow_status	group.name	41	11, 18, 24	separation_tray_component_feature_definition <= shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `liquid flow type'}** group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `barrier edge')** **(group.name = `inlet flow edge')** **(group.name = `outlet flow edge')}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature_definition <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
segment_number	shape_aspect.name	41		separation_tray_component_feature_definition <= shape_aspect shape_aspect.name

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
perimeter_segment to curve	PATH		16, 18	separation_tray_component_feature_definition <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `perimeter'}** representation_item => geometric_representation_item => curve => (bounded_curve => (b_spline_curve) (composite_curve) (trimmed_curve)) (conic => (circle) (ellipse))
perimeter_segment to perimeter	PATH		18	separation_tray_component_feature_definition <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `composition'}** shape_aspect_relationship.relating_shape_aspect -> **{shape_aspect** **shape_aspect.description = `perimeter'}** shape_aspect => separation_tray_component_feature_definition
PRESSURE_-EQUALIZATION_-CHANNEL_SHAPE	separation_tray_component_feature	231	18	separation_tray_component_feature <= shape_aspect **{shape_aspect** **shape_aspect.description = `pressure equalization channel'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
pressure_equalization_-channel_shape to downcomer_apron_-section_shape	PATH		18	separation_tray_component_feature <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `pressure equalization'}** shape_aspect_relationship.relating_shape_aspect ->**{shape_aspect** **shape_aspect.description = `downcomer apron section'}** shape_aspect => separation_tray_component_feature_definition
RISER_AND_TRAY_-PANEL_SHAPE	separation_tray_component_feature	231	18	separation_tray_component_feature <= shape_aspect **{shape_aspect** **shape_aspect.description = `riser and tray panel'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
rise_above_panel_top	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `rise above panel top'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
riser_and_tray_panel_-shape to riser_shape	PATH		18	separation_tray_component_feature <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `composition'}** shape_aspect_relationship.relating_shape_aspect ->**{shape_aspect** **shape_aspect.description = `riser'}** shape_aspect => separation_tray_component_feature_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
riser_and_tray_panel_-shape to tray_panel_-shape	PATH		11, 13, 14, 15, 18, 24	separation_tray_component_feature <= shape_aspect shape_aspect.of_shape ->>br>product_definition_shape <= property_definition property_definition.definition ->>br>characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `tray panel'}** product_definition =>>br>separation_tray_component_definition
RISER_SHAPE	separation_tray_component_feature	231	18	separation_tray_component_feature <= shape_aspect **{shape_aspect** **shape_aspect.description = `riser'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
rise_above_base	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `rise above base'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
width_of_base	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `width of base'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
riser_shape to bubble_-cap_shape	PATH		11, 13, 14, 15, 18, 24	separation_tray_component_feature <= shape_aspect shape_aspect.of_shape ->product_definition_shape <= property_definition property_definition.definition ->characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `bubble cap'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEAL_PAN	product_definition	41	11, 13, 14, 24	**{product_definition [product_definition.frame_of_reference -> product_definition_context <= application_context_element application_context_element.name = `functional occurrence'] [product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `seal pan'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tray component'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tower internal'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEAL_PAN (concluded)				**group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `mass transfer equipment'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process equipment']]}**
seal_pan to seal_pan_-shape	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship** **product_definition_relationship.name = `definitional occurrence'}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `seal pan'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEAL_PAN_RECESS_-SHAPE	separation_tray_component_feature	231	18	separation_tray_component_feature <= shape_aspect **{shape_aspect** **shape_aspect.description = `seal pan recess'}**
recess_depth	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `recess depth'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
seal_pan_recess_shape to seal_pan_shape	PATH		11, 13, 14, 15, 18, 24	separation_tray_component_feature <= shape_aspect shape_aspect.of_shape ->>br>product_definition_shape <= property_definition property_definition.definition ->>br>characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `seal pan'}** product_definition =>>br>separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEAL_PAN_SHAPE	separation_tray_component_definition	231	11, 13, 14, 24	separation_tray_component_definition <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `seal pan']** **[group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation tray component'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation tower internal'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEAL_PAN_SHAPE (concluded)				**group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `mass transfer equipment'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process equipment']}**
seal_pan_location_type	group.name	41	11, 14, 24	separation_tray_component_definition <= product_definition classified_item = product_definition classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `location type'}** group_assignment group_assignment.assigned_group ->** group group.name **{(group.name = `side')** **(group.name = `centre')** **(group.name = `off-centre')}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
seal_pan_shape to separation_tray_shape	PATH		11, 13, 14, 24	separation_tray_component_definition <= product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** {product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray'}** product_definition => separation_tray_component_definition
SEPARATION_-EFFICIENCY	representation	43	16	**{representation** **representation.name = `separation efficiency'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
efficiency_method	type_qualifier.name	45	16	representation representation.items[i]-> **{representation_item** **representation_item.name = `efficiency value'}** representation_item => qualified_representation_item qualified_representation_item.qualifiers[i] -> value_qualifier value_qualifier = type_qualifier type_qualifier type_qualifier.name **{(type_qualifier.name = `corrected Murphree plate efficiency')** **(type_qualifier.name = `uncorrected Murphree plate efficiency')}**
efficiency_type	descriptive_representation_item.-description	45	16, 18	representation representation.items[i] -> **{representation_item** **representation_item.name = `efficiency type'}** representation_item => descriptive_representation_item descriptive_representation_item.description
efficiency_value	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i]-> **{[representation_item** **representation_item.name = `efficiency value']** **[representation_item =>** **qualified_representation_item]}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_PACKING	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `separation packing'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tower internal'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `mass transfer equipment'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> group group.name = `process equipment']}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bed_volume	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `bed volume'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bed_weight	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `bed weight'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
differential_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `differential pressure'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
head_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `head pressure'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
height_equivalent_to_a_- theoretical_plate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `height equivalent to a theoretical plate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
manufacturer	organization.name	41	14, 26	product_definition organization_item = product_definition organization_item <- applied_organization_assignment.items[i] applied_organization_assignment <= **{organization_assignment** **organization_assignment.role ->** **organization_role** **organization_role.name = `manufacturer'}** organization_assignment organization_assignment.assigned_organization -> organization organization.name

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_liquid_loading	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum liquid loading'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_vapor_loading	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum vapour loading'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
name	product.name	41	13, 14	product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product product.name

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
percent_of_design	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `percent of design'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
packing_factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `packing factor'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless']}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> **{group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `separation packing'}** group group.name
separation_packing to separation_efficiency	PATH		14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation **{representation** **representation.name = `separation efficiency'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_- PACKING_COMPONENT	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `separation packing component']** **[group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation tower internal'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `mass transfer equipment'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process equipment']}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> **{group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `separation packing component'}** group group.name

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
separation_packing_-component to separation_packing	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation packing'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_- PACKING_INTERNAL	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `separation packing internal']** **[group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation packing component'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation tower internal'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_- PACKING_INTERNAL (concluded)				**{group** **group.name = `mass transfer equipment'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process equipment']}**
access_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `access diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
corrosion_allowance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `corrosion allowance'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
support_ledge	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `support ledge'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> **{group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `separation packing internal'}** group group.name **{(group.name)** **(group.name = `support plate')** **(group.name = `hold down plate')** **(group.name = `liquid distributor')** **(group.name = `liquid re-distributor')** **(group.name = `bed limiter')** **(group.name = `collector tray')}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_- PACKING_STACK	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `separation packing stack']** **[group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation packing component'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation tower internal'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_- PACKING_STACK (concluded)				**{group** **group.name = `mass transfer equipment'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process equipment']}**
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_stacks	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of perimeter segments'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
section_number	descriptive_representation_item.-description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `section number'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_TOWER	separation_tower	231	11, 13, 14, 24	separation_tower <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `separation tower']** **[group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `mass transfer equipment'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process_equipment']}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_demister_- pad_stacks	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tower <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_definition.description = `internal composition summary'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of demister pad stacks'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_demister_- pads	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tower <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_def.description = `internal composition summary'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of demister pads'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_separate_- tray_stacks	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tower <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_def.description = `internal composition summary'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of separate tray stacks'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_separation_- packing_stacks	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tower <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition {property_definition property_def.description = `internal composition summary'} property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of separation packing stacks'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 13, 14, 24	separation_tower <= product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> **{group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `separation tower'}** group group.name

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
separation_tower to cylindrical_pressure_-vessel	PATH		11, 13, 14, 24	separation_tower => product_definition <- product_definition_relationship.relating_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.related_product_definition ->** {product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cylindrical pressure vessel'}** product_definition => cylindrical_pressure_vessel

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_TOWER_-INTERNAL	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `separation tower internal'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `mass transfer equipment'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> group group.name = `process equipment']}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> **{group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `separation tower internal'}** group group.name

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
separation_tower_internal to cylindrical_pressure_-vessel	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.relating_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.related_product_definition ->** **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cylindrical pressure vessel'}** product_definition => cylindrical_pressure_vessel

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
separation_tower_internal to cylindrical_pressure_-vessel_section	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.relating_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.related_product_definition ->** **product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cylindrical pressure vessel section'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
separation_tower_internal to separation_tower	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tower'}** product_definition => separation_tower

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_TRAY	product_definition	41	11, 13, 14, 24	**{product_definition [product_definition.frame_of_reference -> product_definition_context <= application_context_element application_context_element.name = `functional occurrence'] [product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `separation tray'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tower internal'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group ->**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_TRAY (concluded)				**{group group.name = `mass transfer equipment'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group ->group group.name = `process equipment']]}**
separation_tray to separation_efficiency	PATH		14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation **{representation representation.name = `separation efficiency'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
separation_tray to separation_tray_-hydraulics	PATH		14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_definition.name = `hydraulics'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation **{representation** **representation.name = `separation efficiency'}**
separation_tray to separation_tray_shape	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship** **product_definition_relationship.name = `definitional occurrence'}** product_definition_relationship product_definition_relationship.relating_product_definition -> **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_TRAY_-BAFFLE	product_definition	41	4, 11, 13, 14, 24	**{product_definition [product_definition.frame_of_reference -> product_definition_context => application_context_element application_context_element.name = `functional occurrence'] [product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `separation tray baffle'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> group group.name = `separation tray structural component']]}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
separation_tray_baffle to separation_tray_baffle_-shape	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship** **product_definition_relationship.name = `definitional occurrence'}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray baffle'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_TRAY_-BAFFLE_SHAPE	separation_tray_component_definition	231	11, 13, 14, 24	separation_tray_component_definition <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `separation tray baffle']** **[group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation tray structural component']}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
attachment_method	descriptive_representation_item.-description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `attachment method'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `welded')** **(descriptive_representation_item.description =** **`extends between tray components')** **(descriptive_representation_item.description = `bolted')}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
disengaging_panel_- intersection_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `disengaging panel intersection length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
seal_pan_intersection_-length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `seal pan intersection length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_panel_intersection_-length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tray panel intersection length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
separation_tray_baffle_-shape to separation_-tray_shape	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_TRAY_-COMPONENT	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `separation tray component'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tower internal'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `mass transfer equipment'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> group group.name = `process equipment']}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation ->** product_definition_formation product_definition_formation.of_product ->** product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **{group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `separation tray component'}** group group.name

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
separation_tray_-component to separation_tray	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray'}**
SEPARATION_TRAY_-HYDRAULICS	representation	43	15, 16	**{[representation** **representation.name = `separation tray hydraulics']** **[representation <-** **property_definition_representation.used_representation** **property_definition_representation** **property_definition_representation.definition ->** **represented_definition** **represented_definition = property_definition** **property_definition** **property_definition.name = `hydraulics']}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
absorption_factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `absorption factor'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
capacity_parameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `capacity parameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
dry_tray_pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `dry rate pressure drop'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
entrainment_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `entrainment rate'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
flow_parameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `packing factor'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless']}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
fractional_entrainment	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `fractional entrainment'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
jet_flood_vapour_load_- at_constant_liquid_flow	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `jet flood vapour load at constant liquid flow'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
jet_flood_vapour_load_- at_constant_molar_- overflow	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name =** **`jet flood vapour load at constant molar overflow'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
liquid_height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `liquid height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
liquid_residence_time	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `liquid residence time'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **time_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
percentage_probability_- of_flooding	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `percentage probability of flooding'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
safety_factor_for_- flooding	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `safety factor for flooding'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `tray pressure drop'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
vapour_capacity_factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `vapour capacity factor'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vapour_load_at_dump_-point	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `vapour load at dump point'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
vapour_load_at_weep_-point	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `vapour load at weep point'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vapour_load_limit	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `vapour load limit'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
vapour_residence_time	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `vapour residence time'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **time_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
weep_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `weep fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
weep_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `weep rate'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_TRAY_-SHAPE	separation_tray_component_definition	231	11, 13, 14, 24	separation_tray_component_definition => product_definition **{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `separation tray'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tower internal'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group ->**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_TRAY_-SHAPE (concluded)				**{group group.name = `mass transfer equipment'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group ->** group **group.name = `process equipment']}**
liquid_flow_type	descriptive_representation_item.-description	45	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] -> **{representation_item representation_item.name = `liquid flow type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `chordial') (descriptive_representation_item.description = `radial') (descriptive_representation_item.description = `reverse')}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_baffles	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_def.description = `tray composition summary'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of baffles'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_blinding_- strips	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_def.description = `tray composition summary'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of blinding strips'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_cascades	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_def.description = `tray composition summary'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of cascades'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_downcomers	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_def.description = `tray composition summary'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of downcomers'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_liquid_passes	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_def.description = `tray composition summary'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of liquid passes'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_liquid_- reverses	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_def.description = `tray composition summary'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of liquid reverses'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_panels	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_def.description = `tray composition summary'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of panels'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_seal_pans	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_def.description = `tray composition summary'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of seal pans'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_weirs	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_def.description = `tray composition summary'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of weirs'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_repeat_frequency	descriptive_representation_item.-description	45	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `liquid flow type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `every tray')** **(descriptive_representation_item.description = `every other tray')** **(descriptive_representation_item.description = `unspecified frequency')}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_to_tray_image	descriptive_representation_item.-description	45	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `liquid flow type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `identical')** **(descriptive_representation_item.description = `mirror')** **(descriptive_representation_item.description = `unspecified image')}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_to_tray_rotation_- angle	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tray to tray rotation angle'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **plane_angle_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_type	group.name	41	11, 14, 24	separation_tray_component_definition => product_definition classified_item = product_definition classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `flow type'}** group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `cross-flow')** **(group.name = `counter-flow')** **(group.name = `splash-flow')}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SEPARATION_TRAY_-STACK	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `separation tray stack'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tower internal'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `mass transfer equipment'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> group group.name = `process equipment']}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_trays	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of trays'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
overall_corrected_- efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `overall corrected efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
overall_uncorrected_- efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `overall uncorrected efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
stack_type	group.name	41	11, 14, 24	product_definition classified_item = product_definition classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `flow type'}** group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `pre-assembled')** **(group.name = `in tower')}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_spacing	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tray spacing'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
SEPARATION_TRAY_- STRUCTURAL_- COMPONENT	product_definition	41	11, 13, 14, 24	**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray structural component'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> **{group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `separation tray structural component'}** group group.name

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
separation_tray_-structural_component to separation_tray	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray'}**
TRAY_AND_TRAY_-STACK	assembly_component_usage	44		**{assembly_component_usage <=** **product_definition_usage <=** **product_definition_relationship** **product_definition_relationship.name = `packing stack'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_number_from_- bottom_of_stack	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	assembly_component_usage <= product_definition_usage <= product_definition_relationship characterized_product_definition = product_definition_relationship characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_definition.name = `stack position'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tray number from bottom of stack'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_number_from_top_- of_stack	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	assembly_component_usage <= product_definition_usage <= product_definition_relationship characterized_product_definition = product_definition_relationship characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_definition.name = `stack position'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tray number from top of stack'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_and_tray_stack to separation_tray	PATH		11, 13, 14, 24	product_definition_relationship product_definition_relationship.related_product_definition -> product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray'}**
tray_and_tray_stack to separation_tray_stack	PATH		11, 13, 14, 24	product_definition_relationship product_definition_relationship.relating_product_definition -> product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray stack'}**
TRAY_CASCADE	shape_aspect	41	18	**{shape_aspect** **shape_aspect.description = `tray cascade'}**
cascade_number	shape_aspect.name	41		

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vertical_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `vertical drop'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
tray_cascade to curve	PATH		16, 18	shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> **{representation =>** **shape_representation}** representation representation.items[i] -> representation_item => geometric_representation_item => curve => (bounded_curve => (b_spline_curve) (composite_curve) (trimmed_curve)) (conic => (circle) (ellipse))

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_cascade to separation_tray_shape	PATH		14, 15, 18	shape_aspect shape_aspect.of_shape -> product_definition_shape <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
TRAY_PANEL	product_definition	41	4, 11, 13, 14, 24	**{product_definition [product_definition.frame_of_reference -> product_definition_context <= application_context_element application_context_element.name = `functional occurrence'] [product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `tray panel'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tray component'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group ->**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
TRAY_PANEL (concluded)				**{group** **group.name = `separation tower internal'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `mass transfer equipment'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process equipment']]}**
tray_panel to separation_- efficiency	PATH		14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->** representation **{representation** **representation.name = `separation efficiency'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_panel to tray_- panel_hydraulics	PATH		14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_definition.description = `hydraulics'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation **{representation** **representation.name = `tray panel hydraulics'}**
tray_panel to tray_- panel_shape	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship** **product_definition_relationship.name = `definitional occurrence'}** product_definition_relationship product_definition_relationship.relating_product_definition -> **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `tray panel'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
TRAY_PANEL_AND_- PERFORATION_SHAPE	separation_tray_component_feature	231	18	separation_tray_component_feature <= shape_aspect **{shape_aspect** **shape_aspect.description = `tray panel and perforation'}**
hole_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hole area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_perforations	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `number of perforations'}** representation_item => measure_representation_item <=**{measure_with_unit** **measure_with_unit.value_component ->measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
tray_panel_and_-perforation_shape to perforation_shape	PATH		18	separation_tray_component_feature <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `composition'}** shape_aspect_relationship.relating_shape_aspect ->**{shape_aspect** **shape_aspect.description = `perforation'}** shape_aspect => separation_tray_component_feature_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_panel_and_- perforation_shape to tray_panel_shape	PATH		11, 13, 14, 15, 18, 24	separation_tray_component_feature <= shape_aspect shape_aspect.of_shape ->> product_definition_shape <= property_definition property_definition.definition ->> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->>** **product_definition_formation** **product_definition_formation.of_product ->>** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->>** **group** **group.name = `tray panel'}** product_definition => separation_tray_component_definition
TRAY_PANEL_AND_- SLOT_SHAPE	separation_tray_component_feature	231	18	separation_tray_component_feature <= shape_aspect **{shape_aspect** **shape_aspect.description = `tray panel and slot'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_slots	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of slots'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
slot_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	separation_tray_component_feature <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `slot area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_panel_and_slot_-shape to tray_panel_-shape	PATH		11, 13, 14, 15, 18, 24	separation_tray_component_feature <= shape_aspect shape_aspect.of_shape -> product_definition_shape <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `tray panel'}** product_definition => separation_tray_component_definition
tray_panel_and_slot_-shape to tray_slot_shape	PATH		18	separation_tray_component_feature <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship **{shape_aspect_relationship** **shape_aspect_relationship.name = `composition'}** shape_aspect_relationship.relating_shape_aspect -> **{shape_aspect** **shape_aspect.description = `tray slot'}** shape_aspect => separation_tray_component_feature_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
TRAY_PANEL_- HYDRAULICS	representation	43	15, 16	**{[representation** **representation.name = `tray panel hydraulics']** **[representation <-** **property_definition_representation.used_representation** **property_definition_representation** **property_definition_representation.definition ->** **represented_definition** **represented_definition = property_definition** **property_definition** **property_definition.name = `hydraulics']}**
jet_vapour_flood_at_- constant_liquid	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `jet vapour flood at constant liquid'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
jet_vapour_flood_at_- constant_molar_level	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `jet vapour flood at constant molar level'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
percentage_jet_flood_- at_constant_liquid	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `percentage jet flood at constant liquid'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
percentage_jet_flood_- at_constant_molar_- overflow	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `percentage jet flood at constant molar overflow'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vapour_load_limit	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `vapour load limit'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
TRAY_PANEL_SHAPE	separation_tray_component_definition	231	11, 13, 14, 24	separation_tray_component_definition <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{[group** **group.name = `tray panel']** **[group <-** **group_relationship.related_group** **group_relationship** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship.relating_group ->** **group <-** **{group** **group.name = `separation tray component'}** **group_relationship.related_group** **group_relationship** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship.relating_group ->** **{group** **group.name = `separation tower internal'}** **group <-** **group_relationship.related_group** **group relationship** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship.relating_group ->**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
TRAY_PANEL_SHAPE (concluded)				**{group** **group.name = `mass transfer equipment'}** **group <-** **group_relationship.related_group** **group relationship** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship.relating_group ->** **group** **group.name = `process equipment']}**
hole_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hole area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_active_areas	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of active areas'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_perforation_-geometries	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of perforation geometries'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
percentage_hole_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `percentage hole area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
slope	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `slope'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_panel_shape to separation_tray_shape	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray'}** product_definition => separation_tray_component_definition
TRAY_SLOT_SHAPE	separation_tray_component_feature_-definition	231	18	separation_tray_component_feature_definition <= shape_aspect **{shape_aspect** **shape_aspect.description = `tray slot'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
TRAY_SUPPORT	product_definition	41	4, 11, 13, 14, 24	**{product_definition [product_definition.frame_of_reference ->** **product_definition_context <=** **application_context_element** **application_context_element.name = `functional occurrence']** **[product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `tray support']}**
tray_support to cylindrical_pressure_-vessel_cylinder_section	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cylindrical pressure vessel cylinder section'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_support to separation_tray	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_support to tray_-support_shape	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship** **product_definition_relationship.name = `definitional occurrence'}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `tray support'}** product_definition => separation_tray_component_definition
TRAY_SUPPORT_SHAPE	separation_tray_component_definition	231	11, 13, 14, 24	separation_tray_component_definition <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `tray support'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
VALVE_CAP	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `valve cap'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `perforation cover'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tray component'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
VALVE_CAP (concluded)				**group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tower internal'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `mass transfer equipment'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> group group.name = `process equipment']}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
VALVE_CAP_SHAPE	separation_tray_component_definition	231	11, 13, 14, 24	separation_tray_component_definition <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `valve cap']** **[group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `perforation cover'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation tray component'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
VALVE_CAP_SHAPE (concluded)				**group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation tower internal'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `mass transfer equipment'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process equipment']}**
type_code	group.name	41	11, 14, 24	separation_tray_component_definition <= product_definition classified_item = product_definition classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `valve cap type'}** group_assignment group_assignment.assigned_group ->** **group group.name

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type_name	group.description	41	11, 14, 24	separation_tray_component_definition <= product_definition classified_item = product_definition classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `valve cap type'}** group_assignment group_assignment.assigned_group -> group group.description

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
WEIR	product_definition	41	4, 11, 13, 14, 24	**{product_definition [product_definition.frame_of_reference -> product_definition_context <= application_context_element application_context_element.name = `functional occurrence'] [product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `weir'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tray component'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `separation tower internal'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
WEIR (concluded)				**group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `mass transfer equipment'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process equipment']]}**
weir to weir_shape	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship** **product_definition_relationship.name = `definitional occurrence'}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `weir'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
WEIR_AND_- DISENGAGING_- PANEL_INTERSECTION	shape_aspect	41	18	**{shape_aspect** **shape_aspect.description = `weir and disengaging panel intersection'}**
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
weir_and_disengaging_- panel_intersection to downcomer_- disengaging_panel_shape	PATH		18	shape_aspect <- shape_aspect_relationship.relating_shape_aspect **{shape_aspect_relationship** **shape_aspect_relationship.name = `intersection'}** shape_aspect_relationship shape_aspect_relationship.related_shape_aspect -> **{shape_aspect.description = `downcomer disengaging panel'}** shape_aspect => separation_tray_component_feature

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
weir_and_disengaging_- panel_intersection to weir_shape	PATH		11, 13, 14, 15, 18, 24	shape_aspect shape_aspect.of_shape ->product_definition_shape <= property_definition property_definition.definition ->characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `weir'}** product_definition => separation_tray_component_definition
WEIR_AND_SEAL_- PAN_INTERSECTION	shape_aspect	41	18	**{shape_aspect** **shape_aspect.description = `weir and seal panel intersection'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
weir_and_seal_pan_-intersection to seal_pan_-shape	PATH		11, 13, 14, 15, 18, 24	shape_aspect shape_aspect.of_shape -> product_definition_shape <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition_relationship **{product_definition_relationship => product_definition_usage => assembly_component_usage}** product_definition_relationship product_definition_relationship.related_product_definition -> **{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `seal pan'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
weir_and_seal_pan_- intersection to weir_- shape	PATH		11, 13, 14, 15, 18, 24	shape_aspect shape_aspect.of_shape ->product_definition_shape <= property_definition property_definition.definition ->characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition_relationship **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `weir'}** product_definition => separation_tray_component_definition
WEIR_AND_TRAY_- PANEL_INTERSECTION	shape_aspect	41	18	**{shape_aspect** **shape_aspect.description = `weir and tray panel intersection'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16, 18	shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
weir_and_tray_panel_- intersection to tray_- panel_shape	PATH		11, 13, 14, 15, 18, 24	shape_aspect shape_aspect.of_shape ->** product_definition_shape <= property_definition property_definition.definition ->** characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition_relationship **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.related_product_definition ->** **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `tray panel'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
weir_and_tray_panel_-intersection to weir_-shape	PATH		11, 13, 14, 15, 18, 24	shape_aspect shape_aspect.of_shape -> product_definition_shape <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition_relationship **{product_definition_relationship => product_definition_usage => assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition -> **{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `weir'}** product_definition => separation_tray_component_definition

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
WEIR_SHAPE	separation_tray_component_definition	231	11, 13, 14, 24	separation_tray_component_definition <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `weir']** **[group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation tray component'}** **group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `type hierarchy'}** **group_relationship** **group_relationship.relating_group ->** **{group** **group.name = `separation tower internal'}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
WEIR_SHAPE (concluded)				**group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> {group group.name = `mass transfer equipment'} group <- group_relationship.related_group {group_relationship group_relationship.name = `type hierarchy'} group_relationship group_relationship.relating_group -> group group.name = `process equipment']}**

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
angle_swept_back_in_- direction_of_flow	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `angle swept back in direction of flow'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **plane_angle_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
attachment_method	descriptive_representation_item.-description	45	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `attachment method'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
disengaging_panel_- intersection_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `disengaging panel intersection length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
seal_pan_intersection_-length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `seal pan intersection length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tray_panel_intersection_-length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tray panel intersection length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vertical_height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	separation_tray_component_definition <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `vertical height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 5 - Mapping table for mass_transfer_equipment_data UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
weir_shape to separation_tray_shape	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition -> **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation tray'}** product_definition => separation_tray_component_definition

Table 6 - Mapping table for material_data UoF

Application element	AIM element	Source	Rules	Reference PATH
BULK_- THERMODYNAMIC_- PROPERTIES	thermophysical_property_classification	231	11, 24	thermophysical_property_classification <= group **{[group** **group.name = `bulk thermodynamic properties']** **[group <-** **group_assignment.assigned_group** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `property classification'}** **group_assignment =>** **applied_group_assignment** **applied_group_assignment.items[i] ->** **grouped_item** **grouped_item = representation_item** **representation_item]}**
heat_capacity_mass_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `heat capacity mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_capacity_mole_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `heat capacity mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
heat_of_fusion	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `heat of fusion'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_of_vaporization	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `heat of vaporization'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
ideal_gas_heat_- capacity_mass_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `ideal gas heat capacity mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
ideal_gas_heat_- capacity_mole_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `ideal gas heat capacity mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
specific_enthalpy_mass_- basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `specific enthalpy mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
specific_enthalpy_mole_-basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `specific enthalpy mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
specific_entropy_mass_-basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `specific entropy mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
specific_entropy_mole_-basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `specific entropy mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
bulk_thermodynamic_-properties to bulk_-thermophysical_-properties	PATH		11, 16, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item representation_item <- representation.items[i] representation **{representation** **representation.name = `bulk thermophysical properties'}**

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bulk_thermodynamic_-properties to reference_-state	PATH		11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item representation_item <- representation_item_relationship.related_representation_item representation_item_relationship representation_item_relationship.relating_representation_item ->> representation_item => compound_representation_item => reference_state
BULK_-THERMOPHYSICAL_-PROPERTIES	representation	43	16	**{representation representation.name = `bulk thermophysical properties'}**
bulk_thermophysical_-properties to material_-amount	PATH		8, 16, 17	representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property ->> resource_property resource_property.resource ->> characterized_resource_definition characterized_resource_definition = action_resource **{action_resource action_resource.kind ->> action_resource_type action_resource_type.name = `material amount'}** action_resource => stream

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bulk_thermophysical_-properties to material_-stream	PATH		8, 16, 17	representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property -> resource_property resource_property.resource -> characterized_resource_definition characterized_resource_definition = action_resource **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material stream'}** action_resource => stream
bulk_thermophysical_-properties to mixture	PATH		15, 16	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition
bulk_thermophysical_-properties to specific_-phase	PATH		8, 16, 17	representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property -> resource_property resource_property.resource -> characterized_resource_definition characterized_resource_definition = action_resource action_resource => specific_phase

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
BULK_VAPOUR_- LIQUID_- EQUILIBRIUM_- PROPERTIES	thermophysical_property_classification	231	11, 24	thermophysical_property_classification <= group **{[group** **group.name = `bulk vapour liquid equilibrium properties']** **[group <-** **group_assignment.assigned_group** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `property classification'}** **group_assignment =>** **applied_group_assignment** **applied_group_assignment.items[i] ->** **grouped_item** **grouped_item = representation_item** **representation_item]}**
bubble_point_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `bubble point pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bubble_point_- temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `bubble point temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
dew_point_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `dew point pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
dew_point_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `dew point temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
retrograde_dew_point_- pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `retrograde dew point pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vapour_quality	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `vapour quality'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
bulk_vapour_liquid_- equilibrium_properties to bulk_thermophysical_- properties	PATH		11, 16, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item representation_item <- representation.items[i] representation **{representation** **representation.name = `bulk thermophysical properties'}**

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
COMPONENT_IN_- MIXTURE_PROPERTIES	thermophysical_property_classification	231	11, 24	thermophysical_property_classification <= group **{[group** **group.name = `component in mixture properties']** **[group <-** **group_assignment.assigned_group** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `property classification'}** **group_assignment =>** **applied_group_assignment** **applied_group_assignment.items[i] ->** **grouped_item** **grouped_item = representation_item** **representation_item]}**
activity_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item group_item = representation_item **{representation_item** **representation_item.name = `activity coefficient'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
activity_coefficient_- pressure_correction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item group_item = representation_item **{representation_item** **representation_item.name = `activity coefficient pressure correction'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
diffusion_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item group_item = representation_item **{representation_item** **representation_item.name = `diffusion coefficient'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
fugacity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item group_item = representation_item **{representation_item** **representation_item.name = `fugacity'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
partial_molar_volume	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item group_item = representation_item **{representation_item** **representation_item.name = `partial molar volume'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
component_in_mixture_- properties to chemical_- component	PATH		11, 13, 14, 15, 16, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->> property_definition property_definition.definition ->> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition product_definition.formation ->> product_definition_formation product_definition_formation.of_product ->> product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->>** **group** **group.name = `chemical component'}**

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
component_in_mixture_-properties to single_-phase_thermophysical_-properties	PATH		11, 16, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] -> grouped_item grouped_item = representation_item representation_item <- representation.items[i] representation **{representation** **representation.name = `single phase thermophysical properties'}**
CONSTRUCTION_-MATERIAL	material_designation	45	11, 24	**{material_designation** **classified_item = material_designation** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `material usage classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `construction material'}**
construction_material to plant_item	PATH		14	material_designation material_designation.definitions[i] -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
DENSITY_PROPERTIES	thermophysical_property_classification	231	11, 24	thermophysical_property_classification <= group **{[group** **group.name = `density properties']** **[group <-** **group_assignment.assigned_group** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `property classification'}** **group_assignment =>** **applied_group_assignment** **applied_group_assignment.items[i] ->** **grouped_item** **grouped_item = representation_item** **representation_item]}**
average_molecular_- weight	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `average molecular weight'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
compressibility	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `compressibility'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
density_mass_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `density mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
density_mole_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `density mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
specific_volume_mass_-basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `specific volume mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
specific_volume_mole_-basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `specific volume mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
density_properties to bulk_thermophysical_-properties	PATH		11, 16, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item representation_item <- representation.items[i] representation **{representation** **representation.name = `bulk thermophysical properties'}**

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
density_properties to single_phase_-thermophysical_-properties	PATH		11, 16, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item representation_item <- representation.items[i] representation **{representation** **representation.name = `single phase thermophysical properties'}**
density_properties to transport_properties	PATH		11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> **{grouped_item** **grouped_item = representation_item** **representation_item}** grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `property classification'}** group_assignment group_assignment.assigned_group ->> **{group** **group.name = `transport properties'}** group => thermophysical_property_classification

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
EXCESS_PROPERTIES	thermophysical_property_classification	231	11, 24	thermophysical_property_classification <= group **{[group** **group.name = `excess properties']** **[group <-** **group_assignment.assigned_group** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `property classification'}** **group_assignment =>** **applied_group_assignment** **applied_group_assignment.items[i] ->** **grouped_item** **grouped_item = representation_item** **representation_item]}**
excess_enthalpy_mass_-basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `excess enthalpy mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
excess_enthalpy_mole_-basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `excess enthalpy mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
excess_entropy_mass_-basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `excess entropy mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
excess_entropy_mole_-basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `excess entropy mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
excess_gibbs_free_-energy_mass_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `excess gibbs free energy mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
excess_gibbs_free_- energy_mole_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `excess gibbs free energy mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
excess_helmholtz_free_- energy_mass_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `excess helmholtz free energy mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
excess_helmholtz_free_- energy_mole_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `excess helmholtz free energy mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
excess_properties to reference_state	PATH		11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item representation_item <- representation_item_relationship.related_representation_item representation_item_relationship representation_item_relationship.relating_representation_item ->> representation_item => compound_representation_item => reference_state

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
excess_properties to single_phase_-thermophysical_-properties	PATH		11, 16, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item representation_item <- representation.items[i] representation **{representation** **representation.name = `single phase thermophysical properties'}**
INTERPHASE_-THERMOPHYSICAL_-PROPERTIES	representation	43	8, 16, 17	**{[representation** **representation.name = `interphase thermophysical properties']** **[representation <-** **resource_property_representation.representation** **resource_property_representation** **resource_property_representation.property ->** **resource_property** **resource_property.resource ->** **characterized_resource_definition** **characterized_resource_definition = action_resource** **action_resource =>** **interphase]}**
surface_tension	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->> **{representation_item** **representation_item.name = `surface tension'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
interphase_- thermophysical_- properties to specific_- phase	PATH		8, 16, 17	representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property -> resource_property resource_property.resource -> characterized_resource_definition characterized_resource_definition = action_resource action_resource => interphase <= action_resource_relationship [action_resource_relationship.related_resource ->] [action_resource_relationship.relating_resource ->] action_resource => specific_phase
MATERIAL	(process_material) (material_designation)	231 45	13, 14	(process_material <= [action_resource] [product_definition])
description	(product.description)	41	13, 14	(process_material <= product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product product.description)
name	(product.name) (material_designation.name)	41 45	13, 14	(process_material <= product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product product.name)

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
material to process_-design_property_value	PATH		14, 16	process_material <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation => process_design_property_value
MATERIAL_AMOUNT	action_resource	41	8	**{action_resource action_resource.kind -> action_resource_type action_resource_type.name = `material amount'}**
description	action_resource.description	41		

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mass	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mass'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
material_amount_name	action_resource.name	41		

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
moles	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `molecular quantity'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
volume	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	action_resource characterized_resource_property = action_resource characterized_resource_property <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `volume'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
material_amount to process_simulation	PATH		8	action_resource action_resource.usage[i] ->> supported_item supported_item = action action action.chosen_method -> action_method => process_simulation
material_amount to process_unit_operation	PATH		5, 8, 11, 24	action_resource action_resource.usage[i] -> supported_item supported_item = action action action.chosen_method -> action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `process unit operation'}**

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
material_amount to thermodynamic_-condition	PATH		8, 16	action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation condition_definition = resource_property_representation condition_definition <- data_environment.elements[i] data_environment => thermodynamic_condition
MATERIAL_COST	representation	43	16	**{representation** **representation.name = `material cost'}**
average_cost	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `average cost'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
cost_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `cost basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
material_cost to process_material	PATH		14, 15, 16	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition => process_material
material_cost to site	PATH		9, 15, 16	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_object characterized_object => site

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
material_cost to site_-standard_conditions	PATH		15, 16	representation <- property_definition_representation.used_representation property_definition_representation => material_property_representation material_property_representation.dependent_environment -> data_environment data_environment.elements[i] -> property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition => site_standard_condition
material_cost to thermodynamic_-condition	PATH		16	representation <- property_definition_representation.used_representation property_definition_representation condition_definition = property_definition_representation condition_definition <- data_environment.elements[i] data_environment => thermodynamic_condition
PHASE_-DISTRIBUTION_-COEFFICIENT	representation	43	16	**{representation representation.name = `phase distribution coefficient'}**
coefficient_type	representation_item.name	43	16	representation representation.items[i] -> representation_item representation_item.name **{(representation_item.name = `K value') (representation_item.name = `partition coefficient')}**

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
value	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **(representation_item.name = `K value')** **(representation_item.name = `partition coefficient')}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
phase_distribution_- coefficient to chemical_- component	PATH		11, 13, 14, 15, 16, 24	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->>br>represented_definition represented_definition = property_definition property_definition property_definition.definition ->>br>characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition product_definition.formation ->>br>product_definition_formation product_definition_formation.of_product ->>br>product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `chemical component'}**

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
phase_distribution_- coefficient to specific_- phase (as heavy phase)	PATH		8, 16, 17	representation <- resource_property_representation.representation **{resource_property_representation** **resource_property_representation.name = `heavy phase'}** resource_property_representation resource_property_representation.property -> resource_property resource_property.resource -> characterized_resource_definition characterized_resource_definition = action_resource action_resource => specific_phase
phase_distribution_- coefficient to specific_- phase (as light phase)	PATH		8, 16, 17	representation <- resource_property_representation.representation **{resource_property_representation** **resource_property_representation.name = `light phase'}** resource_property_representation resource_property_representation.property -> resource_property resource_property.resource -> characterized_resource_definition characterized_resource_definition = action_resource action_resource => specific_phase
PROCESS_DESIGN_- PROPERTY_- VARIABLE_USAGE	measure_representation_item	45		

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
dependent_independent_-or_fixed	group.name	41	11, 24	measure_representation_item <= representation_item grouped_item = representation_item grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `variable usage'}** group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `dependent')** **(group.name = `independent')** **(group.name = `fixed')}**
process_design_-property_variable_usage to item_property_-reference	PATH		16	measure_representation_item <= representation_item <- representation.items[i] representation <- representation_relationship.rep_1 **{representation_relationship** **representation_relationship.name = `over-riding property value'}** representation_relationship representation_relationship.rep_2 -> representation **{representation** **representation.name = `item property reference'}**
process_design_-property_variable_usage to process_design_-property_value	PATH		16	measure_representation_item <= representation_item <- representation.items[i] representation => process_design_property_value

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
process_design_-property_variable_usage to process_property_-curve	PATH		16	measure_representation_item <= representation_item <- representation.items[i] representation => data_curve
process_design_-property_variable_usage to process_property_-curve_point	PATH		16	measure_representation_item <= representation_item => compound_representation_item
PROCESS_MATERIAL	process_material	231	11	process_material <= [action_resource] [product_definition]
class	group.name	41	11, 24	process_material grouped_item = process_material grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `material usage'}** group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `ambient process material')** **(group.name = `internal process material')** **(group.name = `product process material')** **(group.name = `raw process material')** **(group.name = `unspecified process material')** **(group.name = `utility process material')** **(group.name = `waste process material')}**

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
process_material to material_amount	PATH		8	process_material <= action_resource <- action_resource_relationship.relating_resource **{action_resource_relationship** **action_resource_relationship.name = `material usage'}** action_resource_relationship action_resource_relationship.related_resource ->** action_resource **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material amount'}**
process_material to material_stream	PATH		8	process_material <= action_resource <- action_resource_relationship.related_resource **{action_resource_relationship** **action_resource_relationship.name = `material usage'}** action_resource_relationship action_resource_relationship.relating_resource ->** **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material stream'}** action_resource => stream
PROCESS_PROPERTY_-CURVE	data_curve	231	16	data_curve <= representation
curve_name	representation.name	43	16	data_curve <= representation representation.name

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
process_property_curve to material_stream	PATH		8, 16, 17	data_curve <= representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property ->> resource_property resource_property.resource ->> characterized_resource_definition characterized_resource_definition = action_resource **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material stream'}** action_resource => stream
process_property_curve to process_material	PATH		8, 16, 17	data_curve <= representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property ->> resource_property resource_property.resource ->> characterized_resource_definition characterized_resource_definition = action_resource action_resource => process_material

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
process_property_curve to process_unit_operation	PATH		5, 8, 11, 16, 17, 24	data_curve <= representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property ->>br>resource_property resource_property.resource ->>br>characterized_resource_definition characterized_resource_definition = action_resource action_resource action_resource.usage[i] ->>br>supported_item supported_item = action action action.chosen_method ->>br>action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `process unit operation'}**
PROCESS_PROPERTY_-CURVE_POINT	compound_representation_item	43	16	**{compound_representation_item <=** **representation_item =>** **measure_representation_item}**
process_property_curve_-point to process_-property_curve	PATH		16	compound_representation_item <= representation_item <- representation.items[i] representation =>>br>data_curve

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SINGLE_PHASE_- THERMOPHYSICAL_- PROPERTIES	representation	43	16	**{representation** **representation.name = `single phase thermophysical properties'}**
single_phase_- thermophysical_- properties to material_- amount	PATH		8, 16, 17	representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property ->resource_property resource_property.resource ->characterized_resource_definition characterized_resource_definition = action_resource action_resource **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material amount'}**
single_phase_- thermophysical_- properties to material_- stream	PATH		8, 16, 17	representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property ->resource_property resource_property.resource ->characterized_resource_definition characterized_resource_definition = action_resource **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material stream'}** action_resource => stream

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
single_phase_- thermophysical_- properties to mixture	PATH		11, 13, 14, 15, 16, 24	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `mixture'}
single_phase_- thermophysical_- properties to phase	PATH		16, 24	representation representation.items[i] -> representation_item grouped_item = representation_item grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group => phase

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
single_phase_- thermophysical_- properties to specific_- phase	PATH		8, 16, 17	representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property -> resource_property resource_property.resource -> characterized_resource_definition characterized_resource_definition = action_resource action_resource => specific_phase
THERMODYNAMIC_- CONDITION	thermodynamic_condition	231		thermodynamic_condition <= data_environment
description	data_environment.description	45		thermodynamic_condition <= data_environment data_environment.description
enthalpy	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	thermodynamic_condition <= data_environment data_environment.elements[i] -> condition_definition condition_definition = property_definition_representation property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `enthalpy'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	thermodynamic_condition <= data_environment data_environment.elements[i] ->> condition_definition condition_definition = property_definition_representation property_definition_representation property_definition_representation.used_representation ->> representation representation.items[i] ->> **{representation_item** **representation_item.name = `pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	thermodynamic_condition <= data_environment data_environment.elements[i] ->> condition_definition condition_definition = property_definition_representation property_definition_representation property_definition_representation.used_representation ->> representation representation.items[i] ->> **{representation_item** **representation_item.name = `temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thermodynamic_- condition to process_- design_property_value	PATH		16	thermodynamic_condition <= data_environment data_environment.elements[i] ->> condition_definition condition_definition = property_definition_representation property_definition_representation property_definition_representation.used_representation ->> representation => process_design_property_value
THERMODYNAMIC_- PROPERTIES	thermophysical_property_classification	231	11, 24	thermophysical_property_classification <= group **{[group** **group.name = `thermodynamic properties']** **[group <-** **group_assignment.assigned_group** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `property classification'}** **group_assignment =>** **applied_group_assignment** **applied_group_assignment.items[i] ->** **grouped_item** **grouped_item = representation_item** **representation_item]}**

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_capacity_constant_- pressure_mole_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `heat capacity constant pressure mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
heat_capacity_constant_- volume_mass_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `heat capacity constant volume mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_capacity_ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `heat capacity ratio'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
specific_gibbs_free_- energy_mass_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `specific gibbs free energy mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
specific_gibbs_free_- energy_mole_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `specific gibbs free energy mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
specific_helmholtz_free_- energy_mass_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `specific helmholtz free energy mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
specific_helmholtz_free_- energy_mole_basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `specific helmholtz free energy mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
specific_enthalpy_mass_- basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `specific enthalpy mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
specific_enthalpy_mole_-basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `specific enthalpy mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
specific_entropy_mass_-basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `specific entropy mass basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
specific_entropy_mole_- basis	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `specific entropy mole basis'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thermodynamic_- properties to chemical_- component	PATH		11, 13, 14, 15, 16, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->> property_definition property_definition.definition ->> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition product_definition.formation ->> product_definition_formation product_definition_formation.of_product ->> product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->>** **group** **group.name = `chemical component'}**

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thermodynamic_- properties to reference_- state	PATH		11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item representation_item <- representation_item_relationship.related_representation_item representation_item_relationship representation_item_relationship.relating_representation_item ->> representation_item => compound_representation_item => reference_state
thermodynamic_- properties to single_- phase_thermophysical_- properties	PATH		11, 16, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item representation_item <- representation.items[i] representation **{representation** **representation.name = `single phase thermophysical properties'}**

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
TRANSPORT_- PROPERTIES	thermophysical_property_classification	231	11, 24	thermophysical_property_classification <= group **{[group** **group.name = `transport properties']** **[group <-** **group_assignment.assigned_group** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `property classification'}** **group_assignment =>** **applied_group_assignment** **applied_group_assignment.items[i] ->** **grouped_item** **grouped_item = representation_item** **representation_item]}**
thermal_conductivity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `thermal conductivity'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **electric_current_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 6 - Mapping table for material_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
viscosity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	11, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item **{representation_item** **representation_item.name = `viscosity'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
transport_properties to bulk_thermophysical_-properties	PATH		11, 16, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item representation_item <- representation.items[i] representation **{representation** **representation.name = `bulk thermophysical properties'}**

Table 6 - Mapping table for material_data UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
transport_properties to single_phase_-thermophysical_-properties	PATH		11, 16, 24	thermophysical_property_classification <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation_item representation_item <- representation.items[i] representation **{representation** **representation.name = `single phase thermophysical properties'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF

Application element	AIM element	Source	Rules	Reference PATH
CC_BALANCE_PISTON	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `equipment component type'} group_assignment group_assignment.assigned_group -> [group group.name = `centrifugal compressor balance piston'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `mechanical equipment component'} group_relationship group_relationship.relating_group -> group group.name = `mechanical component']}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
area	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `area'}** representation_item => descriptive_representation_item descriptive_representation_item.description
fixation_method	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `fixation method'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cc_balance_piston to centrifugal_compressor	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal compressor'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CC_CASING	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `equipment component type'} group_assignment group_assignment.assigned_group -> [group group.name = `centrifugal compressor casing'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `mechanical equipment component'} group_relationship group_relationship.relating_group -> group group.name = `mechanical component']}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
casing_split_seal	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `casing split seal'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
corrosion_allowance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `corrosion allowance'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_casing_- capacity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum casing capacity'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_number_- impellers	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum number of impellers'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_operating_- temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum operating temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_working_- pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum working pressure'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
minimum_operating_- temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `minimum operating temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
radiograph_quality	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `radiograph quality'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `radiography used')** **(descriptive_representation_item.description = `radiography not used')}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
split	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `split'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
test_pressure_helium	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `test pressure helium'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
test_pressure_hydrostatic	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `test pressure hydrostatic'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cc_casing to centrifugal_-compressor	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal compressor'}**
CC_CRITICAL_SPEED	representation	43	16	**{representation** **(representation.name = `torsional critical speed')** **(representation.name = `lateral critical speed')}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
level	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `level'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `first')** **(descriptive_representation_item.description = `second')** **(descriptive_representation_item.description = `third')** **(descriptive_representation_item.description = `fourth')}**
type	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `speed type'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CC_DIAPHRAGM	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `equipment component type'} group_assignment group_assignment.assigned_group -> [group group.name = `centrifugal compressor diaphragm'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `mechanical equipment component'} group_relationship group_relationship.relating_group -> group group.name = `mechanical component']}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cc_diaphragm to centrifugal_compressor	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal compressor'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CC_IMPELLER	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `equipment component type'} group_assignment group_assignment.assigned_group -> [group group.name = `centrifugal compressor impeller'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `mechanical equipment component'} group_relationship group_relationship.relating_group -> group group.name = `mechanical component']}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
fabrication_type	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `fabrication type'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
impeller_number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `impeller number'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_head_at_- rated_speed	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum head at rated speed'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_mach_at_eye	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum mach at eye'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_vanes	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of vanes'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
smallest_tip_internal_- width	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `smallest tip internal width'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tip_speed_at_maximum_- continuous_speed	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tip speed at maximum continuous speed'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tip_speed_at_rated_speed	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tip speed at rated speed'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cc-impeller type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `enclosed')** **(descriptive_representation_item.description = `open')}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cc_impeller to centrifugal_compressor	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal compressor'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cc_impeller to centrifugal_compressor_-stage	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal compressor stage'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CC_LABYRINTH	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `equipment component type'} group_assignment group_assignment.assigned_group -> [group group.name = `centrifugal compressor labyrinth'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `mechanical equipment component'} group_relationship group_relationship.relating_group -> group group.name = `mechanical component']}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
location	(descriptive_representation_- item.description) (axis2_placement_2d) (axis2_placement_3d)	45 42 42	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `location'}** representation_item => (descriptive_representation_item descriptive_representation_item.description) (geometric_representation_item => placement => (axis2_placement_2d) (axis2_placement_3d))

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cc_labyrinth to centrifugal_compressor	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal compressor'}**
CC_LATERAL_-CRITICAL_SPEED	representation	43	16	**{representation** **representation.name = `lateral critical speed'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
damped	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `damped'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
lateral_basis	descriptive_representation_- item.description	45	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `lateral basis'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `damped')** **(descriptive_representation_item.description = `other')** **(descriptive_representation_item.description = `shop test')** **(descriptive_representation_item.description = `unbalance')}**
mode_shape	descriptive_representation_- item.description	45	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `mode shape'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
undamped	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `undamped'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cc_lateral_critical_speed to centrifugal_compressor	PATH		11, 13, 14, 15, 16, 24	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal compressor'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CC_MISCELLANEOUS	product_definition	41	13, 14, 24	**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}**
optical_alignment_flats_-required	descriptive_representation_-item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `optical alignment flats required'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pipe_diameter_before_- suction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pipe diameter before suction'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
provision_for_water_- wash_before_open_- casing	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `provision for water wash before open casing'}** representation_item => descriptive_representation_item descriptive_representation_item.description
torsional_analysis_- report_required	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `torsional analysis report required'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vendor_review_of_- piping_and_foundation_- required	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `vendor review of piping and foundation required'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cc_miscellaneous to centrifugal_compressor	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal compressor'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CC_SHAFT_SLEEVE	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `equipment component type'} group_assignment group_assignment.assigned_group -> [group group.name = `centrifugal compressor shaft sleeve'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `mechanical equipment component'} group_relationship group_relationship.relating_group -> group group.name = `mechanical component']}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
location	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `location'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `interstage')** **(descriptive_representation_item.description = `shaft seals')}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cc_shaft_sleeve to centrifugal_compressor	PATH		11, 13, 1424	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->** **product_definition** **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal compressor'}**
CC_SPEED_CONTROL_-METHOD	representation	43	16	**{representation** **representation.name = `speed control method'}**
anti_surge_bypass	descriptive_representation_-item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `anti-surge bypass'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `automatic')** **(descriptive_representation_item.description = `manual')}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bypass	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item representation_item.name = `bypass'}** representation_item => descriptive_representation_item descriptive_representation_item.description
other_speed_control_- method	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item representation_item.name = `speed control method'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
speed_range	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `speed range'}** representation_item => compound_representation_item compound_representation_item.item_element ->** **compound_item_definition compound_item_definition = list_representation_item list_representation_item list_representation_item[i] ->** **representation_item => measure_representation_item <= {measure_with_unit [measure_with_unit.value_component ->** **measure_value measure_value = ratio_measure ratio_measure] [measure_with_unit.unit_component ->** **unit unit = derived_unit derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
suction_throttling	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `suction throttling'}** representation_item => compound_representation_item compound_representation_item.item_element ->** compound_item_definition compound_item_definition = list_representation_item list_representation_item list_representation_item[i] ->** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cc_speed_control_- method to centrifugal_- compressor	PATH		11, 13, 14, 15, 16, 24	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->> represented_definition represented_definition = property_definition property_definition property_definition.definition ->> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal compressor'}**
CC_SPEED_CONTROL_- SIGNAL	representation	43	16	**{representation** **representation.name = `speed control signal'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
range_other	[[measure_with_unit.value_component] [measure_with_unit.unit_component]] [[measure_with_unit.value_component] [measure_with_unit.unit_component]]	41 41 41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `range other'}** representation_item => compound_representation_item compound_representation_item.item_element ->compound_item_definition compound_item_definition = list_representation_item list_representation_item list_representation_item[i] ->representation_item => compound_representation_item compound_representation_item.item_element ->compound_item_definition compound_item_definition = list_representation_item list_representation_item [list_representation_item[1] ->**{representation_item** **representation_item.name = `required speed'}** representation_item => measure_representation_item <=measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]] [list_representation_item[2] ->**{representation_item** **representation_item.name = `control signal value'}** representation_item => measure_representation_item <=measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
range_pneumatic_control	[[measure_with_unit.value_component] [measure_with_unit.unit_component]] [[measure_with_unit.value_component] [measure_with_unit.unit_component]]	41 41 41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `range pneumatic control'}** representation_item => compound_representation_item compound_representation_item.item_element ->compound_item_definition compound_item_definition = list_representation_item list_representation_item list_representation_item[i] ->representation_item => compound_representation_item compound_representation_item.item_element ->compound_item_definition compound_item_definition = list_representation_item list_representation_item [list_representation_item[1] ->**{representation_item** **representation_item.name = `desired speed'}** representation_item => measure_representation_item <=measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]] [list_representation_item[2] ->**{representation_item** **representation_item.name = `control signal value'}** representation_item => measure_representation_item <=measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
source	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item representation_item.name = `location'}** representation_item => descriptive_representation_item descriptive_representation_item.description
type	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item representation_item.name = `signal type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `analog') (descriptive_representation_item.description = `digital')}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cc_speed_control_signal to centrifugal_compressor	PATH		11, 13, 14, 15, 16, 24	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal compressor'}**
CC_TORSIONAL_-CRITICAL_SPEED	representation	43	16	**{representation** **representation.name = `torsional critical speed'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cc_torsion_critical_speed to centrifugal_compressor	PATH		11, 13, 14, 15, 16, 24	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal compressor'}**
CC_WEIGHTS	representation	43	16	**{representation** **representation.name = `weights'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
compressor_upper_case	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `compressor upper case'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
compressor_only	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `compressor only'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
rotor_compressor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `rotor compressor'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
rotor_driver	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `rotor driver'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
rotor_gear	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `rotor gear'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cc_weights to centrifugal_compressor	PATH		11, 13, 14, 15, 16, 24	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal compressor'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CENTRIFUGAL_-COMPRESSOR	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `equipment type'} group_assignment group_assignment.assigned_group -> group group.name = `centrifugal compressor'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
estimated_surge	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `estimated surge'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
guarantee_point	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `guarantee point'}** representation_item => compound_representation_item compound_representation_item.item_element -> compound_item_definition compound_item_definition = list_representation list_representation list_representation_item[i] -> representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
manufacturer_- performance_curve_- number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `manufacturer performance curve number'}** representation_item => compound_representation_item compound_representation_item.item_element -> compound_item_definition compound_item_definition = list_representation list_representation list_representation_item[i] -> representation_item => compound_representation_item compound_representation_item.item_element -> compound_item_definition compound_item_definition = list_representation list_representation list_representation_item[i] -> representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_stages	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of stages'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
speed_trip	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `speed trip'}** representation_item => **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
centrifugal_compressor to buffer_gas_system	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship** **product_definition_relationship.name = `shaft seal component'}** product_definition_relationship product_definition_relationship.relating_product_definition ->** product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `buffer gas system'}**
CENTRIFUGAL_-COMPRESSOR_STAGE	product_definition	41	11, 13, 14, 24	**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal compressor stage'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stage_number	product_definition.name	41	15	
centrifugal_compressor_-stage to centrifugal_-compressor	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `compressor stage']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->** product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal compressor'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CENTRIFUGAL_PUMP	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `centrifugal pump'}**
corrosion_erosion_-caused_by	descriptive_representation_-item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `corrosion erosion cause'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
npsh_available	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `npsh available'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
npsh_required	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `npsh required'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
proposal_curve_number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `proposal curve number'}** representation_item => compound_representation_item compound_representation_item.item_element -> compound_item_definition compound_item_definition = list_representation list_representation list_representation_item[i] -> representation_item => compound_representation_item compound_representation_item.item_element -> compound_item_definition compound_item_definition = list_representation list_representation list_representation_item[i] -> representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
speed_rpm	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `speed rpm'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
suction_specific_speed	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `centrifugal pump suction specific speed'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
centrifugal_pump to mechanical_seal	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.relating_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.related_product_definition ->>br>product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `mechanical seal'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
centrifugal_pump to pump_casing	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition -> product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `pump casing'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
centrifugal_pump to pump_gland	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `pump gland'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
centrifugal_pump to pump_impeller	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition -> product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `pump impeller'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
centrifugal_pump to pump_packing	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.relating_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.related_product_definition ->>br>product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `pump packing'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
FLUID_TRANSFER_-MACHINE	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `equipment type'} group_assignment group_assignment.assigned_group -> group group.name = `fluid transfer machine'}**
type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment group_assignment.role -> group_role group_role.name = `fluid transfer machine type'}** group_assignment group_assignment.assigned_group -> group group.name

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
GAS_TRANSFER_-MACHINE	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `equipment type'} group_assignment group_assignment.assigned_group -> group group.name = `gas transfer machine'}**
type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment group_assignment.role -> group_role group_role.name = `gas transfer machine type'}** group_assignment group_assignment.assigned_group -> group group.name

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
isentropic_efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `isentropic efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
MATERIAL_- TRANSFER_- EQUIPMENT	product_definition	41	11, 13, 14, 24	**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `material transfer machine'}**
type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation ->product_definition_formation product_definition_formation.of_product ->product classified_item = product classified_item <-classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `material transfer machine type'}** group_assignment group_assignment.assigned_group ->group group.name

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
POSITIVE_- DISPLACEMENT_- COMPRESSOR	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `positive displacement compressor']** **[group <-** **group_relationship.related_group** **{group_relationship** **group_relationship.name = `machine type'}** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `gas transfer machine']}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
positive_displacement_- compressor_type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation ->** product_definition_formation product_definition_formation.of_product ->** product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment group_assignment.role ->** **group_role group_role.name = `positive displacement compressor type'}** group_assignment group_assignment.assigned_group ->** group group.name

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
volumetric_efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `volumetric efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PUMP	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `equipment component type'} group_assignment group_assignment.assigned_group -> [group group.name = `pump'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `positive displacement compressor']}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `pump type'}** group_assignment group_assignment.assigned_group -> group group.name
PUMP_CASING	product_definition	41	11, 13, 14, 24	**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `pump casing'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mount	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mount'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `bracket')** **(descriptive_representation_item.description = `centreline')** **(descriptive_representation_item.description = `foot')** **(descriptive_representation_item.description = `inline')** **(descriptive_representation_item.description = `near centreline')** **(descriptive_representation_item.description = `sump')** **(descriptive_representation_item.description = `vertical')** **(descriptive_representation_item.description = `vertical barrel')}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
split	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `split'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `axial')** **(descriptive_representation_item.description = `radial')}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation ->
product_definition_formation product_definition_formation.of_product ->
product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->
group <- group_relationship.relating_group **{group_relationship** **group_relationship.name = `pump casing type'}** group_relationship group_relationship.related_group ->
group group.name **{(group.name = `diffuser')** **(group.name = `double volute')** **(group.name = `single volute')** **(group.name = `staggered volute')}**
PUMP_CASING_TEST	representation	43	16	**{representation** **representation.name = `pump casing test'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hydraulic_test_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `hydraulic test pressure'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
location	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `location'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `inner')** **(descriptive_representation_item.description = `outer')}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_allowable_- pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `pump casing test maximum allowable pressure'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pump_casing_test to pump_casing	PATH		11, 13, 14, 15, 16, 24	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `pump casing'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PUMP_GLAND	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `equipment component type'} group_assignment group_assignment.assigned_group -> [group group.name = `pump gland'] [group <- group_relationship.related_group {group_relationship group_relationship.name = `mechanical component type'} group_relationship group_relationship.relating_group -> group group.name = `mechanical component']}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PUMP_GLAND_TAPS	product_definition	41	11, 13, 14, 24	**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `pump gland taps'}**
pump_gland_taps_- number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14	product_definition <- product_definition_relationship.related_product_definition product_definition_relationship => product_definition_usage => assembly_component_usage => quantified_assembly_component_usage quantified_assembly_component_usage.quantity -> measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pump_gland_taps_type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation ->
product_definition_formation product_definition_formation.of_product ->
product classified_item = product classified_item <-
classification_assignment.items[i] classification_assignment <=
{group_assignment **group_assignment.role ->**
group_role **group_role.name = `pump gland taps type'}**
group_assignment group_assignment.assigned_group ->
group group.name

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pump_gland_taps to pump_gland	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.relating_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition -> product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `pump gland'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PUMP_IMPELLER	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `equipment component type'} group_assignment group_assignment.assigned_group -> group group.name = `pump impeller'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mount	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mount'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `between bearings')** **(descriptive_representation_item.description = `overhung')}**
PUMP_PACKING	product_definition	41	11, 13, 14, 24	**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `pump packing'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_rings	[measure_with_value.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of rings'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
RECIPROCATING_- COMPRESSOR	product_definition	41	11, 13, 14, 24	**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `reciprocating compressor'}**
number_of_stages	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14	product_definition <- product_definition_relationship.relating_product_definition product_definition_relationship => product_definition_usage => assembly_component_usage => quantified_assembly_component_usage quantified_assembly_component_usage.quantity ->> measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
RECIPROCATING_- COMPRESSOR_STAGE	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `reciprocating compressor stage'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
clearance_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `clearance fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
displacement	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `displacement'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stage_number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `stage number'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `reciprocating compressor stage type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `diaphragm')** **(descriptive_representation_item.description = `piston')}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reciprocating_- compressor_stage to reciprocating_compressor	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{[product_definition_relationship** **product_definition_relationship.name = `compressor stage']** **[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]}** product_definition_relationship product_definition_relationship.relating_product_definition ->** product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment component type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `reciprocating compressor'}**
SERVICE_- CONNECTIONS	property_definition	41	15	**{property_definition** **property_definition.description = `service connection'}**

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
casing_drain	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `casing drain'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
connection_between_- bearing_and_seal	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `connection between bearing and seal'}** representation_item => descriptive_representation_item descriptive_representation_item.description
connection_between_- seal_and_fluid	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `connection between seal and fluid'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
connection_bearing_- housing_purge	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `connection bearing housing purge'}** representation_item => descriptive_representation_item descriptive_representation_item.description
cooling_water	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cooling water'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
lubrication_oil_inlet	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `lubrication oil inlet'}** representation_item => descriptive_representation_item descriptive_representation_item.description
lubrication_oil_outlet	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `lubrication_oil_outlet'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_tap	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure tap'}** representation_item => descriptive_representation_item descriptive_representation_item.description
seal_oil_inlet	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `seal_oil_inlet'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
seal_oil_outlet	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `seal oil outlet'}** representation_item => descriptive_representation_item descriptive_representation_item.description
solvent_injection	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `solvent injection'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stage_drain	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `stage drain'}** representation_item => descriptive_representation_item descriptive_representation_item.description
temperature_tap	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `temperature tap'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vents	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `vents'}** representation_item => descriptive_representation_item descriptive_representation_item.description
warm_up	descriptive_representation_- item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `warm up'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 7 - Mapping table for material_transfer_equipment_data UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
SERVICE_- CONNECTIONS TO FLUID_TRANSFER_- MACHINE	PATH		11, 13, 14, 15, 24	property_definition property_definition.definition ->** characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition product_definition.formation ->** **product_definition_formation product_definition_formation.of_product ->** **product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `equipment type'} group_assignment group_assignment.assigned_group ->** **group group.name = `fluid transfer machine'}**

Table 8 - Mapping table for plant_context UoF

Application element	AIM element	Source	Rules	Reference PATH
ABSOLUTE_TIME_- REFERENCE	(plant_item_reference_time) (site_reference_time) (process_definition_reference_time) (process_simulation_reference_time) (material_amount_reference_time) (process_material_reference_time) (stream_reference_time)	231 231 231 231 231 231 231	7, 15, 17	((plant_item_reference_time <=) (site_reference_time <=) property_definition **{property_definition** **property_definition.description = `absolute'}**) ((process_definition_reference_time <=) (process_simulation_reference_time <=) action_property **{action_property** **action_property.description = `absolute'}**) ((material_amount_reference_time <=) (process_material_reference_time <=) (stream_reference_time <=) resource_property **{resource_property** **resource_property.description = `absolute'}**)

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
absolute_time_name	identification_assignment.assigned_id	41	7, 15, 17, 25	((plant_item_reference_time <=) (site_reference_time <=) property_definition identified_item = property_definition) ((process_definition_reference_time <=) (process_simulation_reference_time <=) action_property identified_item = action_property) ((material_amount_reference_time <=) (process_material_reference_time <=) (stream_reference_time <=) resource_property identified_item = resource_property) identified_item <- applied_identification_assignment.items[i] applied_identification_assignment <= **{identification_assignment** **identification_assignment.role ->** **identification_role** **identification_role.name = `absolute time name'}** identification_assignment identification_assignment.assigned_id
CLOCK_TIME	date_and_time	41		
hour	local_time.hour_component	41		date_and_time date_and_time.time_component ->local_time local_time.hour_component
minute	local_time.minute_component	41		date_and_time date_and_time.time_component ->local_time local_time.minute_component
second	local_time.second_component	41		date_and_time date_and_time.time_component ->local_time local_time.second_component

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
time_zone	local_time.zone	41		date_and_time date_and_time.time_component ->local_time local_time.zone
clock_time to date	PATH			date_and_time date_and_time.date_component ->date
DATE	date	41		
day	calendar_date.day_component	41		date => calendar_date calendar_date.day_component
month	calendar_date.month_component	41		date => calendar_date calendar_date.month_component
year	date.year_component	41		
ELECTRICAL_-SERVICE	representation	43	16	**{representation** **representation.name = `electrical service'}**
continuous_current_-demand	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `continuous current demand'}** representation_item => measure_representation_item <=measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
current_category	descriptive_representation_item.description	45	16	representation representation.items[i] ->** **{representation_item representation_item.name = `current category'}** representation_item => descriptive_representation_item descriptive_representation_item.description
line_voltage	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item representation_item.name = `line voltage'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
number_of_phases	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->** **{representation_item representation_item.name = `number of phases'}** representation_item => measure_representation_item <= **{measure_with_unit measure_with_unit.value_component ->** **measure_value measure_value = count_measure count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
peak_current_demand	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `peak current demand'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
EXTERNAL_-CLASSIFICATION	externally_defined_classification	231	10, 11	externally_defined_classification <= [group] [externally_defined_item]
description	group.description	41	11	externally_defined_classification <= group group.description
name	group.name	41	11	externally_defined_classification <= group group.name
source	external_source.source_id	41	10	externally_defined_classification <= externally_defined_item externally_defined_item.source ->external_source external_source.source_id

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
external_classification to plant_item	PATH		11, 14	externally_defined_classification <= group <- group_assignment.assigned_group group_assignment => classification_assignment classification_assignment.items[i] -> classified_item classified_item = product_definition (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)
external_classification to plant_system	PATH		4, 11, 14	externally_defined_classification <= group <- group_assignment.assigned_group group_assignment => classification_assignment classification_assignment.items[i] -> classified_item classified_item = product_definition (product_definition **{product_definition** **product_definition.frame_of_reference ->** **product_definition_context <=** **application_context_element** **application_context_element.name = `functional occurrence'}**) (product_definition => instrumentation_and_control_system) (product_definition => process_design_case_resource) (product_definition => externally_defined_plant_system)
EXTERNAL_-REFERENCE	external_source	41		
name	external_source.description	41		

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
source	external_source.source_id	41		**{external_source external_source.source_id ->** **source_item** **source_item = identifier** **identifier}**
external_reference to plant_item	PATH			external_source <- externally_defined_item.source externally_defined_item => externally_defined_plant_item_definition
external_reference to plant_system	PATH			external_source <- externally_defined_item.source externally_defined_item => externally_defined_plant_system
external_reference to process_definition	PATH			external_source <- externally_defined_item.source externally_defined_item => externally_defined_action_method <= action_method
ITEM_PROPERTY_-REFERENCE	representation	43	16	**{[representation** **representation.name = `item property reference']** **[representation <-** **representation_relationship.rep_2** **representation_relationship** **representation_relationship.name = `over-riding property value']}**
item_property_-reference to process_-design_property_value	PATH			representation <- representation_relationship.rep_1 representation_relationship representation_relationship.rep_2 -> representation => process_design_property_value

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
item_property_- reference to referenced_object	PATH		7, 15, 16, 17	representation <- (property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->) represented_definition represented_definition = property_definition property_definition property_definition.definition) (action_property_representation.representation action_property_representation action_property_representation.property ->) action_property action_property.definition) (resource_property_representation.representation resource_property_representation resource_property_representation.property ->) resource_property resource_property.resource)
LOCATION_IN_PLANT	(axis2_placement_2d) (axis2_placement_3d)	42 42		

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
location_in_plant to plant	PATH		4, 14, 15, 16	(axis2_placement_2d <=) (axis2_placement_3d <=) placement <= geometric_representation_item <= representation_item <- representation.items[i] **{representation =>** **shape_representation}** representation <- property_definition_representation.used_representation **{property_definition_representation =>** **shape_definition_representation}** property_definition_representation property_definition_representation.definition ->** **represented_definition represented_definition = property_definition **{property_definition =>** **product_definition_shape}** property_definition property_definition.definition ->** **characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.frame_of_reference ->** **product_definition_context <=** **application_context_element** **application_context_element.name = `physical occurrence'}** product_definition product_definition.formation ->** **product_definition_formation product_definition_formation.of_product ->** **product =>** **plant**
LOCATION_IN_SITE	(axis2_placement_2d) (axis2_placement_3d)	42 42		

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
location_in_site to site	PATH		9, 15, 16	(axis2_placement_2d <=) (axis2_placement_3d <=) placement <= geometric_representation_item <= representation_item <- representation.items[i] **{representation =>** **shape_representation}** representation <- property_definition_representation.used_representation **{property_definition_representation =>** **shape_definition_representation}** property_definition_representation property_definition_representation.definition ->** **represented_definition represented_definition = property_definition **{property_definition =>** **product_definition_shape}** property_definition property_definition.definition ->** **characterized_definition characterized_definition = characterized_object characterized_object =>** **site**
MATERIAL_- AMOUNT_- REFERENCE_TIME	material_amount_reference_time	231	17	material_amount_reference_time <= resource_property
material_amount_- reference_time to material_amount	PATH		8, 17	material_amount_reference_time <= resource_property resource_property.resource ->** **characterized_resource_definition characterized_resource_definition = action_resource action_resource **{action_resource action_resource.kind ->** **action_resource_type action_resource_type.name = `material amount'}**

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
material_amount_-reference_time to process_design_-property_value	PATH		16, 17	material_amount_reference_time <= resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation => process_design_property_value
material_amount_-reference_time to time_reference	IDENTICAL MAPPING			
PROCESS_-MATERIAL_-REFERENCE_TIME	process_material_reference_time	231	17	process_material_reference_time <= resource_property
process_material_-reference_time to process_material	PATH		8, 17	process_material_reference_time <= resource_property resource_property.resource -> characterized_resource_definition characterized_resource_definition = action_resource action_resource => process_material
process_material_-reference_time to process_design_-property_value	PATH		16, 17	process_material_reference_time <= resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation => process_design_property_value
process_material_-reference_time to time_reference	IDENTICAL MAPPING			
PLANT	plant	231	13	plant <= product

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
description	product.description	41	13	plant <= product product.description
function	group.name	41	11, 13, 24	plant <= product grouped_item = product grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `plant function'}** group_assignment group_assignment.assigned_group ->** group group.name
name	product.name	41	13	plant <= product product.name
plant_id	product.id	41	13	plant <= product product.id
sub_plant_type	product_definition_relationship.description	41	13, 14	plant <= product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship** **product_definition_relationship.name = `sub plant'}** product_definition_relationship product_definition_relationship.description

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plant to plant_item	PATH		13, 14	plant <= product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition <- product_definition_relationship.relating_product_definition product_definition_relationship product_definition_relationship.related_product_definition -> (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)
plant to process_-definition	PATH		5, 8, 13	plant <= product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition => process_design_case_resource <= action_resource action_resource.usage[i] -> supported_item supported_item = action_method action_method

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plant to process_-design_property_value	PATH		13, 14, 15, 16	plant <= product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation => process_design_property_value
plant to sub_plant_relationship (contains)	PATH		13, 14	plant <= product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition <- product_definition_relationship.relating_product_definition product_definition_relationship **{product_definition_relationship** **product_definition_relationship.name = `sub plant'}**

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plant to sub_plant_relationship (is_used_in)	PATH		13, 14	plant <= product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition <- product_definition_relationship.related_product_definition product_definition_relationship **{product_definition_relationship product_definition_relationship.name = `sub plant'}**
PLANT_ITEM_-REFERENCE_TIME	plant_item_reference_time	231	15	plant_item_reference_time <= property_definition
plant_item_reference_-time to plant_item	PATH		14, 15	plant_item_reference_time <= property_definition property_definition.definition ->characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)
plant_item_reference_-time to process_-design_property_value	PATH		15, 16	plant_item_reference_time <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation => process_design_property_value
plant_item_reference_-time to time_reference	IDENTICAL MAPPING			

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PROCESS_- DEFINITION_- REFERENCE_TIME	process_definition_reference_time	231	7	process_definition_reference_time <= action_property
process_definition_- reference_time to process_definition	PATH		5, 7	process_definition_reference_time <= action_property action_property.definition ->> characterized_action_definition characterized_action_definition = action_method action_method
process_definition_- reference_time to process_design_- property_value	PATH		7, 16	process_definition_reference_item <= action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation => process_design_property_value
process_definition_- reference_time to time_reference	IDENTICAL MAPPING			
PROCESS_DESIGN_- PROPERTY_VALUE	process_design_property_value	231	10, 16	process_design_property_value <= [representation] [externally_defined_item]

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
lower_limit_value	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	process_design_property_value <= representation representation.items[i] ->** **{representation_item =>** **qualified_representation_item** **qualified_representation_item.qualifiers[i] ->** **value_qualifier** **value_qualifier = type_qualifier** **type_qualifier** **type_qualifier.name = `lower limit'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
nominal_value	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	process_design_property_value <= representation representation.items[i] ->** **{representation_item =>** **qualified_representation_item** **qualified_representation_item.qualifiers[i] ->** **value_qualifier** **value_qualifier = type_qualifier** **type_qualifier** **type_qualifier.name = `nominal value'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
property_description	descriptive_representation_item.description	45	16	process_design_property_value <= representation representation.items[i] ->** {representation_item representation_item.name = `property description'}** representation_item => descriptive_representation_item descriptive_representation_item.description
property_name	representation.name	43	16	process_design_property_value <= representation representation.name
source_designation	external_source.source_id	41	8, 10, 16, 17	process_design_property_value <= representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property -> resource_property resource_property.resource -> characterized_resource_definition characterized_resource_definition = action_resource action_resource => externally_defined_action_resource <= externally_defined_item externally_defined_item.source -> external_source external_source.source_id

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
upper_limit_value	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	process_design_property_value <= representation representation.items[i] ->** **{representation_item =>** **qualified_representation_item** **qualified_representation_item.qualifiers[i] ->** **value_qualifier** **value_qualifier = type_qualifier** **type_qualifier** **type_qualifier.name = `upper limit'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
process_design_- property_value to control_adjustment	PATH		5, 7, 11, 16, 24	process_design_property_value <= representation <- action_property_representation.representation action_property_representation action_property_representation.property ->** action_property action_property.definition ->** characterized_action_definition characterized_action_definition = action_method action_method **{action_method** **grouped_item = action_method** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `control adjustment'}**

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
process_design_-property_value to control_event	PATH		5, 7, 11, 16, 24	process_design_property_value <= representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method **{action_method** **grouped_item = action_method** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `control event'}**
process_design_-property_value to control_logic	PATH		5, 7, 11, 16, 24	process_design_property_value <= representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method **{action_method** **grouped_item = action_method** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `control logic'}**

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
process_design_- property_value to control_logic_condition	PATH		7, 16	process_design_property_value <= representation <- action_property_representation.representation action_property_representation action_property_representation.property ->action_property **{action_property** **action_property.description = `control logic condition'}**
process_design_- property_value to control_loop	PATH		5, 7, 11, 16, 24	process_design_property_value <= representation <- action_property_representation.representation action_property_representation action_property_representation.property ->action_property action_property.definition ->characterized_action_definition characterized_action_definition = action_method action_method **{action_method** **grouped_item = action_method** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->group** **group.name = `control loop'}**

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
process_design_- property_value to process_simulation	PATH		5, 7, 16	process_design_property_value <= representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method => process_simulation
process_design_- property_value to process_unit_operation	PATH		5, 7, 11, 16, 24	process_design_property_value <= representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `process unit operation'}**
PROCESS_DESIGN_- PROPERTY_VALUE_- USAGE	measure_representation_item	45		
variable_type	representation_item.name	43		measure_representation_item <= representation_item representation_item.name

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
process_design_- property_value_usage to process_design_- property_value	PATH			measure_representation_item <= representation_item <- representation.items[i] representation => process_design_property_value
PROCESS_- SIMULATION_- REFERENCE_TIME	process_simulation_reference_time	231	16	process_simulation_reference_time <= action_property
process_simulation_- reference_time to process_design_- property_value	PATH		16	process_simulation_reference_time <= action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->> representation => process_design_property_value
process_simulation_- reference_time to process_simulation	PATH		5, 7	process_simulation_reference_time <= action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method => process_simulation
process_simulation_- reference_time to time_reference	IDENTICAL MAPPING			
REFERENCE_TIME_- RELATIONSHIP	(property_definition_relationship) (action_property_relationship) (resource_property_relationship)	45 49 49		

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reference_time_-relationship to time_-reference (is the preceding time in)	PATH			(property_definition_relationship property_definition_relationship.relating_property_definition -> property_definition => (plant_item_reference_time) (site_reference_time)) (action_property_relationship action_property_relationship.relating_action_property -> action_property => (process_definition_reference_time) (process_simulation_reference_time)) (resource_property_relationship resource_property_relationship.relating_resource_property -> resource_property => (material_amount_reference_time) (process_material_reference_time) (stream_reference_time))
reference_time_-relationship to time_-reference (is the succeeding time in)	PATH			(property_definition_relationship property_definition_relationship.related_property_definition -> property_definition => (plant_item_reference_time) (site_reference_time)) (action_property_relationship action_property_relationship.related_action_property -> action_property => (process_definition_reference_time) (process_simulation_reference_time)) (resource_property_relationship resource_property_relationship.related_resource_property -> resource_property => (material_amount_reference_time) (process_material_reference_time) (stream_reference_time))
REFERENCED_-OBJECT	(property_definition.definition) (action_property.definition) (resource_property.resource)	41 49 49		

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
referenced_object to bulk_thermophysical_-properties	PATH		15, 16	property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation **{representation** **representation.name = `bulk thermophysical properties'}**
referenced_object to chemical_reaction	PATH			action_property.definition -> characterized_action_definition characterized_action_definition = action action => product_definition_process
referenced_object to composition_-relationship	PATH		14	property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition_relationship product_definition_relationship **{product_definition_relationship** **product_definition_relationship.name = `substance composition'}**
referenced_object to equipment_port	PATH		18	property_definition.definition -> characterized_definition characterized_definition = shape_definition shape_definition shape_definition = shape_aspect shape_aspect => equipment_port

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
referenced_object to material	PATH		8, 15, 17	(resource_property.resource resource_property resource_property.resource ->) characterized_resource_definition characterized_resource_definition = action_resource action_resource => process_material) (property_definition.definition property_definition property_definition.definition -> characterized_definition <- material_designation.definitions[i] material_designation)
referenced_object to phase	PATH		9	property_definition.definition -> characterized_definition characterized_definition = characterized_object characterized_object => phase
referenced_object to plant_system	PATH		4, 14	property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition (product_definition **{product_definition** **product_definition.frame_of_reference ->** **product_definition_context <=** **application_context_element** **application_context_element.name = `functional occurrence'}**) (product_definition => instrumentation_and_control_system) (product_definition => process_design_case_resource)

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
referenced_object to process_design_-property_value	PATH		15, 16	property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation => process_design_property_value
referenced_object to reaction_rate	PATH		15, 16	property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation **{representation representation.name = `reaction rate'}**
referenced_object to site	PATH		9	property_definition.definition -> characterized_definition characterized_definition = characterized_object characterized_object => site
referenced_object to specific_phase	PATH		8	resource_property.resource -> characterized_resource_definition characterized_resource_definition = action_resource action_resource => specific_phase
referenced_object to stream	PATH		8	resource_property.resource -> characterized_resource_definition characterized_resource_definition = action_resource action_resource => stream

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
referenced_object to substance	PATH		11, 13, 14, 24	property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `substance'}
referenced_object to thermodynamic_-condition	PATH		15	property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation <- data_environment.elements[i] data_environment => thermodynamic_condition

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
RELATIVE_TIME_-REFERENCE	(plant_item_reference_time) (site_reference_time) (process_definition_reference_time) (process_simulation_reference_time) (material_amount_reference_time) (process_material_reference_time) (stream_reference_time)	231 231 231 231 231 231 231	7, 15, 17	**{((plant_item_reference_time <=)** **(site_reference_time <=)** **property_definition** **property_definition.description = `relative')**  **((process_definition_reference_time <=)** **(process_simulation_reference_time <=)** **action_property** **action_property.description = `relative')** **((material_amount_reference_time <=)** **(process_material_reference_time <=)** **(stream_reference_time <=)** **resource_property** **resource_property.description = `relative')}**
name	identification_assignment.assigned_id	41	7, 15, 17, 25	((plant_item_reference_time <=) (site_reference_time <=) property_definition identified_item = property_definition) ((process_definition_reference_time <=) (process_simulation_reference_time <=) action_property identified_item = action_property) ((material_amount_reference_time <=) (process_material_reference_time <=) (stream_reference_time <=) resource_property identified_item = resource_property) identified_item <- applied_identification_assignment.items[i] applied_identification_assignment <= **{identification_assignment** **identification_assignment.role ->** **identification_role** **identification_role.name = `relative time name'}** identification_assignment identification_assignment.assigned_id

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
offset_amount	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	7, 15, 16, 17	((plant_item_reference_time <=) (site_reference_time <=) property_definition <- property_definition_relationship.related_property_definition property_definition_relationship represented_definition = property_definition_relationship represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->) ((process_definition_reference_time <=) (process_simulation_reference_time <=) action_property <- action_property_relationship.related_action_property action_property_relationship characterized_action_definition = action_property_relationship characterized_action_definition <- action_property_representation.property action_property_representation action_property_representation.representation ->) ((material_amount_reference_time <=) (process_material_reference_time <=) (stream_reference_time <=) resource_property <- resource_property_relationship.related_resource_property resource_property_relationship characterized_resource_definition = resource_property_relationship characterized_resource_definition <- resource_property_representation.resource resource_property_representation resource_property_representation.representation ->) representation representation.items[i] -> **{representation_item** **representation_item.name = `relative time reference offset amount'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **time_measure_with_unit}**

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
relative_time_reference to absolute_time_-reference	PATH		7, 15	((plant_item_reference_time <=) (site_reference_time <=) property_definition <- property_definition_relationship.related_property_definition **{property_definition_relationship** **property_definition_relationship.name = `absolute time reference basis'}** property_definition_relationship property_definition_relationship.relating_property_definition ->**{property_definition** **property_definition.description = `absolute'}** property_definition => (plant_item_reference_time) (site_reference_time)) ((process_definition_reference_time <=) (process_simulation_reference_time <=) action_property <- action_property_relationship.related_action_property **{action_property_relationship** **action_property_relationship.name = `absolute time reference basis'}** action_property_relationship action_property_relationship.relating_action_property ->**{action_property** **action_property.description = `absolute'}** action_property => (process_definition_reference_time) (process_simulation_reference_time)) ((material_amount_reference_time <=) (process_material_reference_time <=) (stream_reference_time <=) resource_property <- resource_property_relationship.related_resource_property **{resource_property_relationship** **resource_property_relationship.name = `absolute time reference basis'}** resource_property_relationship resource_property_relationship.relating_resource_property ->**{resource_property** **resource_property.description = `absolute'}** resource_property => (material_amount_reference_time)

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SITE	site	231	9, 15	site <= [characterized_object] [property_definition]
area	representation.name	43	15, 16	site <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.name
address	representation.name	43	15, 16	site <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.name
coordinates	representation.name	43	15, 16	site <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.name

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
elevation	representation.name	43	15, 16	site <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.name
environmental_-references	document.id	41	23	site <= document_reference_item = site document_reference_item <- applied_document_reference.items[i] applied_document_reference <= document_reference document_reference.assigned_document -> document document.id
legal_description	representation.name	41	15, 16	site <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.name
locality	representation.name	41	15, 16	site <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.name

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
name	characterized_object.description	41	9	site <= characterized_object characterized_object.description
orientation	(axis2_placement_2d) (axis2_placement_3d)	42 42	9, 15, 16	site <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `site orientation'}** representation_item => geometric_representation_item => **{placement** **placement.location ->** **cartesian_point <=** **point <=** **geometric_representation_item <=** **representation_item** **representation_item.name = `site location'}** placement => (axis2_placement_2d) (axis2_placement_3d)

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
owners	(person) (organization) (person_and_organization)	41 41 41	26, 27	site (person_item = site person_item <- applied_person_assignment.items[i] applied_person_assignment <= **{person_assignment** **person_assignment.role ->** **person_role** **person_role.name = `owner'}** person_assignment person_assignment.assigned_person -> person) (organization_item = site organization_item <- applied_organization_assignment.items[i] applied_organization_assignment <= **{organization_assignment** **organization_assignment.role ->** **organization_role** **organization_role.name = `owner'}** organization_assignment organization_assignment.assigned_organization -> organization) person_and_organization_item = site person_and_organization_item <- applied_person_and_organization_assignment.items[i] applied_person_and_organization_assignment <= **{person_and_organization_assignment** **person_and_organization_assignment.role ->** **person_and_organization_role** **person_and_organization_role.name = `owner'}** person_and_organization_assignment person_and_organization_assignment.assigned_person_and_organization -> person_and_organization)
site_id	characterized_object.name	41	9	site <= characterized_object characterized_object.name

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
site to process_design_-property_value	PATH		15, 16	site <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation => process_design_property_value
SITE_REFERENCE_-TIME	site_reference_time	231		site_reference_time <= property_definition
site_reference_time to process_design_-property_value	PATH		15, 16	site_reference_time <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation => process_design_property_value
site_reference_time to site	PATH		9, 15	site_reference_time <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_object characterized_object => site
site_reference_time to site	IDENTICAL MAPPING			
SITE_STANDARD_-CONDITIONS	site_standard_condition	231	15	site_standard_condition <= property_definition

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
custody_type	descriptive_representation_item.description	45	15, 16	site_standard_condition <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation_items[i] -> **{representation_item** **representation_item.name = `custody type'}** representation_item => descriptive_representation_item descriptive_representation_item.description
description	descriptive_representation_item.description	45	15, 16	site_standard_condition <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation_items[i] -> **{representation_item** **representation_item.name = `description'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	site_standard_condition <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	site_standard_condition <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
site_standard_- conditions to site	PATH		9, 15	site_standard_condition <= property_definition property_definition.definition ->> characterized_definition characterized_definition = characterized_object characterized_object => site
SITE_UTILITY_- SERVICE	property_definition	41	15	
cost_basis	type_qualifier.name	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cost basis'}** representation_item => qualified_representation_item qualified_representation_item.qualifiers[i] -> value_qualifier value_qualifier = type_qualifier type_qualifier type_qualifier.name

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cost_basis_value	descriptive_representation_item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cost basis value'}** representation_item => descriptive_representation_item descriptive_representation_item.description
site_utility_service_-name	representation.name	43	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.name
source	descriptive_representation_item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation_items[i] -> **{representation_item** **representation_item.name = `source'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	descriptive_representation_item.description	45	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation_items[i] -> **{representation_item** **representation_item.name = `type'}** representation_item => descriptive_representation_item descriptive_representation_item.description
site_utility_service to site	PATH		9, 15	property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_object characterized_object => site
SITED_PLANT	sited_plant	231	15	sited_plant <= property_definition

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plant_site_location	cartesian_point	42	9, 15, 16	sited_plant <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{[representation_item <-** **mapped_item.mapping_target** **mapped_item <=** **representation_item <-** **representation.items[i]** **representation <-** **property_definition_representation.used_representation** **property_definition_representation** **property_definition_representation.definition ->** **represented_definition** **represented_definition = property_definition** **property_definition** **property_definition.definition ->** **characterized_definition** **characterized_definition = characterized_object** **characterized_object =>** **site]** **[representation_item** **representation_item.name = `plant orientation']}** representation_item => geometric_representation_item => **{placement =>** **(axis2_placement_2d)** **(axis2_placement_3d)}**

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plant_site_location (concluded)				placement placement.location ->** cartesian_point **{cartesian_point <= point <= geometric_representation_item <= representation_item representation_item.name = `plant location'}**

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plant_site_orientation	(axis2_placement_2d) (axis2_placement_3d)	42 42	9, 15, 16	site_plant <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{[representation_item <-** **mapped_item.mapping_target** **mapped_item <=** **representation_item <-** **representation.items[i]** **representation <-** **property_definition_representation.used_representation** **property_definition_representation** **property_definition_representation.definition ->** **represented_definition** **represented_definition = property_definition** **property_definition** **property_definition.definition ->** **characterized_definition** **characterized_definition = characterized_object** **characterized_object =>** **site]** **[representation_item** **representation_item.name = `plant orientation']}** representation_item => geometric_representation_item => placement => (axis2_placement_2d) (axis2_placement_3d)

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
sited_plant to site	PATH		9, 15	site_plant <= property_definition property_definition.definition ->> characterized_definition characterized_definition = characterized_object characterized_object => site
STREAM_- REFERENCE_TIME	stream_reference_time	231	17	stream_reference_time <= resource_property
stream_reference_time to process_design_- property_value	PATH		16, 17	stream_reference_time <= resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->> representation => process_design_property_value
stream_reference_time to stream	PATH		8, 17	stream_reference_time <= resource_property resource_property.resource ->> characterized_resource_definition characterized_resource_definition = action_resource action_resource => stream
stream_reference_time to time_reference	IDENTICAL MAPPING			
SUB_PLANT_- RELATIONSHIP	product_definition_relationship	41		**{product_definition_relationship product_definition_relationship.name = `sub plant'}**

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
location_and_- orientation	(axis2_placement_2d) (axis2_placement_3d)	42 42	14, 15, 16	product_definition_relationship characterized_product_definition = product_definition_relationship characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> **{representation =>** **shape_representation}** representation representation.items[i] -> representation_item => geometric_representation_item => placement => (axis2_placement_2d) (axis2_placement_3d)

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
TIME_REFERENCE	(plant_item_reference_time) (site_reference_time) (process_definition_reference_time) (process_simulation_reference_time) (material_amount_reference_time) (process_material_reference_time) (stream_reference_time)	231 231 231 231 231 231 231	7, 15, 17	((plant_item_reference_time <=) (site_reference_time <=) property_definition **{property_definition** **(property_definition.description = `absolute'** **(property_definition.description = `relative')}**) ((process_definition_reference_time <=) (process_simulation_reference_time <=) action_property **{action_property** **(action_property.description = `absolute')** **(action_property.description = `relative')}**) ((material_amount_reference_time <=) (process_material_reference_time <=) (stream_reference_time <=) resource_property **{resource_property** **(resource_property.description = `absolute')** **(resource_property.description = `relative')}**)

Table 8 - Mapping table for plant_context UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
description	descriptive_representation_item.description	45	15, 16	((plant_item_reference_time <=) (site_reference_time <=) property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->) ((process_definition_reference_time <=) (process_simulation_reference_time <=) action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->) ((material_amount_reference_time <=) (process_material_reference_time <=) (stream_reference_time <=) resource_property <- resource_property_representation.resource resource_property_representation resource_property_representation.representation ->) representation representation.items[i] -> **{representation_item** **representation_item.name = `time reference description'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 8 - Mapping table for plant_context UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
time_reference to clock_time	PATH		7, 15, 17, 22	((plant_item_reference_time <=) (site_reference_time <=) property_definition date_time_item = property_definition) ((process_definition_reference_time <=) (process_simulation_reference_time <=) action_property date_time_item = action_property) ((material_amount_reference_time <=) (process_material_reference_time <=) (stream_reference_time <=) resource_property date_time_item = resource_property) date_time_item <- applied_date_time_assignment.items[i] applied_date_time_assignment <= date_and_time_assignment date_and_time_assignment.assigned_date_and_time ->date_and_time
UTILITY_MATERIAL_-SERVICE	representation	43	16	
utility_material_-category	descriptive_representation_item.description	45	16	representation representation_items[i] ->**{representation_item** **representation_item.name = `utility material category'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 9 - Mapping table for plant_item_data UoF

Application element	AIM element	Source	Rules	Reference PATH
ALTERNATING_- CURRENT_PORT	equipment_port	231	11, 18, 24	equipment_port <= shape_aspect **{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `alternating current port'}**
number_of_phases	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
voltage_cycle_frequency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> representation_item => **{representation_item** **representation_item.name = `voltage cycle frequency'}** measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
BASEPLATES_AND_-SOLEPLATES	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `baseplates and soleplates']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `mechanical component']}**
baseplate_for_common	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group ->group group.name **{(group.name = `package common')** **(group.name = `element divided')}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
drip_rim	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `drip rim'}**
horizontal_adjustment_-screws	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `horizontal adjustment screws'}**
nonskid_deckplate	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `nonskid deckplate'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
open_construction	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `open construction'}**
open_drain	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `open drain'}**
other_configuration	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `other configuration'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plate_grouting_type	material_designation.name	45	14, 18	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition => product_definition_shape <- shape_aspect.of_shape **{shape_aspect** **shape_aspect.name = `grouting'}** shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- material_designation.of_definition material_designation material_designation.name
plate_support	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> **{group** **(group.description = `perimeter')** **(group.description = `point')}** group group.name **{group.name = `plate support'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plate_weight	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `plate weight'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
soleplate_for_driver	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `soleplate for driver'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
soleplate_for_gear	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `soleplate for gear'}**
soleplate_for_machine	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `soleplate for machine'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stainless_shims_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `stainless shims thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
transfer_machine_only	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `transfer machine only'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
baseplates_and_- soleplates to fluid_- transfer_machine	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition product_definition_relationship **{[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]** **[product_definition_relationship.name = `composition']}** product_definition_relationship.relating_product_definition ->** **product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `fluid transfer machine'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
BEARING	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `bearing'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `mechanical component']}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
babbit_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 16, 18	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition => product_definition_shape <- shape_aspect.of_shape **{shape_aspect** **shape_aspect.description = `babbit'}** shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `babbit thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
babbit_type	group.name	41	11, 14, 18, 24	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition => product_definition_shape <- shape_aspect.of_shape **{shape_aspect** **shape_aspect.description = `babbit'}** shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name
centre_pivot	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `centre pivot'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
loading_actual	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `loading actual'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
loading_allowed	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `loading actual'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
lubrication_type	material_designation.name	45	14	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- material_designation.of_definition material_designation material_designation.name **{(material_designation.name = `Api614')** **(material_designation.name = `flood')** **(material_designation.name = `grease')** **(material_designation.name = `oil mist')** **(material_designation.name = `pressure')** **(material_designation.name = `ring oil')}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
offset_pivot	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `offset pivot'}**
pad_material	material_designation.name	45	14, 18	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition => product_definition_shape <- shape_aspect.of_shape **{shape_aspect** **shape_aspect.description = `babbit'}** shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- material_designation.of_definition material_designation material_designation.name

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 14, 24	product_definition classified_item = product_definition classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->group group.name
bearing to bearing_-housing	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition product_definition_relationship product_definition_relationship.relating_product_definition ->product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `bearing housing'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bearing to fluid_-transfer_machine	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition product_definition_relationship **{[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]** **[product_definition_relationship.name = `composition']}** product_definition_relationship.relating_product_definition ->** product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `fluid transfer machine'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
BEARING_HOUSING	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `bearing housing']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `mechanical component']}**
type	group.name	41	11, 14, 24	product_definition classified_item = product_definition classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->group group.name **{(group.name = `integral')** **(group.name = `separate')}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bearing_housing to fluid_transfer_machine	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition product_definition_relationship **{[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]** **[product_definition_relationship.name = `composition']}** product_definition_relationship.relating_product_definition ->** product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `fluid transfer machine'}**
BUTTWELD	shape_aspect	41	11, 18, 24	**{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group =>** **piping_connector_classification]** **[group** **group.name = `buttweld']}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CENTRIFUGAL_-COMPRESSOR_TESTS	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** group **group.name = `centrifugal compressor tests'}**
performance_test_air	action_resource	41	5, 8	action_method supported_item = action_method supported_item <- action_resource.usage[i] action_resource **{action_resource action_resource.kind ->** action_resource_type **action_resource_type.name = `compressor test air'}**
performance_test_gas	action_resource	41	5, 8	action_method supported_item = action_method supported_item <- action_resource.usage[i] action_resource **{action_resource action_resource.kind ->** action_resource_type **action_resource_type.name = `compressor test gas'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
COMPRESSION	shape_aspect	41	11, 18, 24	**{shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **[group => piping_connector_classification] [group group.name = `compression']}**
CONDITIONAL_- PROPERTY_VALUE	qualified_representation_item	45		
limit_condition	uncertainty_qualifier	45		qualified_representation_item qualified_representation_item.qualifiers[i] ->value_qualifier value_qualifier = uncertainty_qualifier uncertainty_qualifier
value_context	data_environment	45	16	qualified_representation_item <= representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation => material_property_representation material_property_representation.dependent_environment ->data_environment
CONNECTED_- EQUIPMENT_PORT	equipment_port	231	18	equipment_port <= shape_aspect **{shape_aspect <- (shape_aspect_relationship.related) (shape_aspect_relationship.relating) shape_aspect_relationship shape_aspect_relationship.name = `equipment port connection'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
flow_state	descriptive_representation_- item.description	45	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `flow state'}** representation_item => descriptive_representation_item descriptive_representation_item.description
connected_equipment_- port to equipment_port	Identical_mapping			
connected_equipment_- port to equipment_port_- connection	PATH			equipment_port <= shape_aspect <- (shape_aspect_relationship.related_shape_aspect) (shape_aspect_relationship.relating_shape_aspect) shape_aspect_relationship **{shape_aspect_relationship.name = `equipment port connection'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
COUPLING	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `coupling']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `mechanical component']}**
idling_adapter_required	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group ->group group.name **{group.name = `idling adapter'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
keying_or_fit	group	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group **{group** **[group.description = `keying or fit']** **[(group.name = `hydraulic')** **(group.name = `one key')** **(group.name = `two keys')]}**
limited_end_float_-required	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `limited end float'}**
lubrication	material_designation.name	45	14	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- material_designation.of_definition material_designation material_designation.name

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mount_driver_coupling_-half	organization.description	41	14, 26	product_definition organization_item = product_definition organization_item <- applied_organization_assignment.items[i] applied_organization_assignment <= **{organization_assignment** **organization_assignment.role ->** **organization_role** **organization_role.name = `coupling driver mounter'}** organization_assignment organization_assignment.assigned_organization ->** organization organization.description **{(organization.description = `machine manufacturer')** **(organization.description = `drive manufacturer')** **(organization.description = `purchaser')}**
rating	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `coupling rating'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
rotation_viewed_from_-driven_end	descriptive_representation_-item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `rotation direction'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `clockwise')** **(descriptive_representation_item.description = `counter-clockwise')}**
spacer_required	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `spacer required'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
coupling to fluid_-transfer_machine	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition product_definition_relationship **{[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]** **[product_definition_relationship.name = `composition']}** product_definition_relationship.relating_product_definition ->** product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `fluid transfer machine'}**
DESIGN_PROJECT	organizational_project	41		
design_project_id	organizational_project.name	41		
name	organizational_project.description	41		
number	organizational_project.name	41		
owner	organization	41		organizational_project organizational_project.responsible_organizations[i] ->** organization

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
design_project to pfd_- title_block	PATH		11, 12, 16, 24	organizational_project associated_item = organizational_project associated_item <- presented_item_with_association.items[i] presented_item_with_association <= presented_item <- presented_item_representation.item presented_item_representation presented_item_representation.presentation -> presentation_representation_select presentation_representation_select = presentation_representation presentation_representation <= **{presentation_representation => presentation_with_association}** representation representation.items[i] -> representation_item => styled_item => annotation_occurrence => annotation_symbol_occurrence **{annotation_symbol_occurrence classified_item = annotation_symbol_occurrence classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `pfd title block'}**
DESIGN_PROJECT_- ASSIGNMENT	applied_organization_assignment	231		applied_organization_assignment <= organization_assignment
design_project_- assignment to design_- project	PATH		26	applied_organization_assignment <= organization_assignment organization_assignment.assigned_organization -> organization <- organizational_project.responsible_organizations[i] organizational_project

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
DIRECT_CURRENT_-PORT	equipment_port	231	11, 18, 24	equipment_port <= shape_aspect **{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `direct current port'}**
ELECTRICAL_POWER_-PORT	equipment_port	231	11, 18, 24	equipment_port <= shape_aspect **{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `electrical power port'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
line_voltage	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `line voltage'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **electrical_current_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
normal_current	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `normal current'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **electrical_current_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
peak_current	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `peak current'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **electrical_current_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
rated_current	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `rated current'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **electrical_current_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
type	group.name	41	11, 18, 24	equipment_port <= shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
ENERGY_PORT	equipment_port	231	11, 18, 24	equipment_port <= shape_aspect **{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `energy port'}**
type	group.name	41	11, 18, 24	equipment_port <= shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
port_energy_category	group.name	41	11, 18, 24	equipment_port <= shape_aspect grouped_item = shape_aspect grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> **{group** **group.description = `port energy category'}** group group.name **{(group.name = `ambient')** **(group.name = `process')** **(group.name = `product')** **(group.name = `utility')** **(group.name = `waste')}**
EQUIPMENT_PORT	equipment_port	231		equipment_port <= shape_aspect
equipment_port_name	shape_aspect.name	41	18	equipment_port <= shape_aspect shape_aspect.name
type	group.name	41	11, 18, 24	equipment_port <= shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
normal_flow_direction	descriptive_representation_- item.description	45	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `normal flow direction'}** representation_item => descriptive_representation_item descriptive_representation_item.description
equipment_port to plant_item	PATH		14, 15, 18	equipment_port <= shape_aspect shape_aspect.of_shape -> product_definition_shape <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
equipment_port to process_design_-property_value	PATH		16, 18	equipment_port <= shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation => process_design_property_value
EQUIPMENT_PORT_-CONNECTION	shape_aspect_relationship	41		**{shape_aspect_relationship [shape_aspect_relationship.name = `equipment port connection'] [[shape_aspect_relationship.relating_shape_aspect ->] [shape_aspect_relationship.related_shape_aspect ->] shape_aspect => equipment_port]}**
FEMALE_END	shape_aspect	41	11, 18, 24	**{shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group => connector_end_type_classification] [group group.name = `female end']}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
FLANGED	shape_aspect	41	11, 18, 24	**{shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group => piping_connector_classification] [group group.name = `flanged']}**
FLANGED_END	shape_aspect	41	11, 18, 24	**{shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group => connector_end_type_classification] [group group.name = `flanged end']}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
face_finish	descriptive_representation_- item.description	45	15, 16, 18	shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `face finish'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `flat face')** **(descriptive_representation_item.description = `raised face')** **(descriptive_representation_item.description = `ring')** **(descriptive_representation_item.description = `unspecified')}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
flange_nominal_rating	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `nominal pressure rating'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
flange_piping_schedule	descriptive_representation_- item.description	45	15, 16, 18	shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `flange piping schedule reference'}** representation_item => descriptive_representation_item descriptive_representation_item.description
flange_type	group.name	41	11, 18, 24	shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> **{group =>** **connector_end_type_classification}** group group.name **{(group.name = `slip on')** **(group.name = `threaded')** **(group.name = `unspecified')** **(group.name = `welded')}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
FUNCTIONAL_VOLUME	shape_aspect	41	11, 18, 24	**{shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** [group => connector_end_type_classification] [group group.name = `functional volume']}
description	shape_aspect.description	41		
functional_volume to plant_item	PATH		14, 15, 18	shape_aspect shape_aspect.of_shape ->
product_definition_shape <=
property_definition
property_definition.definition ->
characterized_definition
characterized_definition = characterized_product_definition
characterized_product_definition
characterized_product_definition = product_definition
(product_definition)
(product_definition =>
externally_defined_plant_item_definition)
(product_definition =>
process_design_case_resource)
FUNCTIONAL_-VOLUME_SERVICE_-CASE	functional_volume_service_case	231		functional_volume_service_case <=
[shape_aspect]
[action_resource]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
functional_volume_- service_case to functional_volume	PATH		11, 18, 24	functional_volume_service_case <= shape_aspect <- shape_aspect_relationship.related_shape_aspect shape_aspect_relationship shape_aspect_relationship.relating_shape_aspect ->shape_aspect **{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group =>** **connector_end_type_classification]** **[group** **group.name = `functional volume']}**
functional_volume_- service_case to material_- amount	PATH		8	functional_volume_service_case <= action_resource <- action_resource_relationship.related_resource action_resource_relationship action_resource_relationship.relating_resource ->action_resource **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material amount'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
functional_volume_- service_case to process_- service	PATH		5, 8, 11, 24	functional_volume_service_case <= action_resource action_resource.usage[i] ->** supported_item supported_item = action_method action_method **{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **group group.name = `process service'}**
GASKET	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation product_definition_formation.of_product ->** **product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **[group group.name = `gasket'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `mechanical component']}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nominal_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `nominal diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pipe_schedule	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pipe schedule'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
type	group.name	41	11, 14, 24	product_definition classified_item = product_definition classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> **{group** **group.description = `gasket type'}** group group.name

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
gasket to construction_-material (as body material)	PATH		11, 14, 18, 24	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition => product_definition_shape <- shape_aspect.of_shape **{shape_aspect** **shape_aspect.name = `gasket body'}** shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- material_designation.of_definition material_designation **{material_designation** **classified_item = material_designation** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **[group_assignment.role ->** **group_role** **group_role.name = `material usage classification']** **[group_assignment.assigned_group ->** **group** **group.name = `construction material']}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
gasket to construction_-material (as fill material)	PATH		11, 14, 18, 24	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition => product_definition_shape <- shape_aspect.of_shape **{shape_aspect** **shape_aspect.name = `gasket fill'}** shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- material_designation.of_definition material_designation **{material_designation** **classified_item = material_designation** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **[group_assignment.role ->** **group_role** **group_role.name = `material usage classification']** **[group_assignment.assigned_group ->** **group** **group.name = `construction material']}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
HEAT_PORT	equipment_port	231	11, 18, 24	equipment_port <= shape_aspect **{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `heat port'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
clean_heat_duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `clean heat duty'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
fouled_heat_duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `fouled heat duty'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
normal_heat_duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `normal heat duty'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
INSPECTION_AND_- TESTS	inspection_and_tests	231		inspection_and_tests <= action

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
board_certification_- required	certification	41	20	inspection_and_test <= action certified_item = action certified_item <- applied_certification_assignment.items[i] applied_certification_assignment <= **{certification_assignment** **certification_assignment.role ->** **certification_role** **certification_role.name = `requirement'}** certification_assignment certification_assignment.assigned_certification ->** certification **{certification** **[(certification.purpose = `observed')** **(certification.purpose = `required')** **(certification.purpose = `witnessed')]** **[certification.kind ->** **certification_type** **certification_type.name = `board certification']}**
design_code	document.id	41	23	inspection_and_test <= action document_reference_item = action document_reference_item <- applied_document_reference.items[i] applied_document_reference <= document_reference document_reference.assigned_document ->** document document.id

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
disassemble_- reassemble_after_test	group.name	41	11, 24	inspection_and_tests <= action grouped_item = action grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `disassemble, inspect, and reassemble after test'}**
radiographs_required	group.name	41	11, 24	inspection_and_tests <= action grouped_item = action grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `radiographs required'}**
shop_inspection	group.name	41	11, 24	inspection_and_tests <= action grouped_item = action grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `inspection at manufacturer shop'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stress_relief_required	group.name	41	11, 24	inspection_and_tests <= action grouped_item = action grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group ->** group group.name **{group.name = `stress relief required'}**
test_type	group.name	41	11, 24	inspection_and_tests <= action classified_item = action classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **{group** **group.description = `test type'}** group group.name **{(group.name = `full operating pressure test')** **(group.name = `hydrostatic_test')** **(group.name = `hydrostatic_test_pressure')** **(group.name = `helium_leak_test')** **(group.name = `noise_level_test')}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inspection_and_tests to plant_item	PATH		14	inspection_and_tests <= action <- action_assignment.assigned_action action_assignment => applied_action_assignment applied_action_assignment.items[i] ->> action_item action_item = product_definition (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)
LOCATION_-CONDITIONS	representation	43	16	**{representation representation.name = `location conditions'}**
location_cover	descriptive_representation_-item.description	45	16	representation representation.items[i] ->> **{representation_item representation_item.name = `location cover'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `covered') (descriptive_representation_item.description = `not covered')}**
location_electrical_area_-class	descriptive_representation_-item.description	45	16	representation representation.items[i] ->> **{representation_item representation_item.name = `location electrical area class'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
location_unusual_-conditions	descriptive_representation_-item.description	45	16	representation representation.items[i] -> **{representation_item** **representation_item.name = `location unusual conditions'}** representation_item => descriptive_representation_item descriptive_representation_item.description
location_conditions to plant_item	PATH		14, 15, 16	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->represented_definition represented_definition = property_definition property_definition property_definition.definition ->characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)
MALE_END	shape_aspect	41	11, 18, 24	**{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group =>** **connector_end_type_classification]** **[group** **group.name = `male end']}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bevelled	descriptive_representation_- item.description	45	15, 16, 18	shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `edge type'}** representation_item => description_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `bevelled edge')** **(descriptive_representation_item.description = `flat edge')}**
MATERIAL_PORT	equipment_port	231	11, 18, 24	equipment_port <= shape_aspect **{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `signal port'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
MECHANICAL_-COMPONENT	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `mechanical component'}**
manufacturer	organization.name	41	14, 26	product_definition organization_item = product_definition organization_item <- applied_organization_assignment.items[i] applied_organization_assignment <= **{organization_assignment** **organization_assignment.role ->** **organization_role** **organization_role.name = `manufacturer'}** organization_assignment organization_assignment.assigned_organization ->** **organization organization.name
model	product.name	41	13, 14	product_definition product_definition.formation ->** **product_definition_formation product_definition_formation.of_product ->** **product product.name
serial_number	product_definition.id	41		

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
size	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `size'}** representation_item => descriptive_representation_item descriptive_representation_item.description
type	group.name	41	11, 13, 14, 24	product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
weight	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `weight'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
MECHANICAL_- POWER_PORT	equipment_port	231	11, 18, 24	equipment_port <= shape_aspect **{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `mechanical power port'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 18, 24	equipment_port <= shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name
MECHANICAL_SEAL	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `mechanical seal'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `mechanical component']}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
api_class_code	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> **{group** **group.description = `api class code'}** group group.name

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inner_oil_leakage	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inner oil leakage'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
settling_out_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `settling out pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
system_type	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> **{group** **group.description = `system type'}** group group.name

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 14, 24	product_definition classified_item = product_definition classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->group group.name
mechanical_seal to fluid_transfer_machine	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition product_definition_relationship **{[product_definition_relationship => product_definition_usage => assembly_component_usage] [product_definition_relationship.name = `composition']}** product_definition_relationship.relating_product_definition ->product_definition **{product_definition product_definition.formation ->product_definition_formation product_definition_formation.of_product ->product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->group_role group_role.name = `equipment type'} group_assignment group_assignment.assigned_group ->group group.name = `fluid transfer machine'}**
NOISE_SPECIFICATION	representation	43	16	**{representation representation.name = `noise specification'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
acoustic_housing	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `acoustic housing'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `required')** **(descriptive_representation_item.description = `not required')}**
applicable_to_machine	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `noise level applicable to machine'}** representation_item => descriptive_representation_item descriptive_representation_item.description
applicable_to_- neighborhood	descriptive_representation_- item.description	45	16	representation representation.items[i] ->** **{representation_item** **representation_item.name = `noise level applicable to neighborhood'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
noise_specification to plant_item	PATH		14, 15, 16	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)
PACKAGING	property_definition	41	15	**{property_definition property_definition.description = `packaging'}**
shipping_weight	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item representation_item.name = `shipping weight'}** representation_item => measure_representation_item <= **{measure_with_unit => mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
packaging to plant_item	PATH		14, 15	property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)
PERFORMANCE_CURVE	data_curve	231		data_curve <= representation
description	representation.description	43	16	data_curve <= representation representation.description
identifier	representation.name	43	16	data_curve <= representation representation.name

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
performance_curve to plant_item	PATH		14, 15, 16	data_curve <= representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)
performance_curve to process_service	PATH		5, 7, 11, 16, 24	data_curve <= representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `process service'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
performance_curve to process_unit_operation	PATH		5, 7, 11, 16, 24	data_curve <= representation <- action_property_representation.representation action_property_representation action_property_representation.property ->action_property **{action_property** **action_property.name = `performance'}** characterized_action_definition = action_method action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `process unit operation'}**
PERFORMANCE_MAP	data_curve	231	16	data_curve <= representation **{representation** **representation.items[i] ->** **representation_item =>** **mapped_item}**
PERFORMANCE_MAP_-CURVE	mapped_item	43		
performance_map_curve to performance_curve	PATH			mapped_item <= representation_item <- representation.items[i] representation => data_curve

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
performance_map_curve to performance_map	PATH			mapped_item mapped_item.mapping_source -> representation_map representation_map.mapped_representation -> representation => data_curve
PERFORMANCE_POINT	compound_representation_item	43		
performance_point to simple_performance_-curve	PATH			compound_representation_item <= representation_item <- representation.items[i] representation => data_curve
PIPING_CONNECTOR	shape_aspect	41	11, 18, 24	**{shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **[group => piping_connector_classification] [group group.name = `piping connector']}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
end_engagement_type	descriptive_representation_- item.description	45	15, 16, 18	shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `end engagement type'}** representation_item => descriptive_representation_item descriptive_representation_item.description
end_type	descriptive_representation_- item.description	45	15, 16, 18	shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `end type'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
connector_piping_-schedule	descriptive_representation_-item.description	45	15, 16, 18	shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `connector piping schedule'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inner_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	shape_aspect shape_aspect.of_shape ->
product_definition_shape <=
property_definition
represented_definition = property_definition
represented_definition <-
property_definition_representation.definition
property_definition_representation
property_definition_representation.used_representation ->
representation
representation.items[i] ->
{representation_item
representation_item.name = `inner diameter'}
representation_item =>
measure_representation_item <=
{measure_with_unit =>
length_measure_with_unit}
measure_with_unit
[measure_with_unit.value_component]
[measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nominal_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `nominal diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outer_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outer diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
piping_connector to construction_material	PATH		11, 18, 24	shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- material_designation.of_definition material_designation **{material_designation** **classified_item = material_designation** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **[group_assignment.role ->** **group_role** **group_role.name = `material usage classification']** **[group_assignment.assigned_group ->** **group** **group.name = `construction material']}**
PLANT_ITEM	(product_definition) (externally_defined_plant_item_-definition) (process_design_case_resource)	41 231 231		(externally_defined_plant_item_definition <= [product_definition] [externally_defined_item]) (process_design_case_resource <= [product_definition] [action_resource])

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
boundary	shape_aspect	41	14	(product_definition) (externally_defined_plant_item_definition <= product_definition) (process_design_case_resource <= product_definition) characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition => product_definition_shape <- shape_aspect.of_shape shape_aspect

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
delivered_capital_cost	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	(product_definition) (externally_defined_plant_item_definition <= product_definition) (process_design_case_resource <= product_definition) characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `delivered capital cost'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
description	product.description	41	13	(product_definition) (externally_defined_plant_item_definition <= product_definition) (process_design_case_resource <= product_definition) product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product product.description

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
function	product_definition.description	41	14	(externally_defined_plant_item_definition <=) (process_design_case_resource <=) product_definition product_definition.description
installed_capital_cost	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	(product_definition) (externally_defined_plant_item_definition <= product_definition) (process_design_case_resource <= product_definition) characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `installed capital cost'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
manufacturer	organization	41	14, 26	(product_definition) (externally_defined_plant_item_definition <= product_definition) (process_design_case_resource <= product_definition) organization_item = product_definition organization_item <- applied_organization_assignment.items[i] applied_organization_assignment <= **{organization_assignment** **organization_assignment.role ->** **organization_role** **organization_role.name = `manufacturer'}** organization_assignment organization_assignment.assigned_organization ->organization

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_weight_for_- maintenance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	(product_definition) (externally_defined_plant_item_definition <= product_definition) (process_design_case_resource <= product_definition) characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum weight for maintenance'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
name	product.name	41	13	(product_definition) (externally_defined_plant_item_definition <= product_definition) (process_design_case_resource <= product_definition) product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product product.name

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
operating_factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	(product_definition) (externally_defined_plant_item_definition <= product_definition) (process_design_case_resource <= product_definition) characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `operational time factor'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **time_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
plant_item_id	product.id	41	13	(product_definition) (externally_defined_plant_item_definition <= product_definition) (process_design_case_resource <= product_definition) product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product product.id

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
purchased_capital_cost	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	(product_definition) (externally_defined_plant_item_definition <= product_definition) (process_design_case_resource <= product_definition) characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `purchased capital cost'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
tag	product_definition.id	41	14	(externally_defined_plant_item_definition <=) (process_design_case_resource <=) product_definition product_definition.id

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 13, 24	(product_definition) (externally_defined_plant_item_definition <= product_definition) (process_design_case_resource <= product_definition) product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
weight	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	(product_definition) (externally_defined_plant_item_definition <= product_definition) (process_design_case_resource <= product_definition) characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `weight'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
plant_item to process_-definition	PATH (see note 1)		5, 8	process_design_case_resource <= action_resource action_resource.usage[i] -> supported_item supported_item = action_method action_method

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plant_item to process_-design_property_value	PATH		14, 15, 16	(product_definition) (externally_defined_plant_item_definition <= product_definition) (process_design_case_resource <= product_definition) characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation => process_design_property_value
PLANT_ITEM_-ASSEMBLY_-RELATIONSHIP	assembly_component_usage	44		
PLANT_ITEM_-COLLECTION_-RELATIONSHIP	product_definition_usage	44		**{product_definition_usage <= product_definition_relationship product_definition_relationship.name = `plant item collection'}**
PLANT_ITEM_-CONNECTOR	shape_aspect	41	11, 18, 24	**{shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group => piping_connector_classification] [group group.name = `plant item connector']}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
connector_description	shape_aspect.description	41		
connector_name	shape_aspect.name	41		
function_type	group.name	41	11, 18, 24	shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `functional type classification'}** group_assignment group_assignment.assigned_group ->** group group.name
plant_item_connector to plant_item	PATH		14, 15, 18	shape_aspect shape_aspect.of_shape ->** product_definition_shape <= property_definition property_definition.definition ->** characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)
PLANT_ITEM_GROUP_-RELATIONSHIP	(product_definition_usage) (assembly_component_usage)	44 44		

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
location_and_orientation	(descriptive_representation_item) (placement)	45 42	14, 15, 16	(product_definition_usage <=) (assembly_component_usage <= product_definition_usage <=) product_definition_relationship characterized_product_definition = product_definition_relationship characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> **{representation** **representation.description = `plant item group location and orientation'}** representation representation.items[i] -> representation_item => (descriptive_representation_item) (geometric_representation_item => placement)
plant_item_group_- relationship to plant_item (is a group of)	PATH			(product_definition_usage <=) (assembly_component_usage <= product_definition_usage <=) product_definition_relationship product_definition_relationship.relating_product_definition -> (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plant_item_group_- relationship to plant_item (is an element in)	PATH			(product_definition_usage <=) (assembly_component_usage <= product_definition_usage <=) product_definition_relationship product_definition_relationship.related_product_definition ->) (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)
PLANT_ITEM_- LOCATION	representation	43	16	**{representation representation.description = `plant item location and orientation'}**
location_and_orientation	(descriptive_representation_item) (placement)	45 42	16	representation representation.items[i] ->) representation_item => (descriptive_representation_item) (geometric_representation_item => placement)
location_id	representation.name	43		

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plant_item_location to plant_item	PATH		14, 15, 16	representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)
PORT_SERVICE_CASE	port_service_case	231		port_service_case <= property_definition
port_service_case to equipment_port	PATH		15, 18	port_service_case <= property_definition property_definition.definition -> characterized_definition characterized_definition = shape_definition shape_definition shape_definition = shape_aspect shape_aspect => equipment_port
port_service_case to process_design_case	PATH			port_service_case <= property_definition => process_design_case

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
port_service_case to process_service	PATH		5, 7, 11, 15, 16, 24	port_service_case <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->representation <- action_property_representation.representation action_property_representation action_property_representation.property ->action_property action_property.definition ->characterized_action_definition characterized_action_definition = action_method action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->group** **group.name = `process service'}**
port_service_case to stream	PATH		9, 15	port_service_case <= property_definition property_definition.definition ->characterized_definition characterized_definition = characterized_object characterized_object => stream

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
POWER_PORT	equipment_port	231	11, 18, 24	equipment_port <= shape_aspect **{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `power port'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
normal_power	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `normal power'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
peak_power	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `peak power'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
rated_maximum_- sustained_power	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `rated maximum sustained power'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 18, 24	equipment_port <= shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name
PROCESS_DESIGN_-CASE	process_design_case	231		process_design_case <= property_definition
agitation_condition_-category	group.name	41	11, 15, 24	process_design_case <= property_definition grouped_item = property_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> **{group** **group.description = `agitation condition category'}** group group.name **{(group.name = `none')** **(group.name = `normal')** **(group.name = `other')** **(group.name = `perfect mixing')** **(group.name = `plug flow')** **(group.name = `rated')}**
description	property_definition.description	41	15	process_design_case <= property_definition property_definition.description

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
flow_condition_category	group.name	41	11, 15, 24	process_design_case <= property_definition grouped_item = property_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> **{group** **group.description = `flow condition category'}** group group.name **{(group.name = `maximum')** **(group.name = `minimum')** **(group.name = `none')** **(group.name = `normal')** **(group.name = `other')** **(group.name = `rated')}**
heat_transfer_condition_-category	group.name	41	11, 15, 24	process_design_case <= property_definition grouped_item = property_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> **{group** **group.description = `heat transfer condition category'}** group group.name **{(group.name = `clean')** **(group.name = `fouled')** **(group.name = `none')** **(group.name = `normal')** **(group.name = `other')** **(group.name = `rated')}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
level_condition_category	group.name	41	11, 15, 24	process_design_case <= property_definition grouped_item = property_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> **{group** **group.description = `level condition category'}** group group.name **{(group.name = `maximum')** **(group.name = `minimum')** **(group.name = `none')** **(group.name = `normal')** **(group.name = `other')** **(group.name = `rated')}**
plant_item_design_- condition_name	property_definition.name	41	15	process_design_case <= property_definition property_definition.name

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_condition_-category	group.name	41	11, 15, 24	process_design_case <= property_definition grouped_item = property_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> **{group** **group.description = `pressure condition category'}** group group.name **{(group.name = `maximum')** **(group.name = `minimum')** **(group.name = `none')** **(group.name = `normal')** **(group.name = `other')** **(group.name = `rated')}**
temperature_condition_-category	group.name	41	11, 15, 24	process_design_case <= property_definition grouped_item = property_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> **{group** **group.description = `temperature condition category'}** group group.name **{(group.name = `maximum')** **(group.name = `minimum')** **(group.name = `none')** **(group.name = `normal')** **(group.name = `other')** **(group.name = `rated')}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
process_design_case to conditional_property_-value	PATH		15, 16	process_design_case <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> representation_item => qualified_representation_item
process_design_case to plant_item	PATH		14, 15	process_design_case <= property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
process_design_case to process_definition	PATH		5, 7, 15, 16	process_design_case <= property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method
PROCESS_DESIGN_-CASE_RELATIONSHIP	property_definition_relationship	45		
description	property_definition_-relationship.description	45		
type	property_definition_relationship.name	45		
process_design_case_-relationship to process_-design_case (is the related design case for)	PATH			property_definition_relationship property_definition_relationship.related_property_definition -> property_definition => process_design_case
process_design_case_-relationship to process_-design_case (is the relating design case for)	PATH			property_definition_relationship property_definition_relationship.relating_property_definition -> property_definition => process_design_case

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
RADIAL_BEARING	product_definition	41	11, 13, 14, 24	**{[product_definition classified_item = product_definition classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `radial bearing'] [product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items{i} classification_assignment <= group_assignment group_assignment. assigned_group -> [group group.name = `bearing'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `mechanical component']]}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
fluid_mach_number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `fluid mach number'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
span	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `span'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
radial_bearing to fluid_-transfer_machine	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition product_definition_relationship **{[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]** **[product_definition_relationship.name = `composition']}** product_definition_relationship.relating_product_definition ->** product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `fluid transfer machine'}**
RECIPROCATING_-POWER_PORT	equipment_port	231	11, 18, 24	equipment_port <= shape_aspect **{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `reciprocating power port'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
normal_stroke_frequency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `normal stroke frequency'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_pistons	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of pistons'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
rated_maximum_stroke_- frequency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `rated maximum stroke frequency'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
ROTATING_- EQUIPMENT_TESTS	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **group group.name = `rotating equipment tests'}**
check_bearings_and_- seals_after_test	group.name	41	5, 6, 11, 24	action_method <- action_method_relationship.relating_method action_method_relationship action_method_relationship.related_method ->** **action_method grouped_item = action_method grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group ->** **group group.name {group.name = `check bearings and seals after test'}**
fit_in_spare_rotor_test	group.name	41	5, 6, 11, 24	action_method <- action_method_relationship.relating_method action_method_relationship action_method_relationship.related_method ->** **action_method grouped_item = action_method grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group ->** **group group.name {group.name = `fit in spare rotor test'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
lubrication_and_seal_-job_test	group.name	41	5, 6, 11, 24	action_method <- action_method_relationship.relating_method action_method_relationship action_method_relationship.related_method ->action_method grouped_item = action_method grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group ->group group.name **{group.name = `lubrication and seal job test'}**
lubrication_and_seal_-shop_test	group.name	41	5, 6, 11, 24	action_method <- action_method_relationship.relating_method action_method_relationship action_method_relationship.related_method ->action_method grouped_item = action_method grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group ->group group.name **{group.name = `lubrication and seal shop test'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mechanical_run_spare_-rotor_test	group.name	41	5, 6, 11, 24	action_method <- action_method_relationship.relating_method action_method_relationship action_method_relationship.related_method -> action_method grouped_item = action_method grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `mechanical run spare rotor test'}**
mechanical_run_test	group.name	41	5, 6, 11, 24	action_method <- action_method_relationship.relating_method action_method_relationship action_method_relationship.related_method -> action_method grouped_item = action_method grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `mechanical run test'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
residual_electrical_- mechanical_runout_test	group.name	41	5, 6, 11, 24	action_method <- action_method_relationship.relating_method action_method_relationship action_method_relationship.related_method -> action_method grouped_item = action_method grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `residual electrical mechanical runout test'}**
rotating_equipment_- with_driver_test	group.name	41	5, 6, 11, 24	action_method <- action_method_relationship.relating_method action_method_relationship action_method_relationship.related_method -> action_method grouped_item = action_method grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `rotating equipment with driver test'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
rotating_equipment_- without_driver_test	group.name	41	5, 6, 11, 24	action_method <- action_method_relationship.relating_method action_method_relationship action_method_relationship.related_method ->action_method grouped_item = action_method grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group ->group group.name **{group.name = `rotating equipment without driver test'}**
vibration_and_axial_- probes_job_test	group.name	41	5, 6, 11, 24	action_method <- action_method_relationship.relating_method action_method_relationship action_method_relationship.related_method ->action_method grouped_item = action_method grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group ->group group.name **{group.name = `vibration and axial probes job test'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vibration_probes_job_-test	group.name	41	5, 6, 11, 24	action_method <- action_method_relationship.relating_method action_method_relationship action_method_relationship.related_method -> action_method grouped_item = action_method grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `vibration probes job test'}**
vibration_probes_shop_-test	group.name	41	5, 6, 11, 24	action_method <- action_method_relationship.relating_method action_method_relationship action_method_relationship.related_method -> action_method grouped_item = action_method grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{group.name = `vibration probes shop test'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
ROTATING_POWER_- PORT	equipment_port	231	11, 18, 24	equipment_port <= shape_aspect **{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `rotating power port'}**
allowable_peak_to_- peak_vibration	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `allowable peak to peak vibration'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
normal_revolution_- frequency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `normal revolution frequency'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
normal_torque	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `normal torque'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
rated_maximum_- revolution_frequency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `rated maximum revolution frequency'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
rated_maximum_torque	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `rated maximum torque'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
rotation_direction	descriptive_representation_- item.description	45	15, 16, 18	equipment_port <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `rotation direction'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SHAFT	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `shaft'] group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `mechanical component']}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter_at_coupling_-end	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter at coupling end'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter_at_impellers	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter at impellers'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
shaft to fluid_transfer_-machine	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition product_definition_relationship **{[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]** **[product_definition_relationship.name = `composition']}** product_definition_relationship.relating_product_definition ->** product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `fluid transfer machine'}**
SHOP_TESTING_-REQUIREMENT	action	41	11, 24	**{action** **classified_item = action** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `shop test requirement'}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
test_type	group.name	41	11, 24	action classified_item = action classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> **{group** **group.description = `test type'}** group group.name
witness_requirements	organization	41	26	action organization_item = action organization_item <- applied_organization_assignment.items[i] applied_organization_assignment <= **{organization_assignment** **organization_assignment.role ->** **organization_role** **organization_role.name = `shop test witness'}** organization_assignment organization_assignment.assigned_organization -> organization
shop_testing_requirement to inspection_and_tests	PATH			action <- action_relationship.related_action action_relationship action_relationship.relating_action -> action => inspection_and_tests

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SIGNAL_PORT	equipment_port	231	, 11, 18, 24	equipment_port <= shape_aspect **{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `signal port'}**
SIMPLE_- PERFORMANCE_CURVE	data_curve	231	16	data_curve <= representation **{representation** **representation.items[i] ->** **representation_item =>** **compound_representation_item}**
SOCKET	shape_aspect	41	11, 18, 24	**{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group =>** **piping_connector_classification]** **[group** **group.name = `socket end']}**
SPACE_- REQUIREMENTS	reserved_space	231		reserved_space <= shape_aspect

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
area_required	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16, 18	reserved_space <= shape_aspect shape_definition = shape_aspect shape_definition characterized_definition = shape_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `area required'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
item_description	shape_aspect.description	41	18	reserved_space <= shape_aspect shape_aspect.description

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
space_requirements to plant_item	PATH		14, 15, 18	reserved_space <= shape_aspect shape_aspect.of_shape ->product_definition_shape <= property_definition property_definition.definition ->characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)
SPARE_ITEM_-RELATIONSHIP	product_definition_relationship	41		**{product_definition_relationship product_definition_relationship.name = `spare item relationship'}**
type	group.name	41	11, 24	product_definition_relationship classified_item = product_definition_relationship classified_item <-classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->group group.name
spare_item_relationship to plant_item (is in-service item for)	PATH			product_definition_relationship product_definition_relationship.relating_product_definition ->(product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
spare_item_relationship to plant_item (is spare item for)	PATH			product_definition_relationship product_definition_relationship.related_product_definition -> (product_definition) (product_definition => externally_defined_plant_item_definition) (product_definition => process_design_case_resource)
THREADED	shape_aspect	41	11, 18, 24	**{shape_aspect** **classified_item = shape_aspect** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group =>** **piping_connector_classification]** **[group** **group.name = `threaded end']}**
thread_type	group.name	41	11, 18, 24	shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> **{group** **group.description = `thread type'}** group group.name **{(group.name = `iso tapered')** **(group.name = `normal course')** **(group.name = `normal fine')** **(group.name = `normal pipe')** **(group.name = `unknown')}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
THRUST_BEARING	product_definition	41	11, 13, 14, 24	**{[product_definition classified_item = product_definition classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `thrust bearing'] [product_definition product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `bearing'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `mechanical component']]}**

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
balance_piston_- compression_load	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `balance piston compression load'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
coupling_coefficient_- friction	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `coupling coefficient friction'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
coupling_gear_pitch	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `coupling gear pitch'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **plane_angle_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
coupling_slip_load	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `coupling slip load'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
gas_loading	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `gas loading'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 9 - Mapping table for plant_item_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
location	descriptive_representation_- item.description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `location on shaft'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 9 - Mapping table for plant_item_data UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
thrust_bearing to fluid_-transfer_machine	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition product_definition_relationship **{[product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage]** **[product_definition_relationship.name = `composition']}** product_definition_relationship.relating_product_definition ->** product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equipment type'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `fluid transfer machine'}**

Note 1: for this assertion, only process_design_case_resource applies.

Table 10 - Mapping table for plant_system_definition UoF

Application element	AIM element	Source	Rules	Reference PATH
PLANT_SYSTEM	(product_definition) (instrumentation_and_-control_system) (process_design_case_-resource) (externally_defined_plant_-system)	41 231 231 231	4, 14	(**{product_definition** **product_definition.frame_of_reference ->** **product_definition_context <=** **application_context_element** **application_context_element.name = `functional occurrence'}**) (instrumentation_and_control_system <= product_definition) (process_design_case_resource <= [action_resource] [product_definition]) (externally_defined_plant_system <= [product_definition] [externally_defined_item])
name	product_definition. description	41	14	(instrumentation_and_control_system <=) (process_design_case_resource <=) (externally_defined_plant_system <=) product_definition product_definition.description
plant_system_id	product_definition.id	41	14	(instrumentation_and_control_system <=) (process_design_case_resource <=) (externally_defined_plant_system <=) product_definition product_definition.id

Table 10 - Mapping table for plant_system_definition UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
service_description	property_definition. name	41	14, 15	(product_definition) (instrumentation_and_control_system <= product_definition) (process_design_case_resource <= product_definition) (externally_defined_plant_system <= product_definition) characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition property_definition.name

Table 10 - Mapping table for plant_system_definition UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plant_system to process_-definition	PATH		5, 7, 14, 15, 16	(product_definition) (instrumentation_and_control_system <= product_definition) (process_design_case_resource <= product_definition) (externally_defined_plant_system <= product_definition) characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method
PLANT_SYSTEM_-ASSEMBLY	assembly_component_usage	44		

Table 10 - Mapping table for plant_system_definition UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PROCESS_CONTROL_-UNIT	product_definition	41	4, 11, 14, 24	**{[product_definition [product_definition.frame_of_reference -> product_definition_context <= application_context_element application_context_element.name = `functional occurrence'] [product_definition <- product_definition_relationship.relating_product_definition product_definition_relationship product_definition_relationship.related_product_definition -> product_definition => instrumentation_and_control_system] [product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `process control unit']}**
function	property_definition. description	41		

Table 10 - Mapping table for plant_system_definition UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
PROCESS_TRAIN	product_definition	41	4, 11, 14, 24	**{[product_definition product_definition.frame_of_reference ->** **product_definition_context <=** **application_context_element** **application_context_element.name = `functional occurrence']** **[product_definition <-** **product_definition_relationship.relating_product_definition** **product_definition_relationship** **product_definition_relationship.related_product_definition ->** **product_definition =>** **instrumentation_and_control_system]** **[product_definition** **grouped_item = product_definition** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `process train']}**
function	property_definition. description	41	14, 15	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition property_definition.description

Table 11 - Mapping table for process_description UoF

Application element	AIM element	Source	Rules	Reference PATH
AGGREGATION_- RELATIONSHIP	action_method_relationship	41	6	**{action_method_relationship action_method_relationship.name = `process definition aggregation'}**
ALTERNATE_- RELATIONSHIP	action_method_relationship	41	6	**{action_method_relationship action_method_relationship.name = `process definition alternate'}**
CONNECTED_- PROCESS_PORT	action_resource_relationship	41		**{action_resource_relationship action_resource_relationship.name = `process port connection'}**
flow_state	descriptive_representation_- item.description	45	16, 17	action_resource_relationship characterized_resource_definition = action_resource_relationship characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->> representation representation.items[i] ->> **{representation_item representation_item.name = `flow state'}** representation_item => descriptive_representation_item descriptive_representation_item.description
connected_process_port to process_port	PATH			action_resource_relationship action_resource_relationship.related_resource ->> action_resource => process_port
connected_process_port to process_port_- connection	PATH			action_resource_relationship action_resource_relationship.relating_resource ->> action_resource => process_port_connection

Table 11 - Mapping table for process_description UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
EVENT_- SEQUENCE_WITH_- CONDITION	(concurrent_action_method) (serial_action_method) (sequential_method) (event_sequence_with_condition)	49 49 49 231		(event_sequence_with_condition <= [action_method] [action_method_relationship])
sequence_type	action_method_relationship.name	41	6	(concurrent_action_method <=) (serial_action_method <=) (sequential_method <= serial_action_method <=) (event_sequence_with_condition <=) action_method_relationship action_method_relationship.name
PROCESS_DEFINITION	action_method	41		
description	action_method.description	41		
process_definition_name	action_method.name	41		
type	group.name	41	1, 5, 11, 24	action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> **{group => externally_defined_group}** group group.name
process_definition to plant_item	PATH		5	action_method supported_item = action_method supported_item <- action_resource.usage[i] action_resource => process_resource_plant_item <= product

Table 11 - Mapping table for process_description UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
process_definition to process_design_-property_value	PATH		5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation => process_design_property_resource
PROCESS_-DEFINITION_-RELATIONSHIP	action_method_relationship	41		
description	action_method_relationship.description	41		
type	action_method_relationship.name	41		
process_definition_-relationship to process_-definition	PATH		6	action_method_relationship action_method_relationship.relating_method -> action_method
process_definition_-relationship to process_-definition	PATH		6	action_method_relationship action_method_relationship.related_method -> action_method
PROCESS_PORT	process_port	231		process_port <= [characterized_object] [action_resource]

Table 11 - Mapping table for process_description UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
function	action_method.name	41	5, 6, 8, 11, 24	process_port <= action_resource action_resource.usage[i] ->> supported_item supported_item = action_method **{[action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `process port function']** **[action_method <-** **action_method_relationship.related_action_method** **action_method_relationship** **action_method_relationship.name = `process port function in process']}** action_method action_method.name
normal_flow_direction	descriptive_representation_-item.description	45	8, 16, 17	process_port <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->> representation representation.items[i] ->> **{representation_item** **representation_item.name = `flow state'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 11 - Mapping table for process_description UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
port_name	characterized_object.name	41	9	process_port <= characterized_object characterized_object.name
type	characterized_object.description	41	9	process_port <= characterized_object characterized_object.description **{(characterized_object.description = `energy')** **(characterized_object.description = `signal')** **(characterized_object.description = `material')** **(characterized_object.description = `electrical power')** **(characterized_object.description = `mechanical power')** **(characterized_object.description = `direct current')** **(characterized_object.description = `alternating current')** **(characterized_object.description = `rotating power')** **(characterized_object.description = `reciprocating power')}**
process_port to equipment_port	PATH		9, 18	process_port <= characterized_object characterized_definition = characterized_object characterized_definition<- property_definition.definition **{property_definition** **property_definition.description = 'port connectivity'}** property_definition <- property_definition_relationship.related_property_definition **{property_definition_relationship** **property_definition_relationship.name = 'process connection implementation'}** property_definition_relationship property_definition_relationship.relating_property_definition ->** **{property_definition** **property_definition.description = 'port connectivity'}** property_definition property_definition.definition ->** characterized_definition characterized_definition = shape_definition shape_definition = shape_aspect shape_aspect => equipment_port

Table 11 - Mapping table for process_description UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
process_port to process_-definition	PATH		2, 5, 8	process_port <= action_resource action_resource.usage[i] ->> supported_item supported_item = action_method action_method
PROCESS_PORT_-CONNECTION	process_port_connection	231	9	process_port_connection <= [action_resource] [characterized_object_relationship **{characterized_object_relationship** **[characterized_object_relationship.relating_object ->]** **[characterized_object_relationship.related_object ->]** **characterized_object =>** **process_port}**]
description	characterized_object_-relationship.description	41		process_port_connection <= characterized_object_relationship characterized_object_relationship.description
process_port_connection to stream	PATH		8	process_port_connection <= action_resource <- action_resource_relationship.related_resource **{action_resource_relationship** **action_resource_relationship.name = `stream in port connection'}** action_resource_relationship action_resource_relationship.relating_resource ->> action_resource => stream
PROCESS_PORT_-STREAM_CASE	action_resource_relationship	41		**{action_resource_relationship** **action_resource_relationship.name = `process port stream case'}**
process_port_stream_-case to process_port	PATH		8	action_resource_relationship action_resource_relationship.related_resource ->> action_resource => process_port

Table 11 - Mapping table for process_description UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
process_port_stream_- case to stream	PATH		8	action_resource_relationship action_resource_relationship.relating_resource ->action_resource => stream
PROCESS_SERVICE	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->group group.name = `process service'}**

Table 12 - Mapping table for process_flow_diagram UoF

Application element	AIM element	Source	Rules	Reference PATH
PFD	drawing_revision	101		**{drawing_revision drawing_revision.drawing_identifier ->** **drawing_definition** **drawing_definition.drawing_type = `process flow diagram'}**
id	drawing_definition.drawing_number	101		drawing_revision drawing_revision.drawing_identifier ->drawing_definition drawing_definition.drawing_number
type	group.name	41	11, 24, 11, 24	(presentation_area classified_item = presentation_area) (presentation_layer_assignment classified_item = presentation_layer_assignment) classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->group group.name
version	drawing_revision.revision_identifier	101		
pfd to process_definition	PATH		5, 12, 16, 5, 12, 16	drawing_revision <= presentation_set presentation_representation_select = presentation_set presentation_representation_select <- presented_item_representation.presentation presented_item_representation presented_item_representation.item ->presented_item => presented_item_with_association presented_item_with_association.items[i] ->associated_item associated_item = action_method action_method

Table 12 - Mapping table for process_flow_diagram UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PFD_CURVE	annotation_curve_occurrence	46		
defining_curve	styled_item.item	46		annotation_curve_occurrence <= annotation_occurrence <= styled_item styled_item.item
PFD_ELEMENT	annotation_occurrence	46		
style	styled_item.styles	46		annotation_occurrence <= styled_item styled_item.styles
pfd_element to equipment_port	PATH		12, 16, 12, 16	annotation_occurrence <= styled_item <= representation_item <- representation.items[i] representation => **{presentation_representation =>** **presentation_with_association}** presentation_representation presentation_representation_select = presentation_representation presentation_representation_select <- presented_item_representation.presentation presented_item_representation presented_item_representation.item -> presented_item => presented_item_with_association presented_item_with_association.items[i] -> associated_item associated_item = equipment_port equipment_port

Table 12 - Mapping table for process_flow_diagram UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pfd_element to item_property_reference	PATH		12, 16, 12, 16	annotation_occurrence <= styled_item <= representation_item <- representation.items[i] representation => **{presentation_representation => presentation_with_association}** presentation_representation presentation_representation_select = presentation_representation presentation_representation_select <- presented_item_representation.presentation presented_item_representation presented_item_representation.item ->> presented_item => presented_item_with_association presented_item_with_association.items[i] ->> associated_item associated_item = representation representation **{representation representation.name = `item property_reference'}**
pfd_element to pfd_-presentation_component	PATH			annotation_occurrence <= styled_item <= (representation_item <- representation.items[i] representation => presentation_representation => presentation_area) (representation_item layered_item = representation_item layered_item <- presentation_layer_assignment.assigned_items[i] presentation_layer_assignment)

Table 12 - Mapping table for process_flow_diagram UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pfd_element to process_-design_property_value	PATH		12, 16, 12, 16	annotation_occurrence <= styled_item <= representation_item <- representation.items[i] representation => **{presentation_representation =>** **presentation_with_association}** presentation_representation presentation_representation_select = presentation_representation presentation_representation_select <- presented_item_representation.presentation presented_item_representation presented_item_representation.item ->> presented_item => presented_item_with_association presented_item_with_association.items[i] ->> associated_item associated_item = representation representation => process_design_property_value

Table 12 - Mapping table for process_flow_diagram UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pfd_element to process_equipment	PATH		11, 12, 13, 16, 24, 11, 12, 13, 16, 24	annotation_occurrence <= styled_item <= representation_item <- representation.items[i] representation => **{presentation_representation =>** **presentation_with_association}** presentation_representation presentation_representation_select = presentation_representation presentation_representation_select <- presented_item_representation.presentation presented_item_representation presented_item_representation.item ->>br>presented_item => presented_item_with_association presented_item_with_association.items[i] ->> associated_item associated_item = product product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `equipment'}**

Table 12 - Mapping table for process_flow_diagram UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pfd_element to process_port	PATH		12, 16, 12, 16	annotation_occurrence <= styled_item <= representation_item <- representation.items[i] representation => **{presentation_representation =>** **presentation_with_association}** presentation_representation presentation_representation_select = presentation_representation presentation_representation_select <- presented_item_representation.presentation presented_item_representation presented_item_representation.item ->> presented_item => presented_item_with_association presented_item_with_association.items[i] ->> associated_item associated_item = process_port process_port

Table 12 - Mapping table for process_flow_diagram UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pfd_element to process_unit_operation	PATH		5,11, 12, 16, 24, 5, 11, 12, 16, 24	annotation_occurrence <= styled_item <= representation_item <- representation.items[i] representation => **{presentation_representation =>** **presentation_with_association}** presentation_representation presentation_representation_select = presentation_representation presentation_representation_select <- presented_item_representation.presentation presented_item_representation presented_item_representation.item ->>br>presented_item => presented_item_with_association presented_item_with_association.items[i] ->> associated_item associated_item = action_method action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `process unit operation'}**

Table 12 - Mapping table for process_flow_diagram UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pfd_element to stream	PATH		12, 16, 12, 16	annotation_occurrence <= styled_item <= representation_item <- representation.items[i] representation => **{presentation_representation =>** **presentation_with_association}** presentation_representation presentation_representation_select = presentation_representation presentation_representation_select <- presented_item_representation.presentation presented_item_representation presented_item_representation.item -> presented_item => presented_item_with_association presented_item_with_association.items[i] -> associated_item associated_item = stream stream
pfd_element to utility_- material_service	PATH		12, 16, 12, 16	annotation_occurrence <= styled_item <= representation_item <- representation.items[i] representation => **{presentation_representation =>** **presentation_with_association}** presentation_representation presentation_representation_select = presentation_representation presentation_representation_select <- presented_item_representation.presentation presented_item_representation presented_item_representation.item -> presented_item => presented_item_with_association presented_item_with_association.items[i] -> associated_item associated_item = representation representation

Table 12 - Mapping table for process_flow_diagram UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pfd_element to utility_service_stream_-demand	PATH		12, 16, 12, 16	annotation_occurrence <= styled_item <= representation_item <- representation.items[i] representation => **{presentation_representation =>** **presentation_with_association}** presentation_representation presentation_representation_select = presentation_representation presentation_representation_select <- presented_item_representation.presentation presented_item_representation presented_item_representation.item ->** presented_item => presented_item_with_association presented_item_with_association.items[i] ->** associated_item associated_item = action_resource_requirement action_resource_requirement **{action_resource_requirement** **action_resource_requirement.kind ->** **resource_requirement_type** **resource_requirement_type.name = `utility service stream demand'}**
PFD_POINT	annotation_point_occurrence	46		**{annotation_point_occurrence <=** **annotation_occurrence <=** **styled_item** **styled_item.item ->** **representation_item =>** **geometric_representation_item =>** **point =>** **cartesian_point}**

Table 12 - Mapping table for process_flow_diagram UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
point_coordinates	cartesian_point.coordinates	42		annotation_point_occurrence <= annotation_occurrence <= styled_item styled_item.item ->> representation_item => geometric_representation_item => point => cartesian_point cartesian_point.coordinates
PFD_PRESENTATION_- COMPONENT	(presentation_area) (presentation_layer_assignment)	46 46		
pfd_presentation_- component to pfd	PATH			(presentation_area <-) (presentation_layer_assignment <- presentation_layer_usage.assignment presentation_layer_usage presentation_layer_usage.presentation ->> presentation_representation => presentation_area <-) area_in_set.area area_in_set area_in_set.in_set ->> presentation_set => drawing_revision **{drawing_revision** **drawing_revision.drawing_identifier ->** **drawing_definition** **drawing_definition.drawing_type = `process flow diagram'}**
PFD_PRESENTATION_- COMPONENT_- COMPOSITION	presentation_view	46		

Table 12 - Mapping table for process_flow_diagram UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
clipping	(camera_model_d2) (camera_model_d2_shape_- clipping.shape_clipping)	46 46	16, 16	presentation_view <= presentation_representation <= representation representation.items[i] ->> representation_item => geometric_representation_item => camera_model => (camera_model_d2 **{camera_model_d2** **camera_model_d2.view_window = .True.}**) (camera_model_d2 => camera_model_d2_shape_clipping camera_model_d2_shape_clipping.shape_clipping)
pfd_presentation_- component_composition to pfd_presentation_- component	PATH		16, 16	presentation_view <= presentation_representation <= (representation <- (representation_map.mapped_representation representation_map <- mapped_item.mapping_source mapped_item <= representation_item <- representation.items[i]) (representation_relationship.rep_1 representation_relationship representation_relationship.rep_2 ->) representation => presentation_representation => presentation_area) (representation representation.items[i] ->> representation_item layered_item = representation_item layered_item <- presentation_layer_assignment.assigned_items[i] presentation_layer_assignment)
PFD_SYMBOL_- DEFINITION	(annotation_symbol) (defined_symbol)	46 46		

Table 12 - Mapping table for process_flow_diagram UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
description	descriptive_representation_item.description	45	16, 16	annotation_symbol <= mapped_item mapped_item.mapping_source -> **{representation_map =>** **symbol_representation_map}** representation_map representation_map.mapped_representation -> **{representation =>** **symbol_representation}** representation representation.items[i] -> **{representation_item** **representation_item.name = `symbol description'}** representation_item => descriptive_representation_item descriptive_representation_item.description
identifier	identification_assignment.assigned_id	41	25, 25	(annotation_symbol identified_item = annotation_symbol) (defined_symbol identified_item = defined_symbol) identified_item <- applied_identification_assignment.items[i] applied_identification_assignment <= identification_assignment identification_assignment.assigned_id
name	representation_item.name	43		(annotation_symbol <= mapped_item <=) (defined_symbol <= geometric_representation_item <=) representation_item representation_item.name

Table 12 - Mapping table for process_flow_diagram UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
source	external_source	41	10, 10	defined_symbol defined_symbol.definition -> defined_symbol_select defined_symbol_select = externally_defined_symbol externally_defined_symbol <= externally_defined_item externally_defined_item.source -> external_source
pfd_symbol_definition to pfd_curve	PATH		16, 16	annotation_symbol <= mapped_item mapped_item.mapping_source -> **{representation_map => symbol_representation_map}** representation_map representation_map.mapped_representation -> **{representation => symbol_representation}** representation representation.items[i] -> representation_item => styled_item => annotation_occurrence => annotation_curve_occurrence

Table 12 - Mapping table for process_flow_diagram UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pfd_symbol_definition to pfd_point	PATH		16, 16	annotation_symbol <= mapped_item mapped_item.mapping_source ->** {representation_map => symbol_representation_map}** representation_map representation_map.mapped_representation ->** {representation => symbol_representation}** representation representation.items[i] ->** representation_item => styled_item => annotation_occurrence => annotation_point_occurrence
pfd_symbol_definition to pfd_symbol_occurrence	PATH		16, 16	annotation_symbol <= mapped_item mapped_item.mapping_source ->** {representation_map => symbol_representation_map}** representation_map representation_map.mapped_representation ->** {representation => symbol_representation}** representation representation.items[i] ->** representation_item => styled_item => annotation_occurrence => annotation_symbol_occurrence

Table 12 - Mapping table for process_flow_diagram UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pfd_symbol_definition to pfd_symbol_text	PATH		16, 16	annotation_symbol <= mapped_item mapped_item.mapping_source ->** {representation_map => symbol_representation_map}** representation_map representation_map.mapped_representation ->** {representation => symbol_representation}** representation representation.items[i] ->** representation_item => styled_item => annotation_occurrence => annotation_text_occurrence
PFD_SYMBOL_-OCCURRENCE	annotation_symbol_occurrence	46		
PFD_TEXT	annotation_text_occurrence	46		
text_literal	text_literal	46		annotation_text_occurrence <= annotation_occurrence <= styled_item styled_item.item ->** representation_item => geometric_representation_item => text_literal
PFD_TITLE_BLOCK	annotation_symbol_occurrence	46	11, 24, 11, 24	**{annotation_symbol_occurrence classified_item = annotation_symbol_occurrence classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **group group.name = `pfd title block'}**

Table 12 - Mapping table for process_flow_diagram UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
approvals	approval	41	19, 19	annotation_symbol_occurrence approved_item = annotation_symbol_occurrence approved_item <- applied_approval_assignment.items[i] applied_approval_assignment <= approval_assignment approval_assignment.assigned_approval -> approval
contractor_info	(organization_assignment) (person_and_organization_assignment	41 41	26, 26	annotation_symbol_occurrence (organized_item = annotation_symbol_occurrence organized_item <- applied_organization_assignment.items[i] applied_organization_assignment <= organization_assignment **{organization_assignment** **organization_assignment.role ->** **organization_role** **organization_role.name = `contractor'}**) (person_and_organization_item = annotation_symbol_occurrence person_and_organization_item <- applied_person_and_organization_assignment.items[i] applied_person_and_organization_assignment <= person_and_organization_assignment **{person_and_organization_assignment** **person_and_organization_assignment.role ->** **person_and_organization_role** **person_and_organization_role.name = `contractor'}**)

Table 12 - Mapping table for process_flow_diagram UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
pfd_title_block to pfd	PATH		16, 16	annotation_symbol_occurrence <= annotation_occurrence <= styled_item <= representation_item <- representation.items[i] representation => presentation_representation => presentation_area <- area_in_set.area area_in_set area_in_set.in_set -> presentation_set => drawing_revision **{drawing_revision** **drawing_revision.drawing_identifier ->** **drawing_definition** **drawing_definition.drawing_type = `process flow diagram'}**

Table 13 - Mapping table for process_simulation_data UoF

Application element	AIM element	Source	Rules	Reference PATH
ALGORITHM_TYPE_- PARAMETER	representation_item	43		
parameter_name	representation_item.name	43		
parameter_value	([measure_with_unit.value_component] [measure_with_unit.unit_component]) (descriptive_representation_- item.description)	41 45		representation_item => (measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]) (descriptive_representation_item descriptive_representation_item.description)
BALANCE	action_property	49	7	**{action_property action_property.description = `balance'}**
discrepancy	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	16	action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->> representation representation.items[i] ->> representation_item => **{representation_item representation_item.name = `discrepancy'}** measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
error_flag	descriptive_representation_-item.description	45	16	action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> representation_item => **{representation_item** **representation_item.name = `error flag'}**  descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `error')** **(descriptive_representation_item.description = `no error')}**
type	action_property.description	41		**{(action_property.description = `energy balance')** **(action_property.description = `mass balance')** **(action_property.description = `mole balance')}**
balance to process_-simulation	PATH		5, 7	action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method => process_simulation
CONVERGENCE_-BLOCK_PROPERTY_-VALUE_USAGE	action_property	49	7	**{action_property** **action_property.description = `convergence block property value usage'}**
converging_or_ignored	action_property.name	49		**{(action_property.name = `converging')** **(action_property.name = `ignored')}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
convergence_block_- property_value_usage to stream_convergence_- block	PATH		5, 7	action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method **{action_method** **action_method.purpose = `stream convergence block'}** action_method => process_simulation
convergence_block_- property_value_usage to process_design_- property_value	PATH		16	action_property <- action_property_representation.property action_property_representation **{action_property_representation** **action_property_representation.name = `assigned value'}** action_property_representation.representation -> representation => process_design_property_value
EXTERNALLY_- DEFINED_- SIMULATION_- ALGORITHM	externally_defined_action_resource	231		externally_defined_action_resource <= [action_resource] [externally_defined_item]
name	externally_defined_item. name	41	10	externally_defined_action_resource <= externally_defined_item externally_defined_item.name
source	external_source	41	10	externally_defined_action_resource <= externally_defined_item externally_defined_item.source -> external_source

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
externally_defined_- simulation_algorithm to process_simulation	PATH		5, 8	externally_defined_action_resource <= action_resource action_resource.usage[i] ->>br>supported_item supported_item = action_method action_method => process_simulation
PROCESS_SIMULATION	process_simulation	231		process_simulation <= action_method
algorithm_name	action_resource.name	41	5, 8, 11, 24	process_simulation <= **{action_method** **grouped_item = action_method** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `simulation algorithm'}** action_method supported_item = action_method supported_item <- action_resource.usage[i] action_resource action_resource.name

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
algorithm_type	action_resource_type.name	41	5, 8	process_simulation <= action_method supported_item = action_method supported_item <- action_resource.usage[i] action_resource action_resource.kind -> action_resource_type action_resource_type.name **{(action_resource_type.name = `broyden')** **(action_resource_type.name = `complex')** **(action_resource_type.name = `continuation')** **(action_resource_type.name = `direct')** **(action_resource_type.name = `newton')** **(action_resource_type.name = `model')** **(action_resource_type.name = `other')** **(action_resource_type.name = `secant')** **(action_resource_type.name = `sqp')** **(action_resource_type.name = `wegstein')}**
module_name	action_resource.name	41	5, 8	process_simulation <= action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `simulation module'}** action_resource action_resource.name

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
module_owner	organization	41	5, 26	process_simulation <= action_method organization_item = action_method organization_item <- applied_organization_assignment.items[i] applied_organization_assignment <= organization_assignment organization_assignment.assigned_organization -> organization
name	action_method.name	41	5	process_simulation <= action_method action_method.name
simulation_error_flag	action_method.consequence	41	5	process_simulation <= action_method action_method.consequence
version	identification_assignment.assigned_id	41	5, 8, 25	process_simulation <= **{action_method** **supported_item = action_method** **supported_item <-** **action_resource.usage[i]** **action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `simulation module'}** action_method identified_item = action_method identified_item <- applied_identification_assignment.items[i] applied_identification_assignment <= identification_assignment identification_assignment.assigned_id

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
process_simulation to algorithm_type_- parameter	PATH		5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> representation_item
PROCESS_- SIMULATION_- RELATIONSHIP	action_method_relationship	41		
process_simulation_- relationship to process_- simulation (as related)	PATH		6	action_method_relationship action_method_relationship.related_method -> action_method
process_simulation_- relationship to process_- simulation (as relating)	PATH		6	action_method_relationship action_method_relationship.relating_method -> action_method
SIMULATED_- PROCESS_DEFINITION	simulated_process_definition	231		simulated_process_definition <= action_method_relationship
usage_type	action_method_relationship.name	41	6	simulated_process_definition <= action_method_relationship action_method_relationship.name
simulated_process_- definition to process_- definition	PATH		6	simulated_process_definition <= action_method_relationship action_method_relationship.relating_method -> action_method => process_simulation

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
simulated_process_- definition to process_- simulation	PATH		6	simulated_process_definition <= action_method_relationship action_method_relationship.related_method ->> action_method => process_simulation
SIMULATION_BLOCK	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation block'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process simulation'}**
description	action_method.description	41	5	process_simulation <= action_method action_method.description

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type #1: the type is user specified. #2: The simulation block is one of the three types defined in the arm.	#1 (group.name) #2 (action_method.purpose)	41 41	5, 11, 24	process_simulation <= action_method #1: (classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **{group group.name = `simulation block'}** group <- group_relationship.relating_group group_relationship group_relationship.related_group ->** group group.name) #2: (action_method.purpose **{(action_method.purpose = `simulation unit operation') (action_method.purpose = `stream convergence block') (action_method.purpose = `variable convergence block')}**)
SIMULATION_-CENTRIFUGE	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method [action_method.purpose = `simulation unit operation'] [classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **{group group.name = `simulation centrifuge'} group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `simulation liquid solid separator']}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter_list	compound_representation_item	43	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter list'}** representation_item => compound_representation_item **{compound_representation_item** **compound_representation_item.item_element ->** **compound_item_definition** **compound_item_definition = list_representation_item** **list_representation_item}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
speed_list	compound_representation_item	43	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `speed list'}** representation_item => compound_representation_item **{compound_representation_item** **compound_representation_item.item_element ->** **compound_item_definition** **compound_item_definition = list_representation_item** **list_representation_item}**
SIMULATION_- COMPRESSOR	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation compressor'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation unit operation']}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
calculation_method	action_property	49	5, 7	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property **{action_property** **action_property.name = `calculation method'}**
cooler_differential_-pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	5, 8, 16	process_simulation <= action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `compressor'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.definition resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cooler differential pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cooler_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	5, 8, 16	process_simulation <= action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `compressor'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.definition resource_property <- resource_property_representation.property resource_property_representation action_property_representation.representation ->** **representation representation.items[i] ->** **{representation_item** **representation_item.name = `cooler temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SIMULATION_- COUNTERCURRENT_- SOLIDS_DECANTER	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation countercurrent solids decanter'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation unit operation']}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stages_maximum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum stages'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stages_minimum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `minimum stages'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SIMULATION_- CRYSTALLIZER	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation crystallizer'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation liquid solid separator']}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
equation_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `equation coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
equation_exponent	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `equation exponent'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
equation_identifier	descriptive_representation_item. description	45	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->> representation representation.items[i] ->> **{representation_item** **representation_item.name = `equation identifier'}** representation_item => descriptive_representation_item descriptive_representation_item.description
shape_factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->> representation representation.items[i] ->> **{representation_item** **representation_item.name = `shape factor'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SIMULATION_- DISSOLVER	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation dissolver'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation liquid solid separator']}**
mass_transfer_- coefficients	compound_representation_item	43	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->> representation representation.items[i] ->> **{representation_item** **representation_item.name = `mass transfer coefficients'}** representation_item => compound_representation_item **{compound_representation_item** **compound_representation_item.item_element ->** **compound_item_definition** **compound_item_definition = list_representation_item** **list_representation_item}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mass_transfer_expression	descriptive_representation_- item.description	45	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->> representation representation.items[i] ->> **{representation_item** **representation_item.name = `mass transfer expression'}** representation_item => descriptive_representation_item descriptive_representation_item.description
SIMULATION_- DISTILLATION	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation distillation'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation unit operation']}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
feed_stage_number_- optimum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->> representation representation.items[i] ->> **{representation_item** **representation_item.name = `feed stage number optimum'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
initial_estimation_- method	action_property.description	49	5, 7	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property action_property.description

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
initial_reflux	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `initial reflux'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
initial_reflux_ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `initial reflux ratio'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_stages_- minimum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of stages minimum'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reflux_ratio_multiplier	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `reflux ratio multiplier'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SIMULATION_- DISTILLATION_STAGE	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation distillation stage'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation unit operation']}**
initial_stage_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->> representation representation.items[i] ->> **{representation_item** **representation_item.name = `initial stage pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
initial_stage_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `initial stage temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
SIMULATION_- ELECTROSTATIC_- PRECIPITATOR	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation electrostatic precipitator'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation unit operation']}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
gas_velocity_profile_- standard_deviation	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `gas velocity profile standard deviation'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
SIMULATION_FABRIC_- FILTER	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation fabric filter'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation unit operation']}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
calculation_mode	descriptive_representation_- item.description	45	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `calculation mode'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `calculate pressure drop')** **(descriptive_representation_item.description = `calculate time')}**
SIMULATION_FLASH	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation flash'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation unit operation']}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_estimate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure estimate'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
temperature_estimate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `temperature estimate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
three_phase_calculation	action_resource.name	41	5, 8, 11, 24	process_simulation <= action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **grouped_item = action_resource** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `simulation algorithm'}** action_resource action_resource.name **{(action_resource.name = `gibbs')** **(action_resource.name = `equilibrium')** **(action_resource.name = `none')** **(action_resource.name = `other')** **(action_resource.name = `rigorous')** **(action_resource.name = `unknown')** **(action_resource.name = `water decanted')}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SIMULATION_GAS_-SOLID_SEPARATOR	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation gas solid separator'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation unit operation']}**
calculation_option	action_resource_type.name	41	5, 8, 11, 24	process_simulation <= action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **grouped_item = action_resource** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `simulation algorithm'}** action_resource action_resource.kind ->** action_resource_type action_resource_type.name

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SIMULATION_HEAT_-EXCHANGER	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation heat exchanger'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation unit operation']}**
uamax	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `uamax'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SIMULATION_- HYDROCYCLONE	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation hydrocyclone'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation unit operation']}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
particle_velocity_- equation_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `particle velocity equation coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
particle_velocity_- equation_exponent	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `particle velocity equation exponent'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SIMULATION_LIQUID_-SOLID_SEPARATOR	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation liquid solid separator'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation unit operation']}**
calculation_option	action_method.description	41	5	process_simulation <= action_method action_method.description **{(action_method.description = `design')** **(action_method.description = `simulation')}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SIMULATION_PIPELINE	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation pipeline'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation unit operation']}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
calculation_direction	descriptive_representation_- item.description	45	5, 8, 11, 16, 17, 24	process_simulation <= action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **grouped_item = action_resource** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `simulation algorithm'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.definition **{resource_property** **resource_property.name = `algorithm parameters'}** resource_property <- resource_property_representation.property resource_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `calculation direction'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_differential_- pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum differential pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
maximum_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum velocity'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
minimum_radius	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `minimum radius'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
numerical_integration_-key	descriptive_representation_-item.description	45	5, 8, 11, 16, 17, 24	process_simulation <= action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **grouped_item = action_resource** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `simulation algorithm'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.definition **{resource_property** **resource_property.name = `algorithm parameters'}** resource_property <- resource_property_representation.property resource_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `numerical integration key'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `closed form method')** **(descriptive_representation_item.description = `numerical integration')}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pipe_sizes	compound_representation_item	43	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pipe sizes'}** representation_item => compound_representation_item **{compound_representation_item** **compound_representation_item.item_element ->** **compound_item_definition** **compound_item_definition = set_representation_item** **set_representation_item** **set_representation_item[i] ->** **{representation_item** **representation_item.name = `diameter'}** **representation_item =>** **measure_representation_item <=** **measure_with_unit =>** **length_measure_with_unit}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thermal_simulation_key	descriptive_representation_- item.description	45	5, 8, 11, 16, 17, 24	process_simulation <= action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **grouped_item = action_resource** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `simulation algorithm'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.definition **{resource_property** **resource_property.name = `algorithm parameters'}** resource_property <- resource_property_representation.property resource_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `thermal simulation key'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `energy balance')** **(descriptive_representation_item.description = `linear temperature profile')}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SIMULATION_- PIPELINE_NODE	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation pipeline node'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation unit operation']}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
erosion_velocity_- calculation_constant	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `erosion velocity calculation constant'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SIMULATION_- POLYTROPIC_- COMPRESSOR	process_simulation	231	5, 1124	process_simulation <= action_method [action_method.purpose = `simulation unit operation'] [classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> **{group** **group.name = `simulation polytropic compressor'}** group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `simulation unit operation']}

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
radial_frequency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 16, 17	process_simulation <= action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `compressor'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.definition resource_property <- resource_property_representation.property resource_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `radial frequency'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SIMULATION_- POLYTROPIC_- COMPRESSOR_STAGE	process_simulation	231	5, 6, 11, 24	process_simulation <= action_method **{[action_method <-** **action_method_relationship.related_method** **{action_method_relationship** **action_method_relationship.name = `composition relationship'}** **action_method_relationship** **action_method_relationship.relating_method ->** **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `simulation polytropic compressor'}** **action_method =>** **process_simulation]** **[action_method** **action_method.purpose = `simulation unit operation']** **[action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation polytropic compressor stage'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation unit operation']}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
polytropic_efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `polytropic efficiency'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stage_number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `stage number'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure** **numeric_measure}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
simulation_polytropic_- compressor_stage to simulation_polytropic_- compressor	PATH		6	process_simulation <= action_method <- action_method_relationship.related_method action_method_relationship action_method_relationship.relating_method -> action_method => process_simulation

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SIMULATION_- ROTARY_FILTER	process_simulation	231	5, 11, 24	process_simulation <= action_method **{action_method** **[action_method.purpose = `simulation unit operation']** **[classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `simulation rotary filter'}** **group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `simulation liquid solid separator']}**
pressure_drop_maximum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `pressure drop maximum'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
width_diameter_ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `width diameter ratio'}** representation_item => measure_representation_item <= **{measure_with_unit** **[measure_with_unit.value_component ->** **measure_value** **measure_value = ratio_measure** **ratio_measure]** **[measure_with_unit.unit_component ->** **unit** **unit = derived_unit** **derived_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
SIMULATION_- SECTION_- RELATIONSHIP	action_method_relationship	41	6	**{action_method_relationship** **action_method_relationship.name = `simulation section relationship'}**
process_simulation_- section_name	identification_assignment.assigned_id	41	6, 25	action_method_relationship identified_item = action_method_relationship identified_item <- applied_identification_assignment.items[i] applied_identification_assignment <= identification_assignment identification_assignment.assigned_id

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SIMULATION_UNIT_- OPERATION	process_simulation	41	5	process_simulation <= action_method **{action_method** **action_method.purpose = `simulation unit operation'}**
STREAM_- CONVERGENCE_BLOCK	process_simulation	231	5	process_simulation <= action_method **{action_method** **action_method.purpose = `stream convergence block'}**
acceleration_method	descriptive_representation_- item.description	45	5, 8, 11, 16, 17, 24	process_simulation <= action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **grouped_item = action_resource** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `simulation algorithm'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.definition resource_property <- resource_property_representation.property resource_property_representation action_property_representation.representation ->representation representation.items[i] ->representation_item => descriptive_representation_item descriptive_representation_item.description

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
calculation_sequence_-type	descriptive_representation_-item.description	45	5, 7, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition **{action_property** **action_property.name = `simulation execution environment'}** action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `calculation sequence type'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `algorithm only')** **(descriptive_representation_item.description = `calculation order')** **(descriptive_representation_item.description = `calculation order and algorithm')** **(descriptive_representation_item.description = `complete tear stream')** **(descriptive_representation_item.description = `complete tear stream and algorithm')** **(descriptive_representation_item.description = `partial tear stream')** **(descriptive_representation_item.description = `partial tear stream and algorithm')** **(descriptive_representation_item.description = `system default')}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tolerance_method	descriptive_representation_- item.description	45	5, 7, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition **{action_property** **action_property.name = `simulation execution environment'}** action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tolerance method'}** representation_item => descriptive_representation_item descriptive_representation_item.description
tolerance_value	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition **{action_property** **action_property.name = `simulation execution environment'}** action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tolerance value'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	5, 7, 11, 24	process_simulation <= action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition **{action_property** **action_property.name = `simulation execution environment'}** classified_item = action_property classified_item <- classification_assignment.items [i] classification_assignment => group_assignment **{group_assignment.role ->** **group_role** **group_role.name = `algorithm type'}** group_assignment.assigned_group -> group group.name
stream_convergence_- block to simulation_block	PATH		6	process_simulation <= action_method <- action_method_relationship.related_method **{action_method_relationship** **action_method_relationship.name = `block sequence'}** action_method_relationship action_method_relationship.relating_method -> action_method => process_simulation
stream_convergence_- block to trace_- component_specification	PATH		5	process_simulation <= action_method supported_item = action_method supported_item <- action_resource.usage[i] action_resource => process_design_case_resource

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
THERMOPHYSICAL_-PROPERTY_METHOD	action_property_representation	49	11, 16, 24	**{action_property_representation classified_item = action_property_representation classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** group **group.name = `thermophysical property method'}**
method_description	action_property_-representation.description	49		
method_name	action_property_representation.name	49		
method_phase	phase	231	7, 16	action_property_representation action_property_representation.property ->** **action_property action_property.definition ->** characterized_action_definition characterized_action_definition = action action =>** **phase**
thermophysical_-property_method to equation_group	PATH		16	action_property_representation action_property_representation.representation ->** **representation {representation representation.name = `equation group'}**
THERMOPHYSICAL_-PROPERTY_METHOD_-OPTION	action_property	49	7	**{action_property action_property.description = `thermophysical property option'}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
default	group.name	41	7, 11, 24	action_property classified_item = action_property classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->group group.name **{group.name = `default'}**
name	action_property.name	49		
value	descriptive_representation_item.description	45	16	action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->representation_item => descriptive_representation_item descriptive_representation_item.description
thermophysical_-property_option to process_simulation	PATH		5, 7	action_property action_property.definition ->characterized_action_definition characterized_action_definition = action_method action_method =>process_simulation

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thermophysical_- property_option to thermophysical_- property_method	PATH		11, 16, 24	action_property <- action_property_representation.property action_property_representation **{action_property_representation** **classified_item = action_property_representation** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `thermophysical property method'}**
TRACE_COMPONENT_- SPECIFICATION	process_design_case_resource	231		process_design_case_resource <= [action_resource] [product_definition]
applies_to	descriptive_representation_- item.description	45	8, 16, 17	process_design_case_resource <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `applies to'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `all components')** **(descriptive_representation_item.description = `specified components')}**

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
in_phases	descriptive_representation_- item.description	45	8, 16, 17	process_design_case_resource <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `in phases'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `all phases')** **(descriptive_representation_item.description = `specified phases')}**
minimum_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16, 17	process_design_case_resource <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `minimum fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
VARIABLE_- ADJUSTMENT_- SPECIFICATION	representation	43	16	**{representation** **representation.name = `variable adjustment specification'}**
lower_limit	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `lower limit'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
upper_limit	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	representation representation.items[i] ->**{representation_item** **representation_item.name = `upper limit'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
variable_adjustment_- specification to process_- design_property_value	PATH			representation <- representation_relationship.rep_1 representation_relationship **{representation_relationship** **representation_relationship.name = `variable adjustment'}** representation_relationship.rep_2 ->representation => process_design_property_value

Table 13 - Mapping table for process_simulation_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
variable_adjustment_-specification to variable_-convergence_block	PATH		5, 7, 16	representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property **{action_property** **action_property.name = `variable adjustment'}** action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method **{action_method** **action_method.purpose = `variable convergence block'}**
VARIABLE_-CONVERGENCE_BLOCK	action_method	41	5	**{action_method** **action_method.purpose = `variable convergence block'}**
VARIABLE_-CONVERGENCE_-SPECIFICATION	action_property	41	7	**{action_property** **action_property.name = `variable convergence specification'}**
tolerance_method	descriptive_representation_item.description	45	16	action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation **{representation** **representation.name = `variable convergence tolerance'}** representation.items[i] -> representation_item => **{representation_item** **representation_item.name = `tolerance method'}** descriptive_representation_item descriptive_representation_item.description

Table 13 - Mapping table for process_simulation_data UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
tolerance_value	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->> representation **{representation** **representation.name = `variable convergence tolerance'}** representation.items[i] ->> representation_item => **{representation_item** **representation_item.name = `tolerance value'}** measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
variable_convergence_- specification to variable_- convergence_block	PATH		5, 7	action_property action_property.definition ->> characterized_action_definition characterized_action_definition = action_method action_method {action_method action_method.purpose = `variable convergence block

Table 14 - Mapping table for process_vessel_equipment_data UoF

Application element	AIM element	Source	Rules	Reference PATH
ATMOSPHERIC_TANK	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `atmospheric tank'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `process vessel']}**
foundation	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `foundation required') (group.name = `foundation not required')}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
roof_type	descriptive_representation_item.-description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `roof type'}** representation_item => description_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `bag')** **(descriptive_representation_item.description = `fixed')** **(descriptive_representation_item.description = `floating')** **(descriptive_representation_item.description = `unknown')}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{[representation_item** **representation_item.name = `temperature']** **[representation_item =>** **qualified_representation_item** **qualified_representation_item.qualifiers[1] ->** **value_qualifier** **value_qualifier = type_qualifier** **type_qualifier** **type_qualifier.name = `rated']}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
wall_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `wall thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
water_drawoff	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `water drawoff required')** **(group.name = `water drawoff not required')}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
BIN_SECTION	bin_section	231	11, 13, 14, 24	bin_section <= product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `bin section']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process vessel']}**
agitated	group.name	41	11, 14, 24	bin_section <= product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name `agitation'}** group_assignment group_assignment.assigned_group ->group group.name **{(group.name = `agitation')** **(group.name = `not agitated')}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
flexible_or_rigid_sides	descriptive_representation_item.-description	45	14, 16, 18	bin_section <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition => product_definition_shape <- shape_aspect.of_shape **{shape_aspect** **shape_aspect.name = `bin sides'}** shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `flexible or rigid sides'}** representation_item => description_representation_item descriptive_representation_item.description

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	bin_section <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
wall_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	bin_section <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `wall thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bin_section to bounded_-curve	PATH		14, 15, 16	bin_section <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> representation_item => geometric_representation_item => curve => (bounded_curve => (b_spline_curve) (composite_curve) (trimmed_curve)) (conic => (circle) (ellipse))

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bin_section to construction_material	PATH		11, 14, 24	bin_section <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- material_designation.definitions[i] material_designation **{material_designation** **classified_item = material_designation** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `material usage classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `construction material'}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bin_section to external_-treatment	PATH		14, 15, 16	bin_section <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_definition.name = `surface finish'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation **{representation** **representation.name = `external treatment'}**
bin_section to solids_-storage_bin	PATH		14	bin_section <= product_definition <- product_definition_relationship.related_product_definition product_definition_relationship product-definition_relationship.relating_product_definition -> product_definition => solids_storage_bin
BOOT	boot	231		boot <= product_definition

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
boot to cylindrical_- pressure_vessel_section	PATH		11, 13, 14, 24	boot <= product_definition <- product_definition_relationship.related_product_definition product_definition_relationship product_definition_relationship.relating_product_definition ->product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cylindrical pressure vessel section'}**
BOOT_LOCATION_ON_- CYLINDER_SECTION	intersection_description	231	16	intersection_description <= representation **{representation** **representation.name = `boot on cylinder section'}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
boot_location_on_- cylinder_section to boot	PATH		14, 15, 16	intersection_description <= representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->> represented_definition represented_definition = property_definition property_definition property_definition.definition ->> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition => boot

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
boot_location_on_- cylinder_section to cylindrical_pressure_- vessel_section	PATH		11, 13, 14, 15, 16, 24	intersection_description <= representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->** represented_definition represented_definition = property_definition property_definition property_definition.definition ->** characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition product_definition.formation ->** **product_definition_formation product_definition_formation.of_product ->** **product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **group group.name = `cylindrical pressure vessel section'}**
BOOT_LOCATION_ON_- HEAD_SECTION	intersection_description	231	16	intersection_description <= representation **{representation representation.name = `boot on cylinder head section'}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
boot_location_on_head_-section to boot	PATH		14, 15, 16	intersection_description <= representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition => boot

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
boot_location_on_head_-section to cylindrical_-pressure_vessel_head_-section	PATH		11, 13, 14, 15, 16, 24	intersection_description <= representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cylindrical pressure vessel head section'}**
BOOT_SECTION_-RELATIONSHIP	product_definition_relationship	41		**{product_definition_relationship** **product_definition_relationship.name = `boot ownership'}**
boot_section_relationship to boot	PATH			product_definition_relationship product_definition_relationship.related_product_definition -> product_definition => boot

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
boot_section_relationship to cylindrical_pressure_-vessel_section	PATH		11, 13, 14, 24	product_definition_relationship product_definition_relationship.relating_product_definition -> product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name** **group.name = `cylindrical pressure vessel section'}**
BOUNDED_CURVE	(b_spline_curve) (circle) (composite_curve) (ellipse) (trimmed_curve)	42 42 42 42 42		

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CONICAL_HEAD	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.or_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `conical head'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> {group group.name = `cylindrical pressure vessel head section'} group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `cylindrical pressure vessel section']}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter_large_- end	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inside diameter large end'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter_small_-end	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inside diameter small end'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter_large_- end	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outside diameter large end'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter_small_-end	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outside diameter small end'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CYLINDRICAL_- PRESSURE_VESSEL	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation product_definition_formation.of_product ->** **product [classified_item = product classified_item <-** **classification_assignment.items[i] classification_assignment <=** **group_assignment group_assignment.assigned_group ->** **[group group.name = `cylindrical pressure vessel'] [group <-** **group_relationship.related_group group_relationship group_relationship.relating_group ->** **{group group.name = `pressure vessel'} group <-** **group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `process vessel']}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
orientation	descriptive_representation_item.-description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `orientation'}** representation_item => description_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `horizontal')** **(descriptive_representation_item.description = `other')** **(descriptive_representation_item.description = `unknown')** **(descriptive_representation_item.description = `vertical')}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
overall_height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `overall height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
overall_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `overall length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
CYLINDRICAL_- PRESSURE_VESSEL_- CONNECTION	product_definition_relationship	41		**{product_definition_relationship** **product_definition_relationship.name = `cylindrical pressure vessel connection'}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_radius	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 16, 18	product_definition_relationship characterized_product_definition = product_definition_relationship characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition => product_definition_shape <- shape_aspect.of_shape shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name= `inside radius'}** representation_item => measure_representation_item **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 16, 18	product_definition_relationship characterized_product_definition = product_definition_relationship characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition => product_definition_shape <- shape_aspect.of_shape shape_aspect represented_definition = shape_aspect represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> **{representation_item** **representation_item.name = `thickness'}** representation_item => measure_representation_item **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	11, 14, 18, 24	product_definition_relationship characterized_product_definition = product_definition_relationship characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition product_definition_shape <- shape_aspect.of_shape shape_aspect classified_item = shape_aspect classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `flanged')** **(group.name = `unspecified')** **(group.name = `welded')}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CYLINDRICAL_- PRESSURE_VESSEL_- CYLINDER_SECTION	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `cylindrical pressure vessel cylinder section']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `cylindrical pressure vessel section']}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cylinder_section_- diameter_1	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cylinder section diameter 1'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cylinder_section_- diameter_2	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cylinder section diameter 2'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cylinder_section_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cylinder section length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CYLINDRICAL_- PRESSURE_VESSEL_- ECCENTRIC_SECTION	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `cylindrical pressure vessel eccentric section']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `cylindrical pressure vessel section']}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
ANGULAR_OFFSET_OF_ SMALL_SIDE	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `angular offset of small side'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **plane_angle_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
eccentric_section_- diameter_1	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `eccentric section diameter 1'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
eccentric_section_- diameter_2	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `eccentric section diameter 2'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
eccentric_section_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `eccentric section length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CYLINDRICAL_- PRESSURE_VESSEL_- HEAD_SECTION	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation product_definition_formation.of_product ->** **product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **[group group.name = `cylindrical pressure vessel head section'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `cylindrical pressure vessel section']}**
CYLINDRICAL_- PRESSURE_VESSEL_- SECTION	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation product_definition_formation.of_product ->** **product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **group group.name = `cylindrical pressure vessel section'}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
corrosion_allowance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `corrosion allowance'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
joint_efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `joint efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
wall_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `wall thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cylindrical_pressure_-vessel_section to construction_material	PATH		11, 14, 24	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- material_designation.definitions[i] **{material_designation** **grouped_item = material_designation** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `material usage classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `construction material'}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cylindrical_pressure_-vessel_section to cylindrical_pressure_-vessel	PATH		11, 13, 14, 24	product_definition <- product_definition_relationship.related_product_definition **{product_definition_relationship =>** **product_definition_usage =>** **assembly_component_usage}** product_definition_relationship product_definition_relationship.relating_product_definition ->product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cylindrical pressure vessel'}**
cylindrical_pressure_-vessel_section to cylindrical_pressure_-vessel_connection	PATH		14	product_definition <- [product_definition_relationship.related_product_definition] [product_definition_relationship.relating_product_definition] product_definition_relationship **{product_definition_relationship** **product_definition_relationship.name = ** **`cylindrical pressure vessel connection'}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cylindrical_pressure_- vessel_section to external_treatment	PATH		14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_definition.name = `surface finish'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation **{representation** **representation.name = `external treatment'}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
ELLIPSOIDAL_HEAD	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `ellipsoidal head'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> {group group.name = `cylindrical pressure vessel head section'} group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `cylindrical pressure vessel section']}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
INSIDE_DIAMETER	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
OUTSIDE_DIAMETER	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
FLAT_HEAD	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `flat head'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> {group group.name = `cylindrical pressure vessel head section'} group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `cylindrical pressure vessel section']}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_buttresses	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of buttresses'}** representation_item => measure_representation_item <= **{measure_with_unit** **measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure** **count_measure}** measure_with_unit => [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
HEMISPHERICAL_HEAD	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name =`hemispherical head'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> {group group.name = `cylindrical pressure vessel head section'} group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group.name = `cylindrical pressure vessel section']}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
INTERSECTION_- DESCRIPTION	intersection_description	231		intersection_description <= representation
relative_location	descriptive_representation_item.- description	45	16	intersection_description <= representation representation.items[i] -> **{representation_item** **representation_item.name = `relative location'}** representation_item => description_representation_item descriptive_representation_item.description

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
relative_orientation	descriptive_representation_item.-description	45	16	intersection_description <= representation representation.items[i] ->** {representation_item representation_item.name = `relative orientation'}** representation_item => description_representation_item descriptive_representation_item.description
NOZZLE_LOCATION_-FOR_PRESSURE_-VESSEL_CYLINDER_-SECTION	intersection_description	231	16	intersection_description <= representation **{representation representation.name = `nozzle on cylinder section'}**
cylinder_section_flush_-with_inside	descriptive_representation_item.-description	45	16	intersection_description <= representation representation.items[i] ->** {representation_item representation_item.name = `cylinder section flush with inside'}** representation_item => description_representation_item descriptive_representation_item.description

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nozzle_location_for_- pressure_vessel_- cylinder_section to cylindrical_pressure_- vessel_cylinder_section	PATH		11, 13, 14, 15, 16, 24	intersection_description <= representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cylindrical pressure vessel cylinder section'}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nozzle_location_for_- pressure_vessel_- cylinder_section to nozzle_section	PATH		11, 13, 14, 15, 16, 24	intersection_description <= representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->** represented_definition represented_definition = property_definition property_definition property_definition.definition ->** characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition product_definition.formation ->** **product_definition_formation product_definition_formation.of_product ->** **product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **group group.name = `nozzle section'}**
NOZZLE_LOCATION_- FOR_PRESSURE_- VESSEL_HEAD_- SECTION	intersection_description	231	16	intersection_description <= representation **{representation representation.name = `nozzle on cylinder head section'}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
head_section_flush_-with_inside	descriptive_representation_item.-description	45	16	intersection_description <= representation representation.items[i] ->** {representation_item representation_item.name = `head section flush with inside'}** representation_item => description_representation_item descriptive_representation_item.description
nozzle_location_for_-pressure_vessel_head_-section to cylindrical_-pressure_vessel_head_-section	PATH		11, 13, 14, 15, 16, 24	intersection_description <= representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->** represented_definition represented_definition = property_definition property_definition property_definition.definition ->** characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition product_definition.formation ->** **product_definition_formation product_definition_formation.of_product ->** **product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **group group.name = `cylindrical pressure vessel head section'}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nozzle_location_for_- pressure_vessel_head_- section to nozzle_section	PATH		11, 13, 14, 15, 16, 24	intersection_description <= representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->** represented_definition represented_definition = property_definition property_definition property_definition.definition ->** characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition product_definition.formation ->** **product_definition_formation product_definition_formation.of_product ->** **product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **group group.name = `nozzle section'}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PRESSURE_VESSEL	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `pressure vessel']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `process vessel']}**
shape	group.name	41	11, 14, 24	product_definition classified_item = product_definition classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `shape classification'}** group_assignment group_assignment.assigned_group ->** **group group.name

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PROCESS_VESSEL	product_definition	41	11, 13, 14, 24	**{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `process vessel'}**
capacity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `capacity'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diking_required	group.name	41	11, 14, 24	product_definition grouped_item = product_definition grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `diking required')** **(group.name = `diking not required')}**
type	group.name	41	11, 14, 24	product_definition classified_item = product_definition classified_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `atmospheric tank')** **(group.name = `pressure vessel')** **(group.name = `solids storage bin')}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
process_vessel to external_treatment	PATH		14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_definition.name = `surface finish'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation **{representation** **representation.name = `external treatment'}**
PROCESS_VESSEL_-LEVEL	property_definition	41	11, 15, 24	**{property_definition** **classified_item = property_definition** **classified_item <-** **classification_assignment.items** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `process vessel level'}**
description	property_definition.description	41		
tag_name	property_definition.name	41		

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	representation.name	43	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.name **{(representation.name = `description')** **(representation.name = `tag name')** **(representation.name = `type')** **(representation.name = `volume above')** **(representation.name = `volume below')}**
volume_above	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `volume above'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
volume_below	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	15, 16	property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `volume below'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
process_vessel_level to bin_section	PATH		11, 13, 14, 15, 24	property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `bin section'}** product_definition => bin_section

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
process_vessel_level to boot	PATH		14, 15	property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition => boot
process_vessel_level to cylindrical_pressure_-vessel_section	PATH		11, 13, 14, 15, 24	property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cylindrical pressure vessel section'}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
process_vessel_level to process_vessel	PATH		11, 13, 14, 15, 24	property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition **{product_definition** **product_definition.formation ->** **product_definition_formation** **product_definition_formation.of_product ->** **product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `process vessel'}**
SOLIDS_STORAGE_BIN	solids_storage_bin	231		solids_storage_bin <= product_definition
description_of_discharge	product_definition.description	41	14	solids_storage_bin <= product_definition product_definition.description

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
top_type	shape_aspect.description	41	14, 18	solids_storage_bin <= product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition => product_definition_shape <- shape_aspect.of_shape **{shape_aspect** **shape_aspect.name = `top type'}** shape_aspect shape_aspect.description **{(shape_aspect.description = `closed')** **(shape_aspect.description = `open')** **(shape_aspect.description = `other')}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SPHERICAL_- PRESSURE_VESSEL	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation product_definition_formation.of_product ->** **product [classified_item = product classified_item <-** **classification_assignment.items[i] classification_assignment <=** **group_assignment group_assignment.assigned_group ->** **group group.name = `process vessel'] [classified_item = product classified_item <-** **classification_assignment.items[i] classification_assignment <=** **group_assignment group_assignment.assigned_group ->** **[group group.name = `spherical pressure vessel'] [group <-** **group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `pressure vessel']]}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation_items[i] -> **{representation_item** **representation_item.name = `inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
wall_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `wall thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SPHEROIDAL_- PRESSURE_VESSEL	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation ->** **product_definition_formation product_definition_formation.of_product ->** **product [classified_item = product classified_item <-** **classification_assignment.items[i] classification_assignment <=** **group_assignment group_assignment.assigned_group ->** **group group.name = `process vessel'] [classified_item = product classified_item <-** **classification_assignment.items[i] classification_assignment <=** **group_assignment group_assignment.assigned_group ->** **[group group.name = `spheroidal pressure vessel'] [group <-** **group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `pressure vessel']]}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
axis_of_rotation_-orientation	descriptive_representation_item.-description	45	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `axis of rotation orientation'}** representation_item => description_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `horizontal')** **(descriptive_representation_item.description = `other')** **(descriptive_representation_item.description = `unknown')** **(descriptive_representation_item.description = `vertical')}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
wall_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `wall thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
spheroidal_pressure_- vessel to bounded_curve	PATH		14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> representation_item => geometric_representation_item => curve => (bounded_curve => (b_spline_curve) (composite_curve) (trimmed_curve)) (conic => (circle) (ellipse))

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
STANDARD_DISHED_-HEAD	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `standard dished head'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> {group group.name = `cylindrical pressure vessel head section'} group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `cylindrical pressure vessel section']}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
knuckle_radius	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `knuckle radius'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
nominal_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `nominal diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
TORISPHERICAL_HEAD	product_definition	41	11, 13, 14, 24	**{product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `torispherical head'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> {group group.name = `cylindrical pressure head vessel section'} group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `cylindrical pressure vessel section']}**

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
knuckle_radius	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `knuckle radius'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 14 - Mapping table for process_vessel_equipment_data UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
outside_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	14, 15, 16	product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition =>** **product_definition_shape}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outside diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF

Application element	AIM element	Source	Rules	Reference PATH
DISTILLATION_- STAGE_PHASE	specific_phase	231	8	specific_phase <= action_resource **{action_resource <-** **action_resource_relationship.related_resource** **action_resource_relationship** **action_resource_relationship.relating_resource ->** **action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `distillation stage phase'}**
distillation_stage_phase to uo_distillation_stage	PATH		5, 8, 11, 24	specific_phase <= action_resource action_resource.usage[i] ->** supported_item supported_item = action action action.chosen_method ->** action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo distillation stage'}**

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
ENERGY_STREAM	stream	231	8	stream <= [characterized_object] [action_resource **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `energy stream'}**]
energy_flow_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	stream <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `energy flow rate'}** representation_item => measure_representation_item <=**{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
HEAT_EXCHANGER_-INTERNAL_PHASE	specific_phase	231	8	specific_phase <= action_resource **{action_resource <-** **action_resource_relationship.related_resource** **action_resource_relationship** **action_resource_relationship.relating_resource ->** **action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `heat exchanger internal phase'}**

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_exchanger_- internal_phase to heat_- exchanger_internal_data	PATH		8, 16, 17	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource **{resource_property** **resource_property.name = `heat exchanger internal phase'}** resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->** representation => heat_exchanger_internal_data
INFORMATION_- STREAM	stream	231	8	stream <= [characterized_object] [action_resource **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `information stream'}**]
type	group.name	41	8, 11, 24	stream <= action_resource classified_item = action_resource classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** group group.name

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
INTERNAL_STREAM_-PHASE	specific_phase	231	8	specific_phase <= action_resource **{action_resource <-** **action_resource_relationship.related_resource** **action_resource_relationship** **action_resource_relationship.relating_resource ->** **action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `internal stream phase'}**
mass_flow_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `mass flow rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mole_flow_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mole flow rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
standard_volume_flow_- rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `standard volume flow rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
internal_stream_phase to process_unit_operation	PATH		5, 8, 11, 24	specific_phase <= action_resource action_resource.usage[i] ->** supported_item supported_item = action action action.chosen_method ->** action_method **{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group ->** **group group.name = `process unit operation'}**

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
internal_stream_phase to site_standard_conditions	PATH		8, 15, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property **{resource_property_representation** **resource_property_representation.name = `standard volume reference'}** resource_property_representation resource_property_representation.representation ->** representation <- representation_relationship.rep_2 **{representation_relationship** **representation_relationship.name = `standard volume reference'}** representation_relationship.rep_1 ->** representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->** represented_definition represented_definition = property_definition property_definition => site_standard_condition
MATERIAL_AMOUNT_-PHASE	specific_phase	231	8	specific_phase <= action_resource **{action_resource <-** **action_resource_relationship.related_resource** **action_resource_relationship** **action_resource_relationship.relating_resource ->** **action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material amount phase'}**

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mass	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mass'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **mass_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mass_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mass fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mole_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mole fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
moles	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `molecular quantity'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
volume	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->> representation representation.items[i] ->> **{representation_item** **representation_item.name = `volume'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
volume_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `volume fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
material_amount_phase to material_amount	PATH		8	specific_phase <= action_resource <- action_resource_relationship.related_resource **{action_resource_relationship** **action_resource_relationship.name = `specific phase possession'}** action_resource_relationship action_resource_relationship.relating_resource -> action_resource **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material amount'}**

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
MATERIAL_STREAM	stream	231	8	stream <= [characterized_object] [action_resource **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material stream'}**]
mass_flow_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	stream <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mass flow rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mole_flow_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	stream <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mole flow rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
standard_volume_flow_-rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	stream <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `standard volume flow rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
material_stream to process_material	PATH			stream <= action_resource <- action_resource_relationship.relating_resource **{action_resource_relationship** **action_resource_relationship.name = `material usage'}** action_resource_relationship action_resource_relationship.related_resource -> action_resource => process_material

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
material_stream to site_- standard_conditions	PATH		8, 15, 16	stream <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property **{resource_property_representation** **resource_property_representation.name = `standard volume reference'}** resource_property_representation resource_property_representation.representation ->** representation <- representation_relationship.rep_2 **{representation_relationship** **representation_relationship.name = `standard volume reference'}** representation_relationship.rep_1 ->** representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->** represented_definition represented_definition = property_definition property_definition => site_standard_condition
material_stream to thermodynamic_- condition	PATH		8, 16	stream <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation condition_definition = resource_property_representation condition_definition <- data_environment.elements[i] data_environment => thermodynamic_condition

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
material_stream to uo_-distillation_stage	PATH		5, 8, 11, 24	stream <= action_resource action_resource.usage[i] ->** supported_item supported_item = action_method action_method **{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** group_role **group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group ->** group **group.name = `uo distillation stage'}**
MATERIAL_STREAM_-PHASE	specific_phase	231	8	specific_phase <= action_resource **{action_resource <- action_resource_relationship.related_resource action_resource_relationship action_resource_relationship.relating_resource ->** action_resource **action_resource.kind ->** action_resource_type **action_resource_type.name = `material stream phase'}**

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mass_flow_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mass flow rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mass_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mass fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mole_flow_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mole flow rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mole_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mole fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
standard_volume_flow_- rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->> representation representation.items[i] ->> **{representation_item** **representation_item.name = `standard volume flow rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
volume_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `volume fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
material_stream_phase to material_stream	PATH		8	specific_phase <= action_resource <- action_resource_relationship.related_resource **{action_resource_relationship** **action_resource_relationship.name = `specific phase possession'}** action_resource_relationship action_resource_relationship.relating_resource -> action_resource **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material stream'}**

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PARTICLE_FRACTION	(measure_representation_item) ([measure_representation_item] [measure_representation_item])	45 45 45		**{(measure_representation_item <=** **representation_item** **(representation_item.name = `cumulative mass fraction')** **(representation_item.name = `mass fraction'))** **([measure_representation_item <=** **representation_item** **representation_item.name = `cumulative mass fraction']** **[measure_representation_item <=** **representation_item** **representation_item.name = `mass fraction'])}**
cumulative_mass_- fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		measure_representation_item <= **{[representation_item** **representation_item.name = `cumulative mass fraction']** **[measure_with_unit =>** **ratio_measure_with_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
mass_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		measure_representation_item <= **{[representation_item** **representation_item.name = `mass fraction']** **[measure_with_unit =>** **ratio_measure_with_unit]}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
particle_fraction to particle_size_- distribution_values	PATH			measure_representation_item <= representation_item <- representation.items[i] representation => particle_size_distribution_values

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PARTICLE_SIZE	measure_representation_item	45	16	**{measure_representation_item <= representation_item <- representation.items[i] representation representation.name = `particle size'}**
size_value	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
particle_size to particle_-size_distribution	PATH			measure_representation_item <= representation_item list_representation_item[i] = representation_item list_representation_item compound_item_definition = list_representation_item compound_item_definition <- compound_representation_item.item_element compound_representation_item **{compound_representation_item <= representation_item representation_item.name = `particle size distribution'}**
PARTICLE_SIZE_-DISTRIBUTION	compound_representation_item	43		**{compound_representation_item <= representation_item representation_item.name = `particle size distribution'}**
PARTICLE_SIZE_-DISTRIBUTION_-VALUES	particle_size_distribution_values	231		particle_size_distribution_values <= representation

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
particle_size_-distribution_values to material_amount	PATH		8, 16, 17	particle_size_distribution_values <= representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property ->> resource_property resource_property.resource ->> characterized_resource_definition characterized_resource_definition = action_resource action_resource **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material amount'}**
particle_size_-distribution_values to material_stream	PATH		8, 16, 17	particle_size_distribution_values <= representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property ->> resource_property resource_property.resource ->> characterized_resource_property characterized_resource_property = action_resource action_resource **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material stream'}**
particle_size_-distribution_values to particle_size_distribution	PATH		16	particle_size_distribution_values <= representation representation.items[i] ->> **{representation_item** **representation_item.name = `particle size distribution'}** representation_item => compound_representation_item

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PHASE_REGION	representation_context	43		**{representation_context representation_context.context_type = `phase region'}**
description	group.description	41	11, 24	representation_context classified_item = representation_context classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment group_assignment.role ->** **group_role group_role.name = `phase region classification'}** group_assignment group_assignment.assigned_group ->** group group.description
phase_name	group.name	41	11, 24	representation_context classified_item = representation_context classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment group_assignment.role ->** **group_role group_role.name = `phase region classification'}** group_assignment group_assignment.assigned_group ->** group group.name

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
physical_or_logical	group.name	41	11, 24	representation_context grouped_item = representation_context grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `phase region type'}** group_assignment group_assignment.assigned_group ->** group group.name **{(group.name = `physical')** **(group.name = `logical')}**
phase_region to phase	PATH		24	representation_context grouped_item = representation_context grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group ->** group => phase
phase_region to process_-property_curve	PATH			representation_context <- representation.context_of_items representation => data_curve
PHASES_IN_-EQUILIBRIUM	group	41	11	**{[group <-** **group_assignment.assigned_group** **group_assignment =>** **phases_in_equilibrium_group_assignment]** **[group** **group.name = `phases in equilibrium']}**

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SPECIFIC_PHASE	specific_phase	231		specific_phase <= action_resource
description	action_resource.description	41	8	specific_phase <= action_resource action_resource.description
equilibrium_phase	group.name	41	8, 11, 24	specific_phase <= action_resource grouped_item = action_resource grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `phase state'}** group_assignment group_assignment.assigned_group ->** group group.name **{group.name = `equilibrium phase'}**
phase_name	action_resource.name	41	8	specific_phase <= action_resource action_resource.name

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
physical_or_logical	group.name	41	8, 11, 24	specific_phase <= action_resource classified_item = action_resource classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `phase type'}** group_assignment group_assignment.assigned_group ->** group group.name **{(group.name = `physical')** **(group.name = `logical')}**
specific_phase to phase	PATH		8, 24	specific_phase <= action_resource grouped_item = action_resource grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group ->** group => phase

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
specific_phase to phase_-region	PATH		8, 16, 17	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.context_of_items -> representation_context **{representation_context** **representation_context.context_type = `phase region'}**
specific_phase to phases_in_equilibrium	PATH		11, 24	specific_phase equilibrium_item = specific_phase equilibrium_item <- phases_in_equilibrium_group_assignment.items[i] phases_in_equilibrium_group_assignment <= group_assignment group_assignment.assigned_group -> group **{group** **group.name = `phases in equilibrium'}**
specific_phase to process_design_-property_value	PATH		8, 16, 17	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation => process_design_property_value

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
specific_phase to process_material	PATH			specific_phase <= action_resource <- action_resource_relationship.related_resource **{action_resource_relationship** **action_resource_relationship.name = `material usage'}** action_resource_relationship action_resource_relationship.relating_resource ->action_resource => process_material
specific_phase to thermodynamic_-condition	PATH		8, 16, 17	specific_phase <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation condition_definition = resource_property_representation condition_definition <- data_environment.elements[i] data_environment => thermodynamic_condition
STREAM	stream	231		stream <= [characterized_object] [action_resource]
stream_name	characterized_object.name	41	9	stream <= characterized_object characterized_object.name

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stream to process_-design_property_value	PATH		8, 16, 17	stream <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation => process_design_property_value
stream to process_-simulation	PATH		5, 8	stream <= action_resource action_resource.usage[i] -> supported_item supported_item = action_method action_method => process_simulation
stream to stream_-convergence_block	PATH		5, 8	stream <= action_resource action_resource.usage[i] -> supported_item supported_item = action_method **{action_method** **action_method.purpose = `stream_convergence block'}** action_method => process_simulation
stream to variable_-convergence_block	PATH		5, 8	stream <= action_resource action_resource.usage[i] -> supported_item supported_item = action_method action_method **{action_method** **action_method.purpose = `variable convergence block'}**.

Table 15 - Mapping table for stream_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
THERMAL_STREAM	stream	231	8	stream <= [characterized_object] [action_resource **{action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `thermal stream'}**]
temperature_level	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16, 17	stream <= action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `temperature level'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
UTILITY_SERVICE_- STREAM_DEMAND	action_resource_requirement	49		**{action_resource_requirement** **action_resource_requirement.kind ->** **resource_requirement_type** **resource_requirement_type.name = `utility service stream demand'}**
demand_type	action_resource_requirement.name	49		**{action_resource_requirement** **(action_resource_requirement.name = `peak')** **action_resource_requirement.name = `continuous')}**

Table 15 - Mapping table for stream_data UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
utility_service_stream_-demand to stream	PATH		8	action_resource_requirement => requirement_for_action_resource requirement_for_action_resource.resources[i] -> action_resource => stream
UTILITY_STREAM	action_resource	41	8	**{action_resource action_resource.kind ->** **action_resource_type** **action_resource_type.name = `utility stream'}**
utility_flow_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	8, 16, 17	action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `utility flow rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
utility_name	action_resource.name	41		
WORK_STREAM	action_resource	41	8	**{action_resource action_resource.kind ->** **action_resource_type** **action_resource_type.name = `work stream'}**

Table 16 - Mapping table for substance_experimental_data UoF

Application element	AIM element	Source	Rules	Reference PATH
CITATION	document	41		
bibliographic_-information	document.description	41		
name	document.name	41		
citation to property_note	PATH		23	document <- document_reference.assigned_document document_reference => applied_document_reference applied_document_reference.items[i] -> document_reference_item document_reference_item = representation_item representation_item => descriptive_representation_item descriptive_representation_item.description
DATA_ENTRY	representation	43		
data_entry_name	representation.name	43		
data_entry to property_-data_set	PATH		15, 16	representation <- (action_property_representation.representation action_property_representation action_property_representation.property -> action_property) (property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition)

Table 16 - Mapping table for substance_experimental_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
data_entry to variable_-value (as dependent variable values)	PATH		11, 16, 24	representation representation.items[i] ->**{representation_item grouped_item = representation_item grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `dependent'}** representation_item => measure_representation_item
data_entry to variable_-value (as fixed variable values)	PATH		11, 16, 24	representation representation.items[i] ->**{representation_item grouped_item = representation_item grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `fixed'}** representation_item => measure_representation_item

Table 16 - Mapping table for substance_experimental_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
data_entry to variable_-value (as independent variable values)	PATH		11, 16, 24	representation representation.items[i] ->** **{representation_item grouped_item = representation_item grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group ->** **group group.name = `independent'}** representation_item => measure_representation_item
DATA_SOURCE	document	41		
accuracy_source	person	41	27	document person_item = document person_item <- applied_person_assignment.items[i] applied_person_assignment <= **{person_assignment person_assignment.role ->** **person_role person_role.name = `accuracy source'}** person_assignment person_assignment.assigned_person ->** person

Table 16 - Mapping table for substance_experimental_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
date_of_update	[date.year_component] [calendar_date.day_component] [calendar_date.month_component]	41 41 41	21	document dated_item = document dated_item <- applied_date_assignment.items[i] applied_date_assignment <= **{date_assignment** **date_assignment.role ->** **date_role** **date_role.name = `date of update'}** date_assignment date_assignment.assigned_date ->[date date.year_component] [date => calendar_date calendar_date.day_component] [date => calendar_date calendar_date.month_component]
kind_of_data	document_type.product_data_type	41		document document.kind ->document_type document_type.product_data_type
nature_of_data_source	approval.status	41	19	document approved_item = document approved_item <- applied_approval_assignment.items[i] applied_approval_assignment <= approval_assignment approval_assignment.assigned_approval ->approval approval.status

Table 16 - Mapping table for substance_experimental_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
provider	(person) (organization) (person_and_organization)	41 41 41	26, 27	document (person_item = document person_item <- applied_person_assignment.items[i] applied_person_assignment <= person_assignment person_assignment.assigned_person -> person) (person_and_organization_item = document person_and_organization_item <- applied_person_and_organization_assignment.items[i] applied_person_and_organization_assignment <= person_and_organization_assignment person_and_organization_assignment.assigned_person_and_organization -> person_and_organization) (organization_item = document organization_item <- applied_organization_assignment.items[i] applied_organization_assignment <= organization_assignment organization_assignment.assigned_organization -> organization)
data_source to citation	PATH			document <- document_relationship.relating_document document_relationship document_relationship.related_document -> document
DATA_QUALITY	qualified_representation_item	45		
accuracy	standard_uncertainty	45		qualified_representation_item qualified_representation_item.qualifiers[i] -> value_qualifier value_qualifier = uncertainty_qualifier **{uncertainty_qualifier** **uncertainty_qualifier.name = `accuracy'}** uncertainty_qualifier => standard_uncertainty

Table 16 - Mapping table for substance_experimental_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
standard_deviation	standard_uncertainty	45		qualified_representation_item qualified_representation_item.qualifiers[i] ->value_qualifier value_qualifier = uncertainty_qualifier **{uncertainty_qualifier** **uncertainty_qualifier.name = `standard deviation'}** uncertainty_qualifier =>standard_uncertainty
DISTILLATION_CURVE	property_definition	41	11, 15, 24	**{property_definition** **classified_item = property_definition** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `distillation curve'}**
method_used	property_definition.description	41		

Table 16 - Mapping table for substance_experimental_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
distillation_curve to petroleum_mixture	PATH		11, 13, 14, 15, 24	property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **{group** **group.name = `substance'}** **group <-** **group_relationship.relating_group** **group_relationship** **group_relationship.related_group ->** **{group** **group.name = `mixture'}** **group <-** **group_relationship.relating_group** **group_relationship** **group_relationship.related_group ->** **group** **group.name = `petroleum mixture'}**
EXPERIMENT	action_method	41	5	**{action_method** **action_method.name = `experiment'}**

Table 16 - Mapping table for substance_experimental_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	group.name	41	5, 11, 24	action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `experiment type classification'}** group_assignment group_assignment.assigned_group ->** **group group.name
PROPERTY_DATA_- GROUP	(action_method) (action) (characterized_object)	41 49 41	5, 9	(**{action_method** **(action_method.name = `experiment')** **(action_method.name = `property data group')}**) (**{action** **action.name = `property data group'}**) (**{characterized_object** **characterized_object.name = `property data group'}**)
description	(action_method.description) (characterized_object.description)	41 41		((action action.chosen_method ->** **action_method) (action_method) action_method.description)

Table 16 - Mapping table for substance_experimental_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
property_data_group to property_data_set	PATH		5, 9	((action_method characterized_action_definition = action_method) (action characterized_action_definition = action) characterized_action_definition <- action_property.definition action_property) (characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition)
PROPERTY_DATA_SET #1: THE PROPERTY_-DATA_SET IS FOR AN EXPERIMENT OR IS A REACTION_-PARAMETRIC_DATA #2: THE PROPERTY_-DATA_SET IS GENERAL OR IS A DISTILLATION_CURVE	#1 (action_property) #2 (property_definition)	41 41		
data_set_name	(action_property.name) (property_definition.name)	49 41		
property_data_set to citation	PATH		7, 15, 23	(action_property document_reference_item = action_property) (property_definition document_reference_item = property_definition) document_reference_item <- applied_document_reference.items[i] applied_document_reference <= document_reference document_reference.assigned_document -> document

Table 16 - Mapping table for substance_experimental_data UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
property_data_set to specific_equation	PATH		15, 16	(action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->) (property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->) representation => specific_equation
PROPERTY_NOTE	descriptive_representation_item	45		
note_name	representation_item.name	43		descriptive_representation_item <= representation_item representation_item.name
note_string	descriptive_representation_item. description	45		
REACTION_-PARAMETRIC_DATA	action_property	49	7, 11, 24	**{action_property classified_item = action_property classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `reaction parametric data'}**
reaction_parametric_data to chemical_reaction	PATH		7	action_property action_property.definition -> characterized_action_definition characterized_action_definition = action action => product_definition_process

Table 17 - Mapping table for substance_model_data UoF

Application element	AIM element	Source	Rules	Reference PATH
AMORPHOUS_SOLID	product	41		**{product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** [group group.name = `amorphous solid'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** group **group.name = `substance']}**
BINARY_PARAMETER	compound_representation_item	43		**{compound_representation_item classified_item = compound_representation_item classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** group **group.name = `binary parameter'}**
symmetric	type_qualifier	45		compound_representation_item <= representation_item => qualified_representation_item qualified_representation_item.qualifiers[i] ->** **value_qualifier value_qualifier = type_qualifier type_qualifier {type_qualifier (type_qualifier.name = `symmetric') (type_qualifier.name = `non-symmetric')}**

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
BINARY_PARAMETER_-VALUE	measure_representation_item	45		**{measure_representation_item <= representation_item <- set_representation_item[i] set_representation_item compound_item_definition = set_representation_item compound_item_definition <- compound_representation_item.item_element compound_representation_item <= representation_item grouped_item = representation_item grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `binary parameter'}**

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
binary_parameter_value to substance	PATH			measure_representation_item <= representation_item <- set_representation_item[i] set_representation_item compound_item_definition = set_representation_item compound_item_definition <- compound_representation_item.item_element compound_representation_item <= representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `substance'}**

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CHEMICAL_- COMPONENT	product	41		**{product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **[group group.name = `chemical component'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `substance']}**
CHEMICAL_SPECIE	product	41		**{product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **[group group.name = `chemical specie'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `substance']}**

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cas_registry_number	applied_identification_a- ssignment.assigned_id	41		product identified_item = product identified_item <- applied_identification_assignment.items[i] applied_identification_assignment <= **{identification_assignment =>** **external_identification_assignment** **external_identification_assignment.source ->** **external_source** **external_source.name = `cas registry'}** identification_assignment identification_assignment.assigned_id
CMA_NUMBER	identification_assignment.assigned_id	41		product identified_item = product identified_item <- applied_identification_assignment.items[i] applied_identification_assignment <= **{identification_assignment =>** **external_identification_assignment** **external_identification_assignment.source ->** **external_source** **external_source.name = `cma'}** identification_assignment identification_assignment.assigned_id
dippr_id	identification_assignment.assigned_id	41		product identified_item = product identified_item <- applied_identification_assignment.items[i] applied_identification_assignment <= **{identification_assignment =>** **external_identification_assignment** **external_identification_assignment.source ->** **external_source** **external_source.name = `dippr'}** identification_assignment identification_assignment.assigned_id

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
dot_number	identification_assignment.assigned_id	41		product identified_item = product identified_item <- applied_identification_assignment.items[i] applied_identification_assignment <= **{identification_assignment =>** **external_identification_assignment** **external_identification_assignment.source ->** **external_source** **external_source.name = `dot'}** identification_assignment identification_assignment.assigned_id
chemical_formula	descriptive_representation_- item.description	45		product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition **{property_definition** **property_definition.name = `structural'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `chemical formula'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
iupac_name	identification_assignment.assigned_id	41		product identified_item = product identified_item <- applied_identification_assignment.items[i] applied_identification_assignment <= **{identification_assignment =>** **external_identification_assignment** **external_identification_assignment.source ->** **external_source** **external_source.name = `iupac'}** identification_assignment identification_assignment.assigned_id

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
molecular_weight	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `molecular weight'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
chemical_specie to family	PATH			product grouped_item = product grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group **{group** **group.description = `family'}**

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
CHEMICAL_SPECIE_- STRUCTURAL_GROUP_- RELATIONSHIP	property_definition_relationship	41		
group_occurrence_- quantity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		property_definition_relationship represented_definition = property_definition_relationship represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `structural group occurrence quantity'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **count_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
chemical_specie_- structural_group_- relationship to chemical_- specie	PATH			property_definition_relationship property_definition_relationship.relating_property_definition -> property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `chemical specie'}**
chemical_specie_- structural_group_- relationship to structural_group	PATH			property_definition_relationship property_definition_relationship.related_property_definition -> property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_object characterized_object => molecular_structural_group

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
COEFFICIENT	compound_representation_item	43		**{compound_representation_item classified_item = compound_representation_item classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **group group.name = `coefficient'}**
coefficient_name	representation_item.name	43		compound_representation_item <= representation_item representation_item.name
coefficient_type	group.name	41		compound_representation_item classified_item = compound_representation_item classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment group_assignment.role ->** **group_role group_role.name = `coefficient type'}** group_assignment group_assignment.assigned_group ->** group group.name

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
symbol	identification_assignment.assigned_id	41		compound_representation_item <= representation_item identified_item = representation_item identified_item <- applied_identification_assignment.items[i] applied_identification_assignment <= **{identification_assignment =>** **external_identification_assignment** **external_identification_assignment.source ->** **external_source** **external_source.name = `iupac'}** identification_assignment identification_assignment.assigned_id
coefficient to specific_-equation	PATH			compound_representation_item <= representation_item <- representation.items[i] representation => specific_equation

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
coefficient to variable_-value	PATH			compound_representation_item compound_representation_item.item_element -> compound_item_definition compound_item_definition = list_representation_item list_representation_item list_representation_item[i] -> representation_item => measure_representation_item **{measure_representation_item <=** **representation_item <-** **set_representation_item[i]** **set_representation_item** **compound_item_definition = set_representation_item** **compound_item_definition <-** **compound_representation_item.item_element** **compound_representation_item <=** **representation_item** **grouped_item = representation_item** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **(group.name = `binary parameter')** **(group.name = `substance property')}**
COMPOSITION_-RELATIONSHIP	product_definition_relationship	41		**{product_definition_relationship** **product_definition_relationship.name = `substance composition'}**

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mass_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		product_definition_relationship characterized_product_definition = product_definition_relationship characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mass fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mole_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		product_definition_relationship characterized_product_definition = product_definition_relationship characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mole fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
special_equilibrium	descriptive_representation_- item.description	45		product_definition_relationship characterized_product_definition = product_definition_relationship characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `special equilibrium'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `inert solid')** **(descriptive_representation_item.description = `noncondensable')** **(descriptive_representation_item.description = `nonvolatile')** **(descriptive_representation_item.description = `normal')** **(descriptive_representation_item.description = `supercritical')}**

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
volume_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		product_definition_relationship characterized_product_definition = product_definition_relationship characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `volume fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
composition_relationship to mixture	PATH			product_definition_relationship product_definition_relationship.relating_product_definition -> product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `mixture'}**
composition_relationship to substance	PATH			product_definition_relationship product_definition_relationship.related_product_definition -> product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `substance'}**
EQUATION_GROUP	representation	43		**{representation** **representation.name = `equation group'}**

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
name	descriptive_representation_- item.description	45		representation representation.items[i] ->> representation_item => descriptive_representation_item descriptive_representation_item.description
description	representation.description	43		
equation_type	group.name	41		representation classified_item = representation classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `equation type categorization'}** group_assignment group_assignment.assigned_group ->> group group.name
equation_group to citation	PATH			representation document_reference_item = representation document_reference_item <- applied_document_reference.items[i] applied_document_reference <= document_reference document_reference.assigned_document ->> document
equation_group to property_note	PATH			representation representation.items[i] ->> representation_item => descriptive_representation_item

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
equation_group to variable_approval_-context	PATH			representation approved_item = representation approved_item <- applied_approval_assignment.items[i] applied_approval_assignment <= approval_assignment approval_assignment.assigned_approval ->approval
EXTERNALLY_-DEFINED_VARIABLE_-VALUE	externally_defined_representation_item	231		externally_defined_representation_item <= [externally_defined_item] [representation_item **{representation_item => measure_representation_item}**]
source	external_source	41		externally_defined_representation_item <= externally_defined_item externally_defined_item.source ->external_source
unit	measure_with_unit.unit_component	41		externally_defined_representation_item <= representation_item => measure_representation_item <= measure_with_unit measure_with_unit.unit_component
value	measure_with_unit.value_component	41		externally_defined_representation_item <= representation_item => measure_representation_item <= measure_with_unit measure_with_unit.value_component
FAMILY	group	41		**{group group.description = `family'}**
name	group.name	41		

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
MIXTURE	product	41		**{product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **[group group.name = `mixture'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `substance']}**
type_name	group.name	41		product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **group group.name**

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PETROLEUM_CUT	product	41		**{product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `petroleum cut'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> {group group.name = `petroleum mixture'} group <- group_relationship.related_group group_relationship group_relationship.relating_group -> {group group.name = `mixture'} group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `substance']}**

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
begin_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `begin temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
end_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `end temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PETROLEUM_MIXTURE	product	41		**{product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `petroleum mixture'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> {group group.name = `mixture'} group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `substance']}**

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
petroleum_mixture to distillation_curve	PATH			product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition **{property_definition** **classified_item = property_definition** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `distillation curve'}**
PHASE	phase	231		phase <= [characterized_object] [group]
description	characterized_object.description	41		phase <= characterized_object characterized_object.description
name	characterized_object.name	41		phase <= characterized_object characterized_object.name
physical_state	group.name	41		phase <= group group.name

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
phase to chemical_-reaction	PATH			phase <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = action action => product_definition_process
phase to process_-design_property_value	PATH			phase <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] ->> grouped_item grouped_item = representation representation => process_design_property_value
phase to referenced_-object	PATH			phase <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PSEUDO_COMPONENT	product	41		**{product classified_item = product classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> [group group.name = `pseudo-component'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `substance']}**

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
average_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `average temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
begin_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `begin temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
end_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `end temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
generating_source	application_context_element.name	41		product product.frame_of_reference[i] -> product_context <= application_context_element application_context_element.name

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
MOLECULAR_WEIGHT	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `molecular weight'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
SPECIFIC_GRAVITY	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `specific gravity'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
type	application_context_element.name	41		product <- product_definition_formation.of_product product_definition_formation <- product_definition.definition product_definition product_definition.frame_of_reference -> product_definition_context <= application_context_element application_context_element.name

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
REFERENCE_STATE	reference_state	231		reference_state <= compound_representation_item
basis	descriptive_representation_- item.description	45		reference_state <= compound_representation_item <= representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `ideal gas') (descriptive_representation_item.description = `ideal solution') (descriptive_representation_item.description = `indefinite dilution') (descriptive_representation_item.description = `other mixture type') (descriptive_representation_item.description = `pure component') (descriptive_representation_item.description = `real mixture')}**
value	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		reference_state <= compound_representation_item <= representation_item <- representation_item_relationship.relating_representation_item representation_item_relationship representation_item_relationship.related_representation_item ->
representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reference_state to variable	PATH			reference_state <= compound_representation_item <= representation_item <- representation_item_relationship.relating_representation_item representation_item_relationship representation_item_relationship.related_representation_item -> representation_item => compound_representation_item **{compound_representation_item** **classified_item = compound_representation_item** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **(group.name = `binary parameter')** **(group.name = `substance property')}**
SPECIFIC_EQUATION	specific_equation	43		specific_equation <= representation
specific_equation_name	representation.name	43		specific_equation <= representation representation.name

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
specific_equation to coefficient	PATH			specific_equation <= representation representation.items[i] ->** representation_item => compound_representation_item **{compound_representation_item classified_item = compound_representation_item classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** **group group.name = `coefficient'}**
specific_equation to equation_group	PATH			specific_equation <= representation <- representation_relationship.rep_2 representation_relationship representation_relationship.rep_1 ->** representation **{representation representation.name = `equation group'}**
specific_equation to phase	PATH			specific_equation <= representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->** represented_definition represented_definition = property_definition property_definition property_definition.definition ->** characterized_definition characterized_definition = characterized_object characterized_object => phase

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
specific_equation to variable	PATH			specific_equation <= representation representation.items[i] ->> representation_item => compound_representation_item **{compound_representation_item** **classified_item = compound_representation_item** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **(group.name = `binary parameter')** **(group.name = `substance property')}**
specific_equation to variable_approval_-context	PATH			specific_equation <= representation approved_item = representation approved_item <- applied_approval_assignment.items[i] applied_approval_assignment <= approval_assignment approval_assignment.assigned_approval ->> approval
STRUCTURAL_GROUP	molecular_structural_group	231		molecular_structural_group <= characterized_object
category	group.name			molecular_structural_group <= characterized_object grouped_item = characterized_object grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group ->> group group.name

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
description	descriptive_representation_- item.description	45		molecular_structural_group <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition **{property_definition** **property_definition.name = `structural'}** property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation ->> representation representation.items[i] ->> **{representation_item** **representation_item.name = `chemical formula'}** representation_item => descriptive_representation_item descriptive_representation_item.description
name	characterized_object.name	41		molecular_structural_group <= characterized_object characterized_object.name
type	characterized_object.description	41		molecular_structural_group <= characterized_object characterized_object.description
SUBSTANCE	product	41		**{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `substance'}**

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
substance_identifier	product.id	41		
substance to particle_-size_distribution	PATH			product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `particle size distribution'}** representation_item => compound_representation_item

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
substance to process_-design_property_value	PATH			product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition characterized_product_definition = product_definition characterized_product_definition characterized_definition = characterized_product_definition characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation => process_design_property_value
substance to process_-material	PATH			product <- product_definition_formation.of_product product_definition_formation <- product_definition.formation product_definition <- product_definition_relationship.related_product_definition product_definition_relationship product_definition_relationship.relating_product_definition -> product_definition => process_material
SUBSTANCE_NAME	applied_identification_assignment	231		applied_identification_assignment <= identification_assignment
name_of_substance	identification_assignment.assigned_id	41		applied_identification_assignment <= identification_assignment identification_assignment.assigned_id

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
name_source	external_source.name	41		applied_identification_assignment <= identification_assignment => external_identification_assignment external_identification_assignment.source -> external_source external_source.name
substance_name to substance	PATH			applied_identification_assignment applied_identification_assignment.items[i] -> identified_item identified_item = product product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `substance'}**
SUBSTANCE_-PROPERTY_VALUE	measure_representation_item	45		**{measure_representation_item <=** **representation_item <-** **set_representation_item[i]** **set_representation_item** **compound_item_definition = set_representation_item** **compound_item_definition <-** **compound_representation_item.item_element** **compound_representation_item <=** **representation_item** **grouped_item = representation_item** **grouped_item <-** **applied_group_assignment.items[i]** **applied_group_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `substance property'}**

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
THERMOPHYSICAL_-POINT_PROPERTY	compound_representation_item	43		**{compound_representation_item classified_item = compound_representation_item classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** group **group.name = `thermophysical point property'}**
VARIABLE	compound_representation_item	43		**{compound_representation_item classified_item = compound_representation_item classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group ->** group **(group.name = `binary parameter') (group.name = `substance property')}**
name	representation.name	43		compound_representation_item <= representation_item <- representation.items[i] representation representation.name
type	group.name	41		compound_representation_item classified_item = compound_representation_item classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
variable to data_quality	PATH			compound_representation_item <= representation_item => qualified_representation_item
VARIABLE_- APPROVAL_CONTEXT	approval	41		
approved_by	(person) (organization) (person_and_organization)	41 41 41		approval <- approval_person_organization.authorized_approval approval_person_organization approval_person_organization.person_organization ->person_organization_select (person_organization_select = person person) (person_organization_select = organization organization) (person_organization_select = person_and_organization person_and_organization)
description	approval.level	41		
VARIABLE_VALUE	measure_representation_item	45		**{measure_representation_item <= representation_item <- list_representation_item[i] list_representation_item compound_item_definition = list_representation_item compound_item_definition <- compound_representation_item.item_element compound_representation_item <= representation_item grouped_item = representation_item grouped_item <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group ->group (group.name = `binary parameter') (group.name = `substance property')}**

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
raw_or_approved	type_qualifier	45		measure_representation_item <= representation_item => qualified_representation_item qualified_representation_item.qualifiers[i] -> value_qualifier value_qualifier = type_qualifier type_qualifier **{type_qualifier** **(type_qualifier.name = `raw')** **(type_qualifier.name = `approved')}**
type	representation_item.name	43		measure_representation_item <= representation_item representation_item.name
value	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41		measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
variable_value to citation	PATH			measure_representation_item document_reference_item = measure_representation_item document_reference_item <- applied_document_reference.items[i] applied_document_reference <= document_reference document_reference.assigned_document -> document
variable_value to data_-quality	PATH			measure_representation_item <= representation_item => qualified_representation_item

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
variable_value to data_-source	PATH			measure_representation_item document_reference_item = measure_representation_item document_reference_item <- applied_document_reference.items[i] applied_document_reference <= document_reference document_reference.assigned_document -> document
variable_value to phase	PATH			measure_representation_item <= representation_item <- list_representation_item[i] list_representation_item compound_item_definition = list_representation_item compound_item_definition <- compound_representation_item.item_element compound_representation_item <= representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_object characterized_object => phase

Table 17 - Mapping table for substance_model_data UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
variable_value to substance	PATH			measure_representation_item <= representation_item <- list_representation_item[i] list_representation_item compound_item_definition = list_representation_item compound_item_definition <- compound_representation_item.item_element compound_representation_item <= representation_item <- representation.items[i] representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition characterized_product_definition = product_definition product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `substance'}**

Table 17 - Mapping table for substance_model_data UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
variable_value to variable	PATH			measure_representation_item <= representation_item <- list_representation_item[i] list_representation_item compound_item_definition = list_representation_item compound_item_definition <- compound_representation_item.item_element compound_representation_item **{compound_representation_item** **classified_item = compound_representation_item** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **(group.name = `binary parameter')** **(group.name = `substance property')}**
variable_value to variable_approval_-context	PATH			measure_representation_item approved_item = measure_representation_item approved_item <- applied_approval_assignment.items[i] applied_approval_assignment <= approval_assignment approval_assignment.assigned_approval ->approval

Table 18 - Mapping table for unit_operation UoF

Application element	AIM element	Source	Rules	Reference PATH
CITATION_REFERENCE	applied_document_reference	231		
purpose	document_role.name	41	23	applied_document_reference <= document_reference document_reference.role -> document_role document_role.name
citation_reference to citation	PATH		23	applied_document_reference <= document_reference document_reference.assigned_document -> document
citation_reference to process_unit_operation	PATH		5, 11, 23, 24	applied_document_reference applied_document_reference.items[i] -> document_reference_item document_reference_item = action_method action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `process unit operation'}**
FLUID_TRANSFER_-PERFORMANCE_-DATA_POINT	compound_representation_item	43		compound_representation_item <= representation_item **{representation_item** **representation_item.name = `fluid transfer performance data point'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
adiabatic_efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41		compound_representation_item <= **{representation_item** **representation_item.name = `adiabatic efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
actual_efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41		compound_representation_item <= **{representation_item** **representation_item.name = `actual efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
delta_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41		compound_representation_item <= **{representation_item** **representation_item.name = `delta pressure'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
head_developed	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41		compound_representation_item <= **{representation_item** **representation_item.name = `head developed'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
inlet_volume_flow_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41		compound_representation_item <= **{representation_item** **representation_item.name = `inlet volume flow rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
polytropic_efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41		compound_representation_item <= **{representation_item** **representation_item.name = `polytropic efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
fluid_transfer_- performance_data_point to uo_fluid_transfer	PATH		5, 7, 11, 16, 24	compound_representation_item <= representation_item <- representation.items[i] representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo fluid transfer']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo pressure change']}**
HEAT_EXCHANGER_- INTERNAL_DATA	heat_exchanger_internal_data	231		heat_exchanger_internal_data <= representation

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_exchanger_- cumulative_duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	16	heat_exchanger_internal_data <= representation representation.items[i] ->** **{representation_item representation_item.name = `heat exchanger cumulative duty'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
heat_exchanger_position	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	16	heat_exchanger_internal_data <= representation representation.items[i] ->** **{representation_item representation_item.name = `heat exchanger position'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
heat_exchanger_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	16	heat_exchanger_internal_data <= representation representation.items[i] ->** **{representation_item representation_item.name = `heat exchanger pressure'}** representation_item => measure_representation_item <= **{measure_with_unit => ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_exchanger_- temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	16	heat_exchanger_internal_data <= representation representation.items[i] ->** **{representation_item representation_item.name = `heat exchanger temperature'}** representation_item => measure_representation_item <= **{measure_with_unit => thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
heat_exchanger_- internal_data to uo_- heat_exchanger_side (start)	PATH		5, 7, 11, 16, 24	heat_exchanger_internal_data <= representation <- action_property_representation.representation action_property_representation action_property_representation.property ->** **action_property {action_property.name = `heat exchanger internal data'}** action_property.definition ->** **characterized_action_definition characterized_action_definition = action_method action_method **{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group ->** **group group.name = `uo heat exchanger side'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
HEAT_TRANSFER_-COEFFICIENT	action_property	49	7	**{action_property action_property.name = `heat transfer coefficient'}**
coefficient_of_heat_-transfer	[measure_with_unit.value_component] [measure_with_unit.unit_component]	45	16	action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item representation_item.name = `coefficient of heat transfer'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] **{measure_with_unit.value_component -> measure_value measure_value = numeric_measure numeric_measure}** [measure_with_unit.unit_component] **{measure_with_unit.unit_component -> named_unit => context_dependent_unit context_dependent_unit.name = `unitless'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
phase_coefficient_key	descriptive_representation_item	45	16	action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `phase coefficient key'}** representation_item => descriptive_representation_item **{descriptive_representation_item** **(descriptive_representation_item.name = `B-b')** **(descriptive_representation_item.name = `B-l')** **(descriptive_representation_item.name = `B-v')** **(descriptive_representation_item.name = `L-b')** **(descriptive_representation_item.name = `L-l')** **(descriptive_representation_item.name = `L-v')** **(descriptive_representation_item.name = `V-b')** **(descriptive_representation_item.name = `V-l')** **(descriptive_representation_item.name = `V-v')}**
heat_transfer_coefficient to uo_heat_exchanger	PATH		5, 7, 11, 24	action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo heat exchanger'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
PROCESS_UNIT_-OPERATION	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> group group.name = `process unit operation'}**
process_unit_operation to citation	PATH		5, 23	action_method <- document_reference_item = action_method document_reference_item applied_document_reference.items[i] <- applied_document_reference <= document_reference document_reference.assigned_document -> document
REACTOR_YIELD	reactor_yield	231		reactor_yield <= representation
mass_ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	16	reactor_yield <= representation representation.items[i] -> **{representation_item representation_item.name = `mass ratio'}** representation_item => measure_representation_item <= **{measure_with_unit => ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mole_ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	16	reactor_yield <= representation representation.items[i] ->** **{representation_item** **representation_item.name = `mole ratio'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
reactor_yield to phase	PATH		11, 24	reactor_yield <= representation <- applied_group_assignment.items [i] applied_group_assignment <= group_assignment **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `rate for phase'}** group_assignment.assigned_group -> group group => phase

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reactor_yield to substance	PATH		11, 13, 14, 15, 16, 24	reactor_yield <= representation representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> represented_definition represented_definition = property_definition property_definition property_definition.definition -> characterized_definition characterized_definition = characterized_product_definition characterized_product_definition = product_definition product_definition product_definition.formation -> product_definition_formation product_definition_formation.of_product -> product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `substance'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
REACTOR_YIELD TO UO_SPECIFIED_YIELD_-REACTOR	PATH		5, 7, 11, 16, 24	reactor_yield <= representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo specified yield reactor']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo reactor']}**
STAGE_COLUMN_-SECTION	stage_column_section	231		stage_column_section <= [group] [characterized_object]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
section_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41	9, 15, 16	stage_column_section <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `section diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stage_range	compound_representation_item	41	9, 15, 16	stage_column_section <= characterized_object characterized_definition = characterized_object characterized_definition <- property_definition.definition property_definition represented_definition = property_definition represented_definition <- property_definition_representation.definition property_definition_representation property_definition_representation.used_representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `stage range'}** representation_item => compound_representation_item **{compound_representation_item** **compound_representation_item.item_element ->** **compound_item_element** **compound_item_element = list_representation_item}**
stage_column_section to uo_distillation	PATH		11, 24	stage_column_section <= group <- group_assignment.assigned_group group_assignment => applied_group_assignment applied_group_assignment.items[i] -> action_method
STREAM_-SEPARATION_-SPECIFICATION	stream_separation_specification	231		stream_separation_specification <= representation

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
separation_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	stream_separation_specification <= representation representation.items[i] ->** {representation_item representation_item.name = `separation fraction'}** representation_item => measure_representation_item <= **{measure_with_unit => ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
separation_mass_flow	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	stream_separation_specification <= representation representation.items[i] ->** {representation_item representation_item.name = `separation mass flow'}** representation_item => measure_representation_item <= **{measure_with_unit => ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
separation_mole_flow	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	stream_separation_specification <= representation representation.items[i] ->** {representation_item representation_item.name = `separation mole flow'}** representation_item => measure_representation_item <= **{measure_with_unit => ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
separation_residual_- fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	stream_separation_specification <= representation representation.items[i] ->** **{representation_item representation_item.name = `separation residual fraction'}** representation_item => measure_representation_item <= **{measure_with_unit => ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
separation_standard_- volume_flow	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	stream_separation_specification <= representation representation.items[i] ->** **{representation_item representation_item.name = `separation standard volume flow'}** representation_item => measure_representation_item <= **{measure_with_unit => ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stream_separation_-specification to material_stream	PATH		8, 16, 17	stream_separation_specification <= representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property -> resource_property **{resource_property** **resource_property.name = `stream separation'}** resource_property.resource -> action_resource **{[action_resource =>** **stream]** **[action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material stream']}**
stream_separation_-specification to material_stream_phase	PATH		8, 16, 17	stream_separation_specification <= representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property -> resource_property **{resource_property** **resource_property.name = `stream separation'}** resource_property.resource -> characterized_resource_definition characterized_resource_definition = action_resource action_resource **{[action_resource =>** **specific_phase]** **[action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material stream phase']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stream_separation_- specification to site_- standard_conditions	PATH		16	stream_separation_specification <= representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->property_definition => site_standard_condition
stream_separation_- specification to substance	PATH		11, 13, 14, 15, 16, 24	stream_separation_specification <= representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition ->property_definition property_definition.definition ->characterized_definition characterized_definition = characterized_product_definition characterized_product_definition = product_definition product_definition product_definition.formation ->product_definition_formation product_definition_formation.of_product ->product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items [i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->group** **group.name = `substance'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stream_separation_- specification to uo_- substance_split	PATH		5, 7, 11, 16, 24	stream_separation_specification <= representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo substance split'}**
STREAM_SPLIT_- SPECIFICATION	stream_split_specification	231		stream_split_specification <= representation

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stream_split_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	stream_split_specification <= representation representation.items[i] -> **{representation_item** **representation_item.name = `stream split fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
stream_split_mass_flow	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	stream_split_specification <= representation representation.items[i] -> **{representation_item** **representation_item.name = `stream split mass flow'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
stream_split_mole_flow	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	stream_split_specification <= representation representation.items[i] -> **{representation_item** **representation_item.name = `stream split mole flow'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stream_split_residual_-fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	stream_split_specification <= representation representation.items[i] ->** **{representation_item** **representation_item.name = `stream split residual fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
stream_split_standard_-volume_flow	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	stream_split_specification <= representation representation.items[i] ->** **{representation_item** **representation_item.name = `stream split standard volume flow'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
stream_split_volume_-flow	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	16	stream_split_specification <= representation representation.items[i] ->** **{representation_item** **representation_item.name = `stream split volume flow'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stream_split_- specification to material_stream	PATH		8, 16, 17	stream_split_specification <= representation <- resource_property_representation.representation resource_property_representation resource_property_representation.property ->> resource_property **{resource_property** **resource_property.name = `stream separation'}** resource_property.resource ->> action_resource **{[action_resource =>** **stream]** **[action_resource** **action_resource.kind ->** **action_resource_type** **action_resource_type.name = `material stream']}**
stream_split_- specification to site_- standard_conditions	PATH		15, 16	stream_split_specification <= representation <- property_definition_representation.used_representation property_definition_representation property_definition_representation.definition -> property_definition => site_standard_condition

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stream_split_- specification to uo_- stream_split	PATH		5, 7, 11, 16, 24	stream_separation_specification <= representation <- action_property_representation.representation action_property_representation action_property_representation.property -> action_property action_property.definition -> characterized_action_definition characterized_action_definition = action_method action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo substance split'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_AIR_COOLED_-HEAT_EXCHANGER	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo air cooled heat exchanger'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo heat exchanger']}**
UO_CENTRIFUGAL_-COMPRESSOR	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo centrifugal compressor'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo compressor']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
radial_frequency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `radial frequency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_CENTRIFUGAL_- COMPRESSOR_STAGE	action_method	41	5, 6, 11, 24	**{[action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo centrifugal compressor stage'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo compressor stage']] [action_method <- action_method_relationship.related_method action_method_relationship action_method_relationship.relating_method ->** **action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `uo centrifugal compressor']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
design_flowrate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `design flowrate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
design_head	descriptive_representation_- item.description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `design head'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
design_speed	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `design speed'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
isentropic_efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `isentropic efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stage_number	action_method.name	41		
UO_CENTRIFUGE	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group ->** **[group group.name = `uo centrifuge'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `uo liquid solid separation']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cake_surface_radius	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cake surface radius'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
filter_cake_- compressibility_factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `filter cake compressibility factor'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure}**] [measure_with_unit.unit_component **{measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `factor'}**]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
filter_cake_particle_- diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `filter cake particle diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
filter_cake_particle_- sphericity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `filter cake particle sphericity'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
filter_cake_percent_solid	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `filter cake percent solid'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
filter_cake_porosity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `filter cake porosity'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
filter_cake_specific_- resistance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `filter cake specific resistance'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
filter_cloth_resistance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `filter cloth resistance'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
frequency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `frequency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
liquid_surface_radius	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `liquid surface radius'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
UO_COMPLETELY_- STIRRED_REACTOR	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo completely stirred reactor']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo reactor']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
maximum_volume	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `maximum volume'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
residence_time	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `residence time'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **time_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
volume	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `volume'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
UO_COMPLEX_- DISTILLATION	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo complex distillation']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo separation']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_COMPRESSOR	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo compressor']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo fluid transfer']}**
cooler_differential_- pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `cooler differential pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cooler_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cooler temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_stages	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of stages'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}**] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
overall_isentropic_- efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `overall isentropic efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
overall_polytropic_- efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `overall polytropic efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_COMPRESSOR_- STAGE	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo compressor stage']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo fluid transfer']}**
cooler_differential_- pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->> representation representation.items[i] ->> **{representation_item** **representation_item.name = `cooler differential pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cooler_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cooler temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_compressor_stage to uo_compressor	PATH		5, 6, 11, 24	action_method <- action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** group_assignment group_assignment.assigned_group ->** group group.name = `uo compressor stage'} action_method_relationship.related_method action_method_relationship action_method_relationship.relating_method ->** action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo compressor']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_- COUNTERCURRENT_- SOLIDS_DECANT	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo countercurrent solids decant']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo liquid solid separation']}**
heavy_key_recovery	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `heavy key recovery'}** representation_item => measure_representation_item <=**{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
light_key_recovery	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `light key recovery'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stages	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `stages'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}**] [measure_with_unit.unit_component]
uo_countercurrent_- solids_decant to substance (as light key)	PATH		11, 13, 24	action_method <- action_method_assignment => **{action_method_assignment** **action_method_assignment.role ->** **action_method_role.name = `light key'}** applied_action_method_assignment applied_action_method_assignment.items[i] -> product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items [i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `substance'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_countercurrent_- solids_decant to substance (as heavy key)	PATH		11, 13, 24	action_method <- action_method_assignment => **{action_method_assignment** **action_method_assignment.role ->** **action_method_role.name = `heavy key'}** applied_action_method_assignment applied_action_method_assignment.items[i] ->** product **{product** **classified_item = product** **classified_item <-** **classification_assignment.items [i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `substance'}**
UO_CRUSH	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo crush']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo solid solid separation']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
crusher_type	action_resource_type.name	41	5, 8, 11, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `crusher'}** action_resource action_resource.kind ->** action_resource_type action_resource_type.name **{(action_resource_type.name = `cage mill')** **(action_resource_type.name = `gyratory jaw')** **(action_resource_type.name = `multiple roll')** **(action_resource_type.name = `single roll')}**
operating_mode	action_resource.description	41	5, 8, 11, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `crusher'}** action_resource action_resource.description **{(action_resource.description = `primary')** **(action_resource.description = `secondary')}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outlet_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outlet diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
UO_CRYSTALLIZATION	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo crystallization']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo liquid solid separation']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->
representation representation.items[i] ->
{representation_item **representation_item.name = `duty'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
exchanger_delta_- temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->
representation representation.items[i] ->
{representation_item **representation_item.name = `exchanger delta temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
magma_density	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `magma density'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outlet_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `outlet pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `pressure drop'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
recirculation_flow_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `recirculation flow rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
solute	descriptive_representation_item. description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `solute'}** representation_item => descriptive_representation_item descriptive_representation_item.description
solute_recovery	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `solute recovery'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
solvent	descriptive_representation_item. description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `solvent'}** representation_item => descriptive_representation_item descriptive_representation_item.description
solvent_loss	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `solvent loss'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
volume	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `volume'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_CYCLONE	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group ->** **[group group.name = `uo cyclone'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `uo gas solid separation']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cone_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cyclone'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `cone length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cyclone'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inlet_height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cyclone'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `inlet height'}** representation_item => measure_representation_item <=**{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inlet_width	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cyclone'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `inlet width'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_gas_turns	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of gas turns'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}**] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_parallel_- cyclones	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of parallel cyclones'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}**] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
overflow_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cyclone'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `overflow diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
overflow_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cyclone'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `overflow length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	action_resource_type.name	41	5, 8, 11, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cyclone'}** action_resource action_resource.kind ->** action_resource_type action_resource_type.name

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
underflow_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `cyclone'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `underflow diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vane_constant	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `vane constant'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure}**] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_DISSOLVE	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo dissolve']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo liquid solid separation']}**
dissolution_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `dissolution fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
dissolution_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `dissolution rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `duty'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outlet_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `outlet pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `pressure drop'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
solute	descriptive_representation_item. description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `solute'}** representation_item => descriptive_representation_item descriptive_representation_item.description
solute_recovery	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `solute recovery'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
solvent	descriptive_representation_item. description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `solvent'}** representation_item => descriptive_representation_item descriptive_representation_item.description
solvent_loss	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `solvent loss'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
temperature_change_- outlet_to_inlet	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `temperature change outlet to inlet'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
volume	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `volume'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
UO_DISTILLATION	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo distillation']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo separation']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
condenser_duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `overhead condenser heat exchanger'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `condenser duty'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
condenser_subcooling	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 16, 17	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource =>** **stream}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->>representation representation.items[i] ->>**{representation_item** **representation_item.name = `condenser subcooling'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
condenser_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `condenser temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
distillation_bottom_- pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `distillation bottom pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
distillate_to_feed_ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `distillate to feed ratio'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
distillation_top_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `distillation top pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
distillation_type	action_method.description	41		**{(action_method.description = `absorb') (action_method.description = `extract') (action_method.description = `fractionation') (action_method.description = `stripping')}**
feed_stage_number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item representation_item.name = `feed stage number'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component -> measure_value measure_value = numeric_measure}**] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
feed_quality	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `feed quality'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
heavy_key_recovery	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `heavy key recovery'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
height_equivalent_to_- theoretical_plate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `height equivalent to theoretical plate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
light_key_recovery	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `light key recovery'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_stages	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of stages'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}**] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reboiler_baffle	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `reboiler'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `reboiler baffle'}** representation_item => measure_representation_item <=**{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reboiler_duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `reboiler'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `reboiler duty'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reboiler_type	action_resource_type.name	41	5, 8, 11, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `reboiler'}** action_resource action_resource.kind ->** action_resource_type action_resource_type.name **{(action_resource_type.name = `forced circulation')** **(action_resource_type.name = `kettle')** **(action_resource_type.name = `none')** **(action_resource_type.name = `thermosyphon')}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reflux_ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `reflux ratio'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
reflux_ratio_minimum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `reflux ratio minimum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stage_numbering_- convention	descriptive_representation_- item.description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `stage numbering conversion'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `bottom up')** **(descriptive_representation_item.description = `top down')}**
total_or_partial_- condenser	descriptive_representation_- item.description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `total or partial condenser'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{descriptive_representation_item.description** **(descriptive_representation_item.description = `total')** **(descriptive_representation_item.description = `partial')}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_distillation to substance (as light key)	PATH		11, 13, 24	action_method <- action_method_assignment => **{action_method_assignment action_method_assignment.role -> action_method_role.name = `light key'}** applied_action_method_assignment applied_action_method_assignment.items[i] -> product **{product classified_item = product classified_item <- classification_assignment.items [i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `substance'}**
uo_distillation to substance (as heavy key)	PATH		11, 13, 24	action_method <- action_method_assignment => **{action_method_assignment action_method_assignment.role -> action_method_role.name = `heavy key'}** applied_action_method_assignment applied_action_method_assignment.items[i] -> product **{product classified_item = product classified_item <- classification_assignment.items [i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `substance'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_distillation to uo_-complex_distillation	PATH		5, 6, 11, 24	action_method <- **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo distillation'}** action_method_relationship.related_action_method action_method_relationship **{action_method_relationship** **action_method_relationship.name = `composition'}** action_method_relationship.relating_action_method ->** action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo complex distillation'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_DISTILLATION_-STAGE	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo distillation stage'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo separation']}**
condenser_stage	group.name	41	5, 11, 24	action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment group_assignment.role -> group_role group_role.name = `distillation stage function classification'}** group_assignment group_assignment.assigned_group -> group group.name **{group.name = `condenser stage'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
distillation_stage_number	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `distillation stage number'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure}**] [measure_with_unit.unit_component]
distillation_stage_- pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `distillation stage pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
distillation_stage_- temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `distillation stage temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
external_heat_- exchanger_duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `external heat exchanger'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `external heat exchanger duty'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hole_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hole diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_holes	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of holes'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}**] [measure_with_unit.unit_component]
reboiler_stage	group.name	41	5, 11, 24	action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `distillation stage function classification'}** group_assignment group_assignment.assigned_group -> group group.name **{group.name = `reboiler stage'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
stage_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `stage area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
stage_type	group.name	41	5, 11, 24	action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `distillation stage tray type classification'}** group_assignment group_assignment.assigned_group -> group group.name **{(group.name = `bubble cap')** **(group.name = `ideal tray')** **(group.name = `packed')** **(group.name = `sieve tray')** **(group.name = `valve tray')}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
volume_liquid	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `volume liquid'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
volume_vapour	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `volume vapour'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
weir_height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `weir'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `weir height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
weir_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `weir'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `weir length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_distillation_stage to stage_column_section	PATH			action_method <- applied_group_assignment.items[i] applied_group_assignment <= group_assignment group_assignment.assigned_group -> group => stage_column_section

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_distillation_stage to uo_distillation	PATH		5, 6, 11, 24	action_method <- **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo distillation stage'}** action_method_relationship.related_action_method action_method_relationship **{action_method_relationship** **action_method_relationship.name = `composition'}** action_method_relationship.relating_action_method ->** action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo distillation'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_distillation_stage to uo_heat_exchanger	PATH		5, 6, 11, 24	action_method <- **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo distillation stage'}** action_method_relationship.related_action_method action_method_relationship **{action_method_relationship** **action_method_relationship.name = `provision of external heat transfer'}** action_method_relationship.relating_action_method ->** action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo heat exchanger'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_DISTILLATION_-STAGE_PHASE_PUMP_-AROUND	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group ->** **group group.name = `uo distillation stage phase pump around'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `pump around'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `heat duty'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
liquid_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `liquid fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mass_flow_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `pump around'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `mass flow rate'}** representation_item => measure_representation_item <=**{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mole_flow_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `pump around'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `mole flow rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **amount_of_substance_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
on_or_above_stage	descriptive_representation_- item.description	45	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `pump around'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `on or above stage'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `on stage')** **(descriptive_representation_item.description = `above stage')}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `pump around'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `pump around'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_DOUBLE_PIPE_-HEAT_EXCHANGER	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group ->** **[group group.name = `uo double pipe heat exchanger'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `uo heat exchanger']}**
UO_ELECTROSTATIC_-PRECIPITATOR	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group ->** **[group group.name = `uo electrostatic precipitator'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `uo gas solid separation']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
breakage_voltage	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `breakage voltage'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **electric_current_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
gas_velocity_maximum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `gas velocity maximum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
gas_velocity_minimum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `gas velocity minimum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_plates	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of plates'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}**] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plate_height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `plate height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
plate_height_maximum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `plate height maximum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plate_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `plate length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
plate_length_maximum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `plate length maximum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plate_length_minimum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `plate length minimum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
plate_to_wire_distance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `plate to wire distance'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
plate_width_maximum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `plate width maximum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
wire_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `wire'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->** representation representation.items[i] ->** **{representation_item** **representation_item.name = `wire diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
wire_roughness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `wire roughness'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_unit.value_component ->** **measure_value** **measure_value = numeric_measure}**] [measure_with_unit.unit_component **{measure_with_unit_component ->** **unit =>** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless'}**]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_EXPANDER	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo expander']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo fluid transfer']}**
design_flowrate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `design flowrate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
design_head	descriptive_representation_- item.description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `design head'}** representation_item => descriptive_representation_item descriptive_representation_item.description
design_speed	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `design speed'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_design	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure design'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
radial_frequency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `radial frequency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_EXTENT_- SPECIFIED_REACTOR	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group ->** **[group group.name = `uo extent specified reactor'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `uo reactor']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
reactor_type	action_resource_type.name	41	5, 8, 11, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `reactor'}** action_resource action_resource.kind ->** action_resource_type action_resource_type.name **{(action_resource_type.name = `gibbs')** **(action_resource_type.name = `stoichiometric')** **(action_resource_type.name = `equilibrium')}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_EXTRACT	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo extract'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo separation']}**
UO_FABRIC_FILTER	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo fabric filter'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo gas solid separation']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bag_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `bag'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `bag area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bag_cleaning_time	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `bag'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `bag area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **time_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
bag_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `bag'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `bag diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
dust_resistance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `dust resistance'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
filtration_time	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `filtration time'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **time_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
gas_velocity_maximum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `gas velocity maximum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
gas_velocity_minimum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `gas velocity minimum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_bags_per_cell	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of bags per cell'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_cells	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of cells'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}**] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_cells_cleaned	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of cells cleaned'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}**] [measure_with_unit.unit_component]
pressure_drop_clean_bag	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure drop clean bag'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_drop_maximum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure drop maximum'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
UO_FIRED_HEATER	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo fired heater'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `duty'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
fuel_efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `fuel efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
fuel_heating_value	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `fuel heating value'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
outlet_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outlet temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure drop'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
UO_FIRED_REACTOR	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo fired reactor']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo reactor']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_FLASH	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo flash']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo separation']}**
duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `duty'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
overhead_to_feed_- mole_ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `overhead to feed mole ratio'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure drop'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
specification	descriptive_representation_- item.description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `specification'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `pressure duty flash')** **(descriptive_representation_item.description = ** **`pressure volume fraction flash')** **(descriptive_representation_item.description = `temperature pressure flash')** **(descriptive_representation_item.description = `temperature duty flash')** **(descriptive_representation_item.description = \** **`temperature volume fraction flash')** **(descriptive_representation_item.description = `unknown')}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
UO_FLUID_TRANSFER	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo fluid transfer']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo pressure change']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_GAS_SOLID_-SEPARATION	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** group_role **group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group ->** group **group.name = `uo gas solid separation'}**
gas_velocity				
pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->** representation representation.items[i] -> **{representation_item representation_item.name = `pressure drop'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
separation_efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `separation efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
UO_HEAT_EXCHANGER	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo heat exchanger'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `duty'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
flow_direction	descriptive_representation_- item.description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `flow direction'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `cocurrent')** **(descriptive_representation_item.description = `countercurrent')** **(descriptive_representation_item.description = `unspecified')}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
lmtd_correction_factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `Lmtd correction factor'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
minimum_approach_- temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `minimum approach temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_shell_passes	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of shell passes'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}**] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_tube_passes	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of tube passes'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}**] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
overall_heat_transfer_-coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `overall heat transfer coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
shell_pass	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `shell pass'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}**] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
shell_volume	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `shell volume'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
surface_area	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `surface area'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **area_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tube_pass	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tube pass'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}**] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
tube_volume	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `tube volume'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
UO_HEAT_- EXCHANGER_FLUID	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo heat exchanger fluid'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_exchanger_shell_-or_tube	descriptive_representation_-item.description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `heat exchanger shell or tube'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `shell')** **(descriptive_representation_item.description = `tube')}**
uo_heat_exchanger_fluid to stream	PATH		5	action_method supported_item = action_method supported_item <- action_resource.usage[i] action_resource => stream

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_heat_exchanger_fluid to uo_heat_exchanger_-side	PATH		5, 6, 11, 24	action_method <- **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo heat exchanger fluid'}** action_method_relationship.related_action_method action_method_relationship **{action_method_relationship** **action_method_relationship.name = `possession'}** action_method_relationship.relating_action_method ->** action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo heat exchanger side'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_HEAT_- EXCHANGER_SIDE	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo heat exchanger side'}**
heat_exchanger_side_- delta_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->
representation representation.items[i] -> **{representation_item** **representation_item.name = `heat exchanger side delta temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
heat_exchanger_side_id	action_method.name	41		

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
heat_exchanger_side_- outlet_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `heat exchanger side outlet temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
heat_exchanger_side_- pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `heat exchanger side pressure drop'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
hot_or_cold	descriptive_representation_- item.description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `hot or cold'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `hot')** **(descriptive_representation_item.description = `cold')}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_heat_exchanger_side to uo_heat_exchanger	PATH		5, 6, 11, 24	action_method <- **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo heat exchanger side'}** action_method_relationship.related_action_method action_method_relationship **{action_method_relationship** **action_method_relationship.name = `possession'}** action_method_relationship.relating_action_method ->** action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo heat exchanger'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_HYDROCYCLONE	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo hydrocyclone']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo liquid solid separation']}**
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `diameter'}** representation_item => measure_representation_item <=**{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter_maximum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter maximum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inlet_nozzle_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `nozzle'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `inlet nozzle diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
number_of_parallel_- hydrocyclones	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `number of parallel hydrocyclones'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = count_measure}**] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
overflow_nozzle_- diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `nozzle'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `overflow nozzle diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_drop_maximum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->
representation representation.items[i] ->
{representation_item **representation_item.name = `pressure drop maximum'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
separation_efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->
representation representation.items[i] ->
{representation_item **representation_item.name = `separation efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
underflow_nozzle_- diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `nozzle'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `underflow nozzle diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vortex_finder_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `vortex finder'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `vortex finder diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
vortex_finder_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `vortex finder'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `vortex finder length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_JET_EJECTOR	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo jet ejector'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo pressure changer']}**
UO_LIQUID_LIQUID_-FLASH	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo liquid liquid flash'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo multi phase flash']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_LIQUID_SOLID_-SEPARATION	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** group_role **group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group ->** group **group.name = `uo liquid solid separation'}**
UO_LIQUID_VAPOUR_-FLASH	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** group_role **group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group ->** **[group group.name = `uo liquid vapour flash'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** group **group.name = `uo multi phase flash']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_MELT	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo melt'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo phase changer']}**
UO_MIX	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> group group.name = `uo mix'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure drop'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
pressure_out	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure out'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_MULTI_PHASE_-FLASH	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** group_role **group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo multi phase flash'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo flash']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation drum'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `diameter'}** representation_item => measure_representation_item <=**{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
entrained_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `entrained fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
entrainment_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `entrainment fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
entrainment_from	action_resource.name	41	5	action_method <- action_method_assignment.assigned_action_method **{.role = `entrainment to'}** applied_action_method_assignment.items ->> stream
entrainment_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `entrainment rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
entrainment_to	action_resource.name	41	5	action_method <- action_method_assignment.assigned_action_method **{.role = `entrainment to'}** applied_action_method_assignment.items ->> stream

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
height_above_grade	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation drum'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `height above grade'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `separation drum'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_PHASE_CHANGE	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo phase changer'}**
duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `duty'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_PIPELINE	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** group_role **group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo pipeline'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** group **group.name = `uo pressure changer']}**
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->** representation representation.items[i] -> **{representation_item representation_item.name = `diameter'}** representation_item => measure_representation_item <= **{measure_with_unit => length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_PIPELINE_NODE	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo pipeline node']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo pressure changer']}**
ambient_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `ambient temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `duty'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
number	action_method.name	41		
pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
x_position	cartesian_point.coordinates[1]	42	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `position'}** representation_item => geometric_representation_item => point => cartesian_point cartesian_point.coordinates[1]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
y_position	cartesian_point.coordinates[2]	42	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `position'}** representation_item => geometric_representation_item => point => cartesian_point cartesian_point.coordinates[2]
z_position	cartesian_point.coordinates[3]	42	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `position'}** representation_item => geometric_representation_item => point => cartesian_point cartesian_point.coordinates[3]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_pipeline_node to uo_-pipeline	PATH		5, 6, 11, 24	action_method <- **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo pipeline node'}** action_method_relationship.related_action_method action_method_relationship **{action_method_relationship** **action_method_relationship.name = `possession'}** action_method_relationship.relating_action_method ->** action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo pipeline'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_pipeline_node to uo_-pipeline_segment (as in node)	PATH		5, 6, 11, 24	action_method <- **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo pipeline node'}** action_method_relationship.related_action_method action_method_relationship **{action_method_relationship** **action_method_relationship.name = `in node possession'}** action_method_relationship.relating_action_method ->** action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo pipeline segment'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_pipeline_node to uo_-pipeline_segment (as out node)	PATH		5, 6, 11, 24	action_method <- **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo pipeline node'}** action_method_relationship.related_action_method action_method_relationship **{action_method_relationship** **action_method_relationship.name = `out node possession'}** action_method_relationship.relating_action_method ->** action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo pipeline segment'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_PIPELINE_-SEGMENT	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** group_role **group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo pipeline segment'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** group **group.name = `uo pressure changer']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inner_diameter_of_- outer_pipe	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `outer pipe'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `inner diameter of outer pipe'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outer_diameter_of_- inner_pipe	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `inner pipe'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outer diameter of inner pipe'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
overall_heat_transfer_-coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `overall heat transfer coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
pipe_efficiency_factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pipe efficiency factor'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pipe_roughness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pipe roughness'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_unit.value_component ->** **measure_value** **measure_value = numeric_measure}**] [measure_with_unit.unit_component **{measure_with_unit_component ->** **unit =>** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless'}**]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure drop'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
segment_number	action_method.name	41		

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_pipeline_segment to uo_pipeline	PATH		5, 6, 11, 24	action_method <- **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo pipeline segment'}** action_method_relationship.related_action_method action_method_relationship **{action_method_relationship** **action_method_relationship.name = `possession'}** action_method_relationship.relating_action_method ->** action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo pipeline'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_PLUG_FLOW_- REACTOR	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo plug flow reactor']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo reactor']}**
coolant_flow_direction	descriptive_representation_- item.description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `flow direction'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `cocurrent')** **(descriptive_representation_item.description = `countercurrent')}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
overall_heat_transfer_-coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `overall heat transfer coefficient'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
UO_POSITIVE_-DISPLACEMENT_-COMPRESSOR	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo positive displacement compressor']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo compressor']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_POSITIVE_- DISPLACEMENT_- COMPRESSOR_STAGE	action_method	41	5, 6, 11, 24	**{[action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** group_role **group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo positive displacement compressor stage'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo compressor stage']] [action_method <- action_method_relationship.related_method action_method_relationship action_method_relationship.relating_method -> action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= group_assignment group_assignment.assigned_group -> group group.name = `uo positive displacement compressor']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
clearance_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `clearance fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
displacement	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `displacement'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
polytropic_efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `polytropic efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
stage_number	action_method.name	41		
UO_PRESSURE_- CHANGE	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo pressure changer'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
brake_horsepower	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `brake horsepower'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
differential_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `differential pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
driver_power_quantity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `driver power'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
driver_power_type	action_resource_type.name	41	5, 8, 11, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `driver'}** action_resource action_resource.kind -> action_resource_type action_resource_type.name **{(action_resource_type.name = `electricity power')** **(action_resource_type.name = `fuel gas power')** **(action_resource_type.name = `steam power')}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
inlet_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inlet pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
inlet_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `inlet temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
mechanical_efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `mechanical efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
outlet_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outlet pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outlet_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outlet temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
pressure_ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure ratio'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_PUMP	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo pump']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo fluid transfer']}**
design_flowrate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `design flowrate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
design_head	descriptive_representation_- item.description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `design head'}** representation_item => descriptive_representation_item descriptive_representation_item.description
design_speed	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `design speed'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
net_positive_suction_- head	descriptive_representation_- item.description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `net positive suction head'}** representation_item => descriptive_representation_item descriptive_representation_item.description
radial_frequency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `radial frequency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
type	action_resource_type.name	41	5, 8	action_method supported_item = action_method supported_item <- action_resource.usage[i] action_resource action_resource.kind -> action_resource_type action_resource_type.name
volumetric_flow_rate	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `volumetric flow rate'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_REACTOR	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo reactor'}**
duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `duty'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outlet_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outlet pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
outlet_temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outlet temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
outlet_vapour_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `outlet vapour fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure drop'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_reactor to chemical_-reaction	PATH			action_method <- action.chosen_method action => product_definition_process
UO_RESTRICT	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo restrict']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo pressure changer']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
large_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `large diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
restriction_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `restriction diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_ROTARY_FILTER	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group ->** **[group group.name = `uo rotary filter'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `uo liquid solid separation']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cake_compressibility_-factor	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `cake compressibility factor'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component **{measure_with_unit.value_component ->** **measure_value** **measure_value = numeric_measure}**] [measure_with_unit.unit_component **{measure_with_unit.unit_component ->** **unit** **unit = named_unit** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `factor'}**]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cake_particle_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cake particle diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
cake_particle_sphericity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cake particle sphericity'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cake_percent_solid	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cake percent solid'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
cake_porosity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cake porosity'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
cake_specific_resistance	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cake specific resistance'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
cake_thickness	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `cake thickness'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
filtration_angle	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `filtration angle'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **solid_angle_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
frequency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `frequency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
width	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `width'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_SCREEN	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo screen'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo solid solid separation']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
opening_size	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `screen'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `opening size'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
operating_level	action_resource_type.name	41	5, 8, 11, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `screen'}** action_resource action_resource.kind ->** action_resource_type action_resource_type.name **{(action_resource_type.name = `lower')** **(action_resource_type.name = `upper')}**
operating_mode	descriptive_representation_item.description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->** representation representation.items[i] ->** **{representation_item** **representation_item.name = `operating mode'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `dry screen')** **(descriptive_representation_item.description = `wet screen')}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
separation_efficiency	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `separation efficiency'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
separation_strength	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `separation strength'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] **{measure_with_unit.value_component ->** **measure_value** **measure_value = parameter_value}** [measure_with_unit.unit_component] **{measure_with_unit.unit_component ->** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless'}**
UO_SEPARATION	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo separation'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_separation to separation_efficiency	PATH			
UO_SEPARATION_-THREE_PHASE_FLASH	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group ->** **[group group.name = `uo separation three phase flash'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `uo multi phase flash']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
weir_height	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `weir'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `weir height'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
weir_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `weir'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `weir length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_SHELL_AND_- TUBE_HEAT_- EXCHANGER	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** group_role **group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo shell and tube heat exchanger'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** group **group.name = `uo heat exchanger']}**
UO_SINGLE_PHASE_- FLASH	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** group_role **group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo single phase flash'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** group **group.name = `uo flash']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
node_volume	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `node volume'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **volume_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
UO_SOLID_SOLID_- SEPARATION	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo solid solid separation'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_SOLIDS_DECANT_-STAGE	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** group_role **group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo solids decant stage'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** group **group.name = `uo liquid solid separation']}**
decanter_stage_number	action_method.name	41		
decanter_stage_outlet_-pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->** representation representation.items[i] -> **{representation_item representation_item.name = `decanter stage outlet pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
decanter_stage_- pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `decanter stage pressure drop'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
flow_ratio_overflow_to_- underflow	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `flow ratio overflow to underflow'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
solids_concentration_- overflow_to_underflow	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `solids concentration overflow to underflow'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
uo_solids_decant_stage to uo_countercurrent_-solids_decant	PATH		5, 6, 11, 24	action_method <- **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo solids decant stage'}** action_method_relationship.related_action_method action_method_relationship **{action_method_relationship** **action_method_relationship.name = `possession'}** action_method_relationship.relating_action_method ->** action_method **{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `uo solids decant'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_SOLIDS_DRYING	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo solids drying']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo liquid solid separation']}**
duty	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation ->representation representation.items[i] ->**{representation_item** **representation_item.name = `duty'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
entrained_fraction	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `entrained fraction'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
overhead_to_feed_- mass_ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `overhead to feed mass ratio'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
overhead_to_feed_- mole_ratio	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `overhead to feed mole ratio'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
pressure_drop	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure drop'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
temperature	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `temperature'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **thermodynamic_temperature_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_SPECIFIED_YIELD_-REACTOR	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo specified yield reactor'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group ->** **group group.name = `uo reactor']}**
UO_SPLIT	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role ->** **group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group ->** **group group.name = `uo split'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
differential_pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `differential pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
pressure	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `pressure'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_STREAM_SPLIT	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo stream split'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo split']}**
UO_SUBSTANCE_SPLIT	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo substance split'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo split']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_VALVE	action_method	41	5, 11, 24	**{action_method** **classified_item = action_method** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **{group_assignment** **group_assignment.role ->** **group_role** **group_role.name = `unit operation type classification'}** **group_assignment** **group_assignment.assigned_group ->** **[group** **group.name = `uo valve']** **[group <-** **group_relationship.related_group** **group_relationship** **group_relationship.relating_group ->** **group** **group.name = `uo pressure changer']}**
action	action_resource_type.name	41	5, 8, 11, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `valve'}** action_resource action_resource.kind ->** action_resource_type action_resource_type.name **{(action_resource_type.name = `close')** **(action_resource_type.name = `open')}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
control_type	descriptive_representation_- item.description	45	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `control type'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
fail	descriptive_representation_- item.description	45	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `valve'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `fail'}** representation_item => descriptive_representation_item descriptive_representation_item.description **{(descriptive_representation_item.description = `fail close')** **(descriptive_representation_item.description = fail fixed')** **(descriptive_representation_item.description = fail open')}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
valve_flow_coefficient	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `valve flow coefficient'}** representation_item => measure_representation_item <= measure_with_unit [measure_with_unit.value_component] **{measure_with_unit.value_component ->** **measure_value** **measure_value = parameter_value}** [measure_with_unit.unit_component] **{measure_with_unit.unit_component ->** **named_unit =>** **context_dependent_unit** **context_dependent_unit.name = `unitless'}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
valve_style	descriptive_representation_item. description	45	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `valve'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `valve style'}** representation_item => descriptive_representation_item descriptive_representation_item.description

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
valve_type	organization.name	41	5, 8, 11, 24, 26	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `valve'}** action_resource organization_item = action_resource organization_item <- applied_organization_assignment.items[i] applied_organization_assignment <= **{organization_assignment** **organization_assignment.role ->** **organization_role** **organization_role.name = `manufacturer'}** organization_assignment organization_assignment.assigned_organization -> organization organization.name

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
UO_VAPOURIZE	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo vapourize'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo phase changer']}**
UO_VENTURI_-SCRUBBER	action_method	41	5, 11, 24	**{action_method classified_item = action_method classified_item <- classification_assignment.items[i] classification_assignment <= {group_assignment group_assignment.role -> group_role group_role.name = `unit operation type classification'} group_assignment group_assignment.assigned_group -> [group group.name = `uo venturi scrubber'] [group <- group_relationship.related_group group_relationship group_relationship.relating_group -> group group.name = `uo gas solid separation']}**

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
gas_velocity_maximum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `gas velocity maximum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
gas_velocity_minimum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `gas velocity minimum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
liquid_throat_velocity	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `throat'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `liquid throat velocity'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
liquid_to_gas_volume_- ratio_maximum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `liquid to gas volume ratio maximum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]
liquid_to_gas_volume_- ratio_minimum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 7, 16	action_method characterized_action_definition = action_method characterized_action_definition <- action_property.definition action_property <- action_property_representation.property action_property_representation action_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `liquid to gas volume ratio minimum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **ratio_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
throat_diameter	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `throat'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->** representation representation.items[i] ->** **{representation_item** **representation_item.name = `throat diameter'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
throat_diameter_- maximum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `throat'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation ->** representation representation.items[i] ->** **{representation_item** **representation_item.name = `throat diameter maximum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (continued)

Application element	AIM element	Source	Rules	Reference PATH
throat_diameter_- minimum	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `throat'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `throat diameter minimum'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

Table 18 - Mapping table for unit_operation UoF (concluded)

Application element	AIM element	Source	Rules	Reference PATH
throat_length	[measure_with_unit.value_component] [measure_with_unit.unit_component]	41 41	5, 8, 11, 16, 17, 24	action_method supported_item = action_method supported_item <- action_resource.usage[i] **{action_resource** **classified_item = action_resource** **classified_item <-** **classification_assignment.items[i]** **classification_assignment <=** **group_assignment** **group_assignment.assigned_group ->** **group** **group.name = `throat'}** action_resource characterized_resource_definition = action_resource characterized_resource_definition <- resource_property.resource resource_property <- resource_property_representation.property resource_property_representation resource_property_representation.representation -> representation representation.items[i] -> **{representation_item** **representation_item.name = `throat length'}** representation_item => measure_representation_item <= **{measure_with_unit =>** **length_measure_with_unit}** measure_with_unit [measure_with_unit.value_component] [measure_with_unit.unit_component]

The following rules are referenced in the preceding table:

1) application_context_requires_ap_definition
2) dependent_instantiable_application_context
3) dependent_instantiable_product_context
4) dependent_instantiable_product_definition_context
5) subtype_exclusive_action_method
6) subtype_exclusive_action_method_relationship
7) subtype_exclusive_action_property
8) subtype_exclusive_action_resource
9) subtype_exclusive_characterized_object
10) subtype_exclusive_externally_defined_item
11) subtype_exclusive_group
12) subtype_exclusive_presented_item
13) subtype_exclusive_product
14) subtype_exclusive_product_definition
15) subtype_exclusive_property_definition
16) subtype_exclusive_representation
17) subtype_exclusive_resource_property
18) subtype_exclusive_shape_aspect
19) subtype_mandatory_approval_assignment
20) subtype_mandatory_certification_assignment
21) subtype_mandatory_date_assignment
22) subtype_mandatory_date_and_time_assignment
23) subtype_mandatory_document_reference
24) subtype_mandatory_group_assignment
25) subtype_mandatory_identification_assignment
26) subtype_mandatory_organization_assignment
27) subtype_mandatory_person_assignment
28) subtype_mandatory_versioned_action_request

5.2 AIM EXPRESS short listing

This clause specifies the EXPRESS schema that uses elements from the integrated resources and contains the types, entity specializations, rules, and functions that are specific to this part of ISO 10303. This clause also specifies modifications to the text for constructs that are imported from the integrated resources. The definitions and EXPRESS provided in the integrated resources for constructs used in the AIM may include select list items and subtypes that are not imported into the AIM. Requirements stated in the integrated resources that refer to select list items and subtypes apply exclusively to those items that are imported into the AIM.

EXPRESS specification:

```
*)
SCHEMA conceptual_process_design;

USE FROM action_schema -- ISO 10303-41
  (action,
   action_method,
   action_method_relationship,
```

```
   action_relationship,
   action_request_solution,
   action_resource,
   action_resource_relationship,
   versioned_action_request);

USE FROM application_context_schema -- ISO 10303-41
  (application_context,
   application_protocol_definition,
   product_context,
   product_definition_context);

USE FROM approval_schema -- ISO 10303-41
  (approval,
   approval_date_time,
   approval_person_organization);

USE FROM certification_schema -- ISO 10303-41
  (certification);

USE FROM date_time_schema -- ISO 10303-41
  (calendar_date,
   date_and_time);

USE FROM document_schema -- ISO 10303-41
  (document,
   document_relationship,
   document_usage_constraint);

USE FROM drawing_definition_schema -- ISO 10303-101
  (drawing_revision,
   drawing_revision_sequence,
   drawing_sheet_revision,
   drawing_sheet_revision_usage);

USE FROM external_reference_schema -- ISO 10303-41
  (externally_defined_item,
   external_source,
   external_source_relationship,
   pre_defined_item);

USE FROM geometry_schema -- ISO-10303-42
  (axis2_placement_2d,
   axis2_placement_3d,
   b_spline_curve_with_knots,
   bezier_curve,
   cartesian_point,
   circle,
   composite_curve,
   curve,
   direction,
   ellipse,
   geometric_representation_context,
   geometric_representation_item,
   hyperbola,
   line,
   offset_curve_2d,
   parabola,
   point,
   point_on_curve,
   polyline,
   quasi_uniform_curve,
   rational_b_spline_curve,
   trimmed_curve,
```

```
   uniform_curve);

USE FROM group_schema -- ISO 10303-41
  (group,
   group_relationship);

USE FROM management_resources_schema -- ISO 10303-41
  (action_assignment,
   action_method_assignment,
   action_request_assignment,
   approval_assignment,
   certification_assignment,
   date_assignment,
   date_and_time_assignment,
   document_reference,
   external_identification_assignment,
   group_assignment,
   identification_assignment,
   organization_assignment,
   person_assignment);

USE FROM material_property_definition_schema -- ISO 10303-45
  (material_designation,
   material_designation_characterization,
   material_property,
   property_definition_relationship);

USE FROM material_property_representation_schema -- ISO 10303-45
  (data_environment,
   material_property_representation);

USE FROM measure_schema -- ISO 10303-41
  (amount_of_substance_measure,
   amount_of_substance_measure_with_unit,
   amount_of_substance_unit,
   area_measure,
   area_measure_with_unit,
   area_unit,
   context_dependent_measure,
   context_dependent_unit,
   conversion_based_unit,
   count_measure,
   derived_unit,
   electric_current_measure,
   electric_current_measure_with_unit,
   electric_current_unit,
   global_unit_assigned_context,
   length_measure,
   length_measure_with_unit,
   length_unit,
   luminous_intensity_measure,
   luminous_intensity_measure_with_unit,
   luminous_intensity_unit,
   mass_measure,
   mass_measure_with_unit,
   mass_unit,
   named_unit,
   numeric_measure,
   parameter_value,
   positive_length_measure,
   positive_plane_angle_measure,
   positive_ratio_measure,
   ratio_measure,
   ratio_measure_with_unit,
```

```
    ratio_unit,
    si_unit,
    solid_angle_measure,
    solid_angle_measure_with_unit,
    solid_angle_unit,
    thermodynamic_temperature_measure,
    thermodynamic_temperature_measure_with_unit,
    thermodynamic_temperature_unit,
    time_measure,
    time_measure_with_unit,
    time_unit,
    volume_measure,
    volume_measure_with_unit,
    volume_unit);

USE FROM person_organization_schema -- ISO 10303-41
  (organization,
    organization_relationship,
    organizational_project,
    person,
    person_and_organization);

USE FROM presentation_appearance_schema -- ISO 10303-46
  (box_height,
    box_rotate_angle,
    box_slant_angle,
    box_width,
    context_dependent_invisibility,
    curve_style,
    curve_style_font,
    externally_defined_curve_font,
    externally_defined_hatch_style,
    externally_defined_tile_style,
    fill_area_style,
    fill_area_style_colour,
    fill_area_style_hatching,
    fill_area_style_tile_symbol_with_style,
    fill_area_style_tiles,
    marker_type,
    pre_defined_curve_font,
    presentation_style_by_context,
    point_style,
    styled_item,
    symbol_colour,
    symbol_style,
    text_style,
    text_style_for_defined_font,
    text_style_with_box_characteristics,
    text_style_with_mirror);

USE FROM presentation_definition_schema -- ISO 10303-46
  (annotation_curve_occurrence,
    annotation_fill_area,
    annotation_fill_area_occurrence,
    annotation_occurrence_relationship,
    annotation_point_occurrence,
    annotation_symbol,
    annotation_symbol_occurrence,
    annotation_text,
    annotation_text_occurrence,
    annotation_text_with_extent,
    defined_symbol,
    externally_defined_symbol,
    symbol_representation,
```

```
    symbol_representation_map,
    symbol_representation_relationship,
    symbol_target,
    text_alignment,
    text_literal,
    text_literal_with_associated_curves,
    text_literal_with_blanking_box,
    text_literal_with_delineation,
    text_literal_with_extent,
    text_string_representation);

USE FROM presentation_organization_schema -- ISO 10303-46
  (camera_model_d2,
    camera_model_d2_shape_clipping,
    graphical_transformation,
    presentation_area,
    presentation_layer_assignment,
    presentation_layer_usage,
    presentation_representation,
    presentation_representation_relationship,
    presentation_size,
    presentation_view,
    presented_item,
    presented_item_representation,
    product_data_representation_view);

USE FROM presentation_resource_schema -- ISO 10303-46
  (colour_rgb,
    externally_defined_text_font,
    font_select,
    planar_box,
    planar_extent,
    pre_defined_colour,
    pre_defined_text_font,
    presentation_scaled_placement);

USE FROM process_property_schema -- ISO 10303-49
  (action_property,
    action_property_relationship,
    action_resource_requirement,
    process_product_association,
    process_property_association,
    requirement_for_action_resource,
    resource_property,
    resource_property_relationship);

USE FROM process_property_representation_schema -- ISO 10303-49
  (action_property_representation,
    resource_property_representation);

USE FROM product_definition_schema -- ISO 10303-41
  (product,
    product_category,
    product_category_relationship,
    product_definition,
    product_definition_relationship,
    product_definition_with_associated_documents,
    product_related_product_category);

USE FROM product_property_definition_schema -- ISO 10303-41
  (characterized_object,
    characterized_object_relationship,
    product_definition_shape,
    property_definition,
```

```
   shape_aspect,
   shape_aspect_relationship);

USE FROM product_property_representation_schema -- ISO 10303-41
  (property_definition_representation,
   shape_representation);

USE FROM product_structure_schema -- ISO 10303-44
  (assembly_component_usage,
   next_assembly_usage_occurrence,
   make_from_usage_option,
   quantified_assembly_component_usage);

USE FROM qualified_measure_schema -- ISO 10303-45
  (descriptive_representation_item,
   measure_representation_item,
   qualified_representation_item,
   precision_qualifier,
   type_qualifier);

USE FROM representation_schema -- ISO 10303-43
  (compound_representation_item,
   list_representation_item,
   representation,
   representation_context,
   representation_item,
   set_representation_item);
(*
```

Note – The schemas referenced above can be found in the following parts of ISO 10303:

action_schema	ISO 10303-41
application_context_schema	ISO 10303-41
approval_schema	ISO 10303-41
configuration_management_schema	ISO 10303-44
date_time_schema	ISO 10303-41
document_schema	ISO 10303-41
effectivity_schema	ISO 10303-41
geometry_schema	ISO 10303-42
group_schema	ISO 10303-41
management_resources_schema	ISO 10303-41
measure_schema	ISO 10303-41
person_organization_schema	ISO 10303-41
process_property_schema	ISO 10303-49
process_property_representation_schema	ISO 10303-49
product_definition_schema	ISO 10303-41
product_property_definition_schema	ISO 10303-41
product_property_representation_schema	ISO 10303-41
product_structure_schema	ISO 10303-44
qualified_measure_schema	ISO 10303-45
representation_schema	ISO 10303-43

5.2.1 AIM EXPRESS short listing types

5.2.1.1 action_item

An action_item identifies a **product_definition** that is associated with an **action**.

EXPRESS specification:

```
*)
TYPE action_item = SELECT
    (product_definition);
END_TYPE;
(*
```

5.2.1.2 action_method_item

An **action_method_item** identifies an **action_resource** that is associated with an **action_method**.

EXPRESS specification:

```
*)
TYPE action_method_item = SELECT
    (action_resource,
    product);
END_TYPE;
(*
```

5.2.1.3 approved_item

An **approved_item** identifies a **document**, **measure_representation_item**, or **representation** that is associated with an **approval**.

EXPRESS specification:

```
*)
TYPE approved_item = SELECT
    (document,
    measure_representation_item,
    representation);
END_TYPE;
(*
```

5.2.1.4 associated_item

An **associated_item** identifies an **action_method**, **action_resource_requirement**, **equipment_port**, **organizational_project**, **process_port**, **product_definition**, **representation**, **representation_item**, or **stream** that may be associated with a piece of annotation that is presenting it on a schematic diagram.

EXPRESS specification:

```
*)
TYPE associated_item = SELECT
    (action_method,
     action_resource_requirement,
     equipment_port,
     organizational_project,
```

```
     process_port,
     product_definition,
     representation,
     representation_item,
     stream);
END_TYPE;
(*
```

5.2.1.5 certified_item

A **certified_item** identifies the **action** that is associated with a **certification**.

EXPRESS specification:

```
*)
TYPE certified_item = SELECT
    (action);
END_TYPE;
(*
```

5.2.1.6 classified_item

A **classified_item** identifies an **action**, **action_method**, **action_property**, **action_property_representation**, **action_resource**, **compound_representation_item**, **material_designation**, **product**, **product_definition**, **product_definition_relationship**, **property_definition**, **representation**, **representation_context**, or **shape_aspect** to which a group is assigned for the purpose of classifying it.

EXPRESS specification:

```
*)
TYPE classified_item = SELECT
    (action,
     action_method,
     action_property,
     action_property_representation,
     action_resource,
     compound_representation_item,
     material_designation,
     product,
     product_definition,
     product_definition_relationship,
     property_definition,
     representation,
     representation_context,
     shape_aspect,
     shape_aspect_relationship);
END_TYPE;
(*
```

5.2.1.7 dated_item

A **dated_item** identifies a **document** that is associated with a **date**.

EXPRESS specification:

```
*)
TYPE dated_item = SELECT
    (document);
END_TYPE;
(*
```

5.2.1.8 date_time_item

A **date_time_item** identifies a **applied_date_time_assignment**, **date_and_time**, **material_amount_-reference_time**, **plant_item_reference_time**, **process_definition_reference_time**, **process_material_-reference_time**, **process_simulation_reference_time**, or **site_reference_time** that is associated with a **date_and_time**.

EXPRESS specification:

```
*)
TYPE date_time_item = SELECT
    (applied_date_time_assignment,
     date_and_time,
     material_amount_reference_time,
     plant_item_reference_time,
     process_definition_reference_time,
     process_material_reference_time,
     process_simulation_reference_time,
     site_reference_time);
END_TYPE;
(*
```

5.2.1.9 document_reference_item

A **document_reference_item** identifies an **action**, **action_property**, **measure_representation_item**, **property_definition**, or **representation** that is associated with a **document**.

EXPRESS specification:

```
*)
TYPE document_reference_item = SELECT
    (action,
     action_method,
     action_property,
     measure_representation_item,
     property_definition,
     representation);
END_TYPE;
(*
```

5.2.1.10 equilibrium_item

An **equilibrium_item** identifies a **specific_phase** that is associated with a **group**.

EXPRESS specification:

```
*)
TYPE equilibrium_item = SELECT
    (specific_phase);
END_TYPE;
```

```
(*
```

5.2.1.11 grouped_item

A **grouped_item** identifies an **action**, **action_method**, **action_resource**, **characterized_object**, **material_designation**, **process_material**, **product**, **product_definition**, **property_definition**, **representation_context**, **representation_item** or **shape_aspect** that is associated with a **group**.

EXPRESS specification:

```
*)
TYPE grouped_item = SELECT
    (action,
     action_method,
     action_resource,
     characterized_object,
     material_designation,
     process_material,
     product,
     product_definition,
     property_definition,
     representation,
     representation_context,
     representation_item,
     shape_aspect);
END_TYPE;
(*
```

5.2.1.12 identified_item

An **identified_item** identifies a **material_amount_reference_time**, **plant_item_reference_time**, **process_definition_reference_time**, **process_material_reference_time**, **process_simulation_-reference_time**, **product**, **representation_item**, or **site_reference_time** that is associated with an **identification_assignment.**

EXPRESS specification:

```
*)
TYPE identified_item = SELECT
    (material_amount_reference_time,
     plant_item_reference_time,
     process_definition_reference_time,
     process_material_reference_time,
     process_simulation_reference_time,
     product,
     representation_item,
     site_reference_time);
END_TYPE;
(*
```

5.2.1.13 organization_item

An **organization_item** identifies an **action**, **action_resource**, **document**, **product_definition**, or **site** that is associated with an **organization**.

EXPRESS specification:

```
*)
TYPE organization_item = SELECT
    (action,
     action_resource,
     document,
     product_definition,
     site);
END_TYPE;
(*
```

5.2.1.14 person_item

A **person_item** identifies a **document** or **site** that is associated with an **person**.

EXPRESS specification:

```
*)
TYPE person_item = SELECT
    (document,
     site);
END_TYPE;
(*
```

5.2.1.15 presented_item_select

A **presented_item_select** identifies an **action_method** that is being presented on a PFD.

EXPRESS specification:

```
*)
TYPE presented_item_select = SELECT
    (action_method);
END_TYPE;
(*
```

5.2.2 AIM EXPRESS short listing entities

5.2.2.1 AIM EXPRESS short listing entity definitions

5.2.2.1.1 applied_action_assignment

An **applied_action_assignment** assigns an **action** to one or more **product_definition**s.

EXPRESS specification:

```
*)
ENTITY applied_action_assignment
  SUBTYPE OF (action_assignment);
  items : SET [1:?] OF action_item;
END_ENTITY;
(*
```

Attribute definitions:

items: the set of **product_definition**s to which the **action** is assigned.

5.2.2.1.2 applied_action_method_assignment

An **applied_action_method_assignment** assigns an **action_method** to one or more **action_resource**s.

EXPRESS specification:

```
*)
ENTITY applied_action_method_assignment
  SUBTYPE OF (action_method_assignment);
  items : SET [1:?] OF action_method_item;
END_ENTITY;
(*
```

Attribute definitions:

items: the set of **product_definition**s to which the **action_method** is assigned.

5.2.2.1.3 applied_approval_assignment

An **applied_approval_assignment** assigns an **approval** to one or more **document**s, **measure_-representation_item**s, and **representation**s.

EXPRESS specification:

```
*)
ENTITY applied_approval_assignment
  SUBTYPE OF (approval_assignment);
  items : SET [1:?] OF approved_item;
END_ENTITY;
(*
```

Attribute definitions:

items: the set of **document**s, **measure_representation_item**s, and **representation**s to which the **approval** is assigned.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **applied_approval_assignment** entity:

— subtype_mandatory_approval_assignment (see 5.2.3.19).

5.2.2.1.4 applied_certification_assignment

An **applied_certification_assignment** assigns a **certification** to one or more **action**s.

EXPRESS specification:

```
*)
ENTITY applied_certification_assignment
  SUBTYPE OF (certification_assignment);
  items : SET [1:?] OF certified_item;
END_ENTITY;
(*
```

Attribute definitions:

items: the set of **action**s to which the **certification** is assigned.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **applied_certification_-assignment** entity:

— subtype_mandatory_certification_assignment (see 5.2.3.20).

5.2.2.1.5 applied_date_assignment

An **applied_date_assignment** assigns a **date** to one or more **document**s.

EXPRESS specification:

```
*)
ENTITY applied_date_assignment
  SUBTYPE OF (date_assignment);
  items : SET [1:?] OF dated_item;
END_ENTITY;
(*
```

Attribute definitions:

items: the set of **document**s to which the **date** is assigned.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **applied_date_assignment** entity:

— subtype_mandatory_date_assignment (see 5.2.3.21).

5.2.2.1.6 applied_date_time_assignment

An **applied_date_time_assignment** assigns a **date_and_time** to one or more **applied_date_time_-assignment**s, **date_and_time**s, **material_amount_reference_time**s, **plant_item_reference_time**s, **process_definition_reference_time**s, **process_material_reference_time**s, **process_simulation_-reference_time**s, or **site_reference_time**s.

EXPRESS specification:

```
*)
ENTITY applied_date_time_assignment
  SUBTYPE OF (date_and_time_assignment);
  items : SET [1:?] OF date_time_item;
END_ENTITY;
(*
```

Attribute definitions:

items: the set of **applied_date_time_assignment**s, **date_and_time**s, **material_amount_reference_-time**s, **plant_item_reference_time**s, **process_definition_reference_time**s, **process_material_-reference_time**s, **process_simulation_reference_time**s, or **site_reference_time**s to which the **date_-and_time** is assigned.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **applied_date_time_-assignment** entity:

— subtype_mandatory_date_and_time_assignment (see 5.2.3.22).

5.2.2.1.7 applied_document_reference

An **applied_document_reference** associates a **document** with one or more **action**s, **action_property**s, **measure_representation_item**s, **property_definition**s, and **representation**s.

EXPRESS specification:

```
*)
ENTITY applied_document_reference
  SUBTYPE OF (document_reference);
  items : SET [1:?] OF document_reference_item;
END_ENTITY;
(*
```

Attribute definitions:

items: the set of **action**s, **action_property**s, **measure_representation_item**s, **property_definition**s, and **representation**s with which the **document** is associated.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **applied_document_reference** entity:

— subtype_mandatory_document_reference (see 5.2.3.23).

5.2.2.1.8 applied_group_assignment

The **applied_group_assignment** assigns one or more **action**s, **action_method**s, **action_resource**s, **characterized_object**s, **material_designation**s, **process_material**s, **product**s, **product_definition**s, **property_definition**s, **representation**s, **representation_context**s, **representation_item**s and **shape_aspect**s to a **group**.

EXPRESS specification:

```
*)
ENTITY applied_group_assignment
  SUBTYPE OF (group_assignment);
  items : SET [1:?] OF grouped_item;
END_ENTITY;
(*
```

Attribute definitions:

items: the set of **action**s, **action_method**s, **action_resource**s, **characterized_object**s, **material_designation**s, **process_material**s, **product**s, **product_definition**s, **property_definition**s, **representation**s, **representation_context**s, **representation_item**s, and **shape_aspect**s that are assigned to the **group**.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **applied_group_assignment** entity:

— subtype_mandatory_group_assignment (see 5.2.3.24).

5.2.2.1.9 applied_identification_assignment

An **applied_identification_assignment** assigns an **identification** to one or more **material_amount_reference_time**, **plant_item_reference_time**, **process_definition_reference_time**, **process_material_reference_time**, **process_simulation_reference_time**, **product**, **representation_item**, or **site_reference_time**s.

EXPRESS specification:

```
*)
ENTITY applied_identification_assignment
  SUBTYPE OF (identification_assignment);
  items : SET [1:?] OF identified_item;
 END_ENTITY;
(*
```

Attribute definitions:

items: the set of **material_amount_reference_time**s, **plant_item_reference_time**s, **process_definition_reference_time**s, **process_material_reference_time**s, **process_simulation_reference_time**s, **product**s, **representation_item**s, or **site_reference_time**s to which the **identification** is assigned.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **applied_identification_-assignment** entity:

— subtype_mandatory_identification_assignment (see 5.2.3.25).

5.2.2.1.10 applied_organization_assignment

An **applied_organization_assignment** assigns an **organization** to one or more **action**s, **action_-resource**s, **document**s, and **product_definition**s.

EXPRESS specification:

```
*)
ENTITY applied_organization_assignment
  SUBTYPE OF (organization_assignment);
  items : SET [1:?] OF organization_item;
END_ENTITY;
(*
```

Attribute definitions:

items: the set of **action**s, **action_resource**s, **document**s, and **product_definition**s to which the **organization** is assigned.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **applied_organization_-assignment** entity:

— subtype_mandatory_organization_assignment (see 5.2.3.26).

5.2.2.1.11 applied_person_assignment

An **applied_person_assignment** assigns a **person** to one or more **document**s.

EXPRESS specification:

```
*)
ENTITY applied_person_assignment
  SUBTYPE OF (person_assignment);
  items : SET [1:?] OF person_item;
END_ENTITY;
(*
```

Attribute definitions:

items: the set of **document**s to which the **person** is assigned.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **applied_person_assignment** entity:

— subtype_mandatory_person_assignment (see 5.2.3.27).

5.2.2.1.12 bin_section

A **bin_section** is a section of a solids storage bin.

EXPRESS specification:

```
*)
ENTITY bin_section
  SUBTYPE OF (product_definition);
WHERE
  WR1: SIZEOF (QUERY (pdr <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PRODUCT_DEFINITION_RELATIONSHIP.RELATED_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.SOLIDS_STORAGE_BIN' IN
       TYPEOF (pdr.relating_product_definition))) = 1;
  WR2: SIZEOF (QUERY (pd <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION.DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
       TYPEOF (pd))) = 1;
  WR3: SIZEOF (QUERY (pds <* QUERY (pd <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
       TYPEOF (pd)) |
       SIZEOF (USEDIN (pds, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION')) = 1)) = 1;
  WR4: SIZEOF (QUERY (pds <* QUERY (pd <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
       TYPEOF (pd)) |
       SIZEOF (QUERY (pdr <* USEDIN (pds, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') |
       SIZEOF (QUERY (it <* pdr.used_representation.items |
       'CONCEPTUAL_PROCESS_DESIGN.GEOMETRIC_REPRESENTATION_ITEM' IN
       TYPEOF (it))) = 2)) = 1)) = 1;
  WR5: SIZEOF (QUERY (pds <* QUERY (pd <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
       TYPEOF (pd)) |
       SIZEOF (QUERY (pdr <* USEDIN (pds, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') |
       SIZEOF (QUERY (it <* pdr.used_representation.items |
       it.name = 'upper cross section')) = 1)) = 1)) = 1;
  WR6: SIZEOF (QUERY (pds <* QUERY (pd <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
       TYPEOF (pd)) |
       SIZEOF (QUERY (pdr <* USEDIN (pds, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') |
       SIZEOF (QUERY (it <* pdr.used_representation.items |
       it.name = 'lower cross section')) = 1)) = 1)) = 1;
  WR7: SIZEOF (QUERY (pds <* QUERY (pd <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
       TYPEOF (pd)) |
```

```
        SIZEOF (QUERY (pdr <* USEDIN (pds, 'CONCEPTUAL_PROCESS_DESIGN.' +
        'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') |
        SIZEOF (QUERY (it <* pdr.used_representation.items |
        NOT (SIZEOF (TYPEOF (it) *
        ['CONCEPTUAL_PROCESS_DESIGN.POLYLINE',
        'CONCEPTUAL_PROCESS_DESIGN.CIRCLE',
        'CONCEPTUAL_PROCESS_DESIGN.ELLIPSE',
        'CONCEPTUAL_PROCESS_DESIGN.B_SPLINE_CURVE',
        'CONCEPTUAL_PROCESS_DESIGN.COMPOSITE_CURVE',
        'CONCEPTUAL_PROCESS_DESIGN.TRIMMED_CURVE']) =1))) = 0)) = 1)) = 1;
  WR8: SIZEOF (QUERY (pds <* QUERY (pd <* USEDIN (SELF,
        'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION') |
        'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
        TYPEOF (pd)) |
        SIZEOF (QUERY (pdr <* USEDIN (pds, 'CONCEPTUAL_PROCESS_DESIGN.' +
        'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') |
        SIZEOF (QUERY (cc <* QUERY (it <* pdr.used_representation.items |
        'CONCEPTUAL_PROCESS_DESIGN.COMPOSITE_CURVE' IN TYPEOF (it)) |
        NOT (SIZEOF (QUERY (seg <* cc.segments |
        SIZEOF (TYPEOF (seg) *  ['CONCEPTUAL_PROCESS_DESIGN.POLYLINE',
        'CONCEPTUAL_PROCESS_DESIGN.CIRCLE',
        'CONCEPTUAL_PROCESS_DESIGN.ELLIPSE',
        'CONCEPTUAL_PROCESS_DESIGN.B_SPLINE_CURVE',
        'CONCEPTUAL_PROCESS_DESIGN.TRIMMED_CURVE']) =1)) = 0))) = 1)) = 1))
        = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: The **bin_section** shall be related to exactly one **solids_storage_bin**.

WR2: The **bin_section** shall have exactly one **product_definition_shape**.

WR3: The **product_definition_shape** of the **bin_section** shall have exactly one **representation**.

WR4: The **representation** of the **product_definition_shape** of the **bin_section** shall contain exactly two **geometric_representation_item**s.

WR5: The **representation** of the **product_definition_shape** of the **bin_section** shall contain exactly one **representation_item** with a name attribute value of `upper cross section'.

WR6: The **representation** of the **product_definition_shape** of the **bin_section** shall contain exactly one **representation_item** with a name attribute value of `lower cross section'.

WR7: The **representation** of the **product_definition_shape** of the **bin_section** shall contain **representation_item**s that are a **polyline**, **circle**, **ellipse**, **b_spline_curve**, **composite_curve**, or **trimmed_curve**.

WR8: The **composite_curve**s in the items set of the **representation** of the **product_definition_shape** of the **bin_section** shall have segments that are either a **polyline**, **circle**, **ellipse**, **b_spline_curve**, or **trimmed_curve**.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **bin_section** entity:

— subtype_exclusive_product_definition (see 5.2.3.14).

5.2.2.1.13 boot

A **boot** is functional view of a collection of two or more cylindrical pressure vessel sections that serve the purpose of a draw-off.

EXPRESS specification:

```
*)
ENTITY boot
  SUBTYPE OF (product_definition);
WHERE
  WR1: SELF.frame_of_reference.name = 'functional occurrence';
  WR2: SIZEOF (QUERY (ca <* USEDIN (SELF.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.assigned_group.name = 'process vessel')) = 1;
  WR3: SIZEOF (QUERY (ca <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.assigned_group.name = 'boot')) = 1;
  WR4: SIZEOF (QUERY (ownership <* QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'PRODUCT_DEFINITION_RELATIONSHIP.RELATED_PRODUCT_DEFINITION') |
       pdr.name = 'boot ownership') |
       SIZEOF (QUERY (ca <* USEDIN (ownership.relating_product_definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       class_name_in_hierarchy (ca.assigned_group.name,
       'cylindrical pressure vessel section'))) = 1)) >= 2;
END_ENTITY;
(*
```

EXPRESS specification:

WR1: The **boot** shall have a **product_definition_context** identifying it as a `functional occurrence'.

WR2: The **boot** shall be a definition of a **product** that is classified as a `process vessel'.

WR3: The **boot** shall be classified as a `boot'.

WR4: The **boot** shall be related to at least two cylindrical pressure vessel sections as the boot ownership.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **boot** entity:

— subtype_exclusive_product_definition (see 5.2.3.14).

5.2.2.1.14 classification_assignment

The **classification_assignment** assigns a **group** to one or more **action**s, **action_method**s, **action_property**s, **action_property_representation**s, **action_resource**s, **compound_representation_item**s, **material_designation**s, **product**s, **product_definition**s, **product_definition_relationship**s, **property_-**

definitions, **representation**s, **representation_context**s, and **shape_aspect**s for the purpose of classifying them.

EXPRESS specification:

```
*)
ENTITY classification_assignment
  SUBTYPE OF (group_assignment);
  items : SET [1:?] OF classified_item;
END_ENTITY;
(*
```

Attribute definitions:

items: the set of **action**s, **action_method**s, **action_property**s, **action_property_representation**s, **action_resource**s, **compound_representation_item**s, **material_designation**s, **product**s, **product_definition**s, **product_definition_relationship**s, **property_definition**s, **representation**s, **representation_context**s, and **shape_aspect**s to which the **group** is assigned.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **classification_assignment** entity:

— subtype_mandatory_group_assignment (see 5.2.3.24).

5.2.2.1.15 connector_end_type_classification

A **connector_end_type_classification** is a type of **group** that classifies the end type of the connectors that are assigned to it.

EXPRESS specification:

```
*)
ENTITY connector_end_type_classification
  SUBTYPE OF (group);
END_ENTITY;
(*
```

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **connector_end_type_classification** entity:

— subtype_exclusive_group (see 5.2.3.11).

5.2.2.1.16 control_objective

A **control_objective** is a basic control goal of a **control_scheme.** The **control_objective** specifies a either a control loop or a set of control logic that is defined to achieve it, and one or more controlled variables.

EXPRESS specification:

```
*)
ENTITY control_objective
  SUBTYPE OF (action_request_solution, characterized_object);
WHERE
  WR1: 'CONCEPTUAL_PROCESS_DESIGN.CONTROL_SCHEME' IN
       TYPEOF (SELF.request);
  WR2: SIZEOF (QUERY (ca <* USEDIN (SELF.method,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.assigned_group.name IN
       ['control loop', 'control logic'])) = 1;
  WR3: SIZEOF (QUERY (pd <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION.DEFINITION') |
       pd.name = 'controlled variables')) = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: The **control_objective** shall reference a **control_scheme** as its request attribute.

WR2: The **control_objective** shall reference an **action_method** that is classified as either a `control loop' or `control logic'.

WR3: The **control_objective** shall have exactly one **property_definition** with a name of `controlled variables'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **control_objective** entity:

— subtype_exclusive_characterized_object (see 5.2.3.9).

5.2.2.1.17 control_scheme

A **control_scheme** is the intention to perform an action or group of actions that will perform basic control of a plant to permit a product or products to be manufactured.

EXPRESS specification:

```
*)
ENTITY control_scheme
  SUBTYPE OF (versioned_action_request);
WHERE
  WR1: SELF.description IN ['continuous', 'discrete'];
  WR2: SIZEOF (QUERY (ars <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'ACTION_REQUEST_SOLUTION.REQUEST') |
       'CONCEPTUAL_PROCESS_DESIGN.CONTROL_OBJECTIVE' IN
       TYPEOF (ars))) >= 1;
  WR3: (NOT (SELF.description = 'continuous')) OR
       (SIZEOF (QUERY (co <* QUERY (ars <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.ACTION_REQUEST_SOLUTION.REQUEST') |
       'CONCEPTUAL_PROCESS_DESIGN.CONTROL_OBJECTIVE' IN TYPEOF (ars)) |
       NOT (SIZEOF (QUERY (ca <* USEDIN (co.method,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
```

```
      NOT (ca.assigned_group.name = 'control loop'))) = 0))) = 0);
  WR4: (NOT (SELF.description = 'discrete')) OR
       (SIZEOF (QUERY (co <* QUERY (ars <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.ACTION_REQUEST_SOLUTION.REQUEST') |
       'CONCEPTUAL_PROCESS_DESIGN.CONTROL_OBJECTIVE' IN TYPEOF (ars)) |
       NOT (SIZEOF (QUERY (ca <* USEDIN (co.method,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       NOT (ca.assigned_group.name = 'control logic'))) = 0))) = 0);
END_ENTITY;
(*
```

Formal propositions:

WR1: The **control_scheme** shall have a description attribute value of either `continuous' or `discrete'.

WR2: The **control_scheme** shall have at least one **action_request_solution** that is a **control_objective** related to it.

WR3: If the **control_scheme** has a description attribute with a value of `continuous', it shall have only **control_objective**s related to it that reference **action_method**s that are classified as `control loop'.

WR4: If the **control_scheme** has a description attribute with a value of `discrete', it shall have only **control_objective**s related to it that reference **action_method**s that are classified as `control logic'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **control_scheme** entity:

— subtype_mandatory_versioned_action_request (see 5.2.3.28).

5.2.2.1.18 data_curve

A **data_curve** is a **representation** that contains variables used to evaluate the process design.

EXPRESS specification:

```
*)
ENTITY data_curve
  SUBTYPE OF (representation);
WHERE
  WR1: SIZEOF (QUERY (it <* SELF.items |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.' +
       'COMPOUND_REPRESENTATION_ITEM',
       'CONCEPTUAL_PROCESS_DESIGN.MAPPED_ITEM'] *
       TYPEOF (it)) = 1))) = 0;
  WR2: SIZEOF (QUERY (cri <* QUERY (it <* SELF.items |
       'CONCEPTUAL_PROCESS_DESIGN.COMPOUND_REPRESENTATION_ITEM' IN
       TYPEOF (it)) |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.LIST_REPRESENTATION_ITEM' IN
       TYPEOF (cri.item_element)))) = 0;
  WR3: SIZEOF (QUERY (cri <* QUERY (it <* SELF.items |
       'CONCEPTUAL_PROCESS_DESIGN.COMPOUND_REPRESENTATION_ITEM' IN
       TYPEOF (it)) |
       NOT (SIZEOF (QUERY (el <* cri.item_element |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.MEASURE_REPRESENTATION_ITEM' IN
       TYPEOF (el)))) = 0))) = 0;
```

```
  WR4: SIZEOF (QUERY (cri <* QUERY (it <* SELF.items |
       'CONCEPTUAL_PROCESS_DESIGN.COMPOUND_REPRESENTATION_ITEM' IN
       TYPEOF (it)) |
       NOT (SIZEOF (QUERY (el <* cri.item_element |
       NOT (SIZEOF (QUERY (vu <* QUERY (aga <* USEDIN (el,
       'CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT.ITEMS') |
       aga.role.name = 'variable usage') |
       vu.assigned_group.name IN
       ['independent', 'dependent', 'fixed'])) = 1))) = 0))) = 0;
  WR5: SIZEOF (QUERY (mi <* QUERY (it <* SELF.items |
       'CONCEPTUAL_PROCESS_DESIGN.MAPPED_ITEM' IN TYPEOF (it)) |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.DATA_CURVE' IN
       TYPEOF (mi.mapping_source.mapped_representation)))) = 0;
END_ENTITY;
(*
```

Formal propositions:

WR1: A **data_curve** shall have either **compound_representation_item**s or **mapped_item**s in its set of items.

WR2: An item_element attribute of each **compound_representation_item** in the items set of the **data_-curve** shall be a **list_representation_item**.

WR3: An item_element attribute of each **compound_representation_item** in the items set of the **data_-curve** shall be comprised of **measure_representation_item**s.

WR4: A **representation_item**s that comprise the item_element attribute of each **compound_-representation_item** in the items set of the **data_curve** shall be referenced by exactly one **applied_-group_assignment** with a role of `variable usage' and a **group** name of `independent', `dependent', or `fixed'.

WR5: A **mapped_representation** of each **mapped_item** in the items set of the **data_curve** shall be a **data_curve**.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **data_curve** entity:

— subtype_exclusive_representation (see 5.2.3.16).

5.2.2.1.19 document_with_properties

A **document_with_properties** is a **document** that is characterized by different attributes and their values.

EXPRESS specification:

```
*)
ENTITY document_with_properties
  SUBTYPE OF (document, characterized_object);
END_ENTITY;
(*
```

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **document_with_properties** entity:

— subtype_exclusive_characterized_object (see 5.2.3.9).

5.2.2.1.20 equipment_port

An **equipment_port** is a **shape_aspect** that identifies the portion of the shape of a plant item at which a connection is made.

EXPRESS specification:

```
*)
ENTITY equipment_port
  SUBTYPE OF (shape_aspect);
WHERE
  WR1: SELF.product_definitional;
  WR2: 'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION' IN
       TYPEOF (SELF.of_shape.definition);
  WR3: SIZEOF (QUERY (sar <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') |
       sar.name = 'equipment port connection')) +
       SIZEOF (QUERY (sar <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') |
       sar.name = 'equipment port connection')) <= 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: An **equipment_port** shall lie on the boundary of the plant item.

WR2: An **equipment_port** shall be an aspect of the shape of a **product_definition**.

WR3: An **equipment_port** shall be referenced by at most one **shape_aspect** in an `equipment port connection'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **equipment_port** entity:

— subtype_exclusive_shape_aspect (see 5.2.3.18).

5.2.2.1.21 event_sequence_with_condition

An **event_sequence_with_condition** is an **action_method** and **action_method_relationship** that specifies an activity, the execution of which is constrained by a conditional relationship between two other events. The condition that controls the execution of the **event_sequence_with_condition** is specified by an **action_property** that is defined for the **event_sequence_with_condition**.

```
*)
ENTITY event_sequence_with_condition
  SUBTYPE OF (action_method, action_method_relationship);
WHERE
  WR1: SIZEOF (QUERY (ap <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'ACTION_PROPERTY.DEFINITION') |
       ap.description = 'control logic condition')) = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: An **event_sequence_with_condition** shall have exactly one control logic condition.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **event_sequence_with_-condition** entity:

— subtype_exclusive_action_method (see 5.2.3.5);

— subtype_exclusive_action_method_relationship (see 5.2.3.6).

5.2.2.1.22 exchanger_zone

An **exchanger_zone** is a **shape_aspect** that is an identified area on a heat exchanger.

EXPRESS specification:

```
*)
ENTITY exchanger_zone
  SUBTYPE OF (shape_aspect);
WHERE
  WR1: ('CONCEPTUAL_PROCESS_DESIGN.HEAT_TRANSFER_EQUIPMENT' IN TYPEOF
       (SELF.of_shape.definition)) AND
       (SIZEOF (QUERY (et <* QUERY (ca <*
       USEDIN (SELF.of_shape.definition.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment type') |
       et.assigned_group.name = 'shell and tube heat exchanger unit'))
       = 1);
  WR2: SIZEOF (QUERY (pdr <* USEDIN (SELF.of_shape,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_RELATIONSHIP.RELATED_PROPERTY_DEFINITION') |
       pdr.name = 'exchanger performance')) = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: An **exchanger_zone** shall be an aspect of the shape of a **heat_transfer_equipment** that is classified as a `shell and tube heat exchanger unit'.

WR2: The shape of which the **exchanger_zone** is an aspect shall be related to exactly one **property_-definition** with a name of `exchanger performance'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **exchanger_zone** entity:

— subtype_exclusive_shape_aspect (see 5.2.3.18).

5.2.2.1.23 externally_defined_action_method

An **externally_defined_action_method** is an **action_method** and an **externally_defined_item** that specifies an **action_method** which has a source external to this Part of ISO 10303.

EXPRESS specification:

```
*)
ENTITY externally_defined_action_method
  SUBTYPE OF (action_method, externally_defined_item);
END_ENTITY;
(*
```

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **externally_defined_action_-method** entity:

— subtype_exclusive_action_method (see 5.2.3.5);

— subtype_exclusive_externally_defined_item (see 5.2.3.10).

5.2.2.1.24 externally_defined_action_resource

An **externally_defined_action_resource** is an **action_resource** and an **externally_defined_item** that specifies an **action_resource** which has a source external to this Part of ISO 10303.

EXPRESS specification:

```
*)
ENTITY externally_defined_action_resource
  SUBTYPE OF (action_resource, externally_defined_item);
END_ENTITY;
(*
```

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **externally_defined_action_-resource** entity:

— subtype_exclusive_externally_defined_item (see 5.2.3.10).

5.2.2.1.25 externally_defined_classification

An **externally_defined_classification** is a **group** and an **externally_defined_item** that specifies a grouping for product data for which there exist a set of criteria to determine membership in the group that has a source external to this Part of ISO 10303.

EXPRESS specification:

```
*)
ENTITY externally_defined_classification
  SUBTYPE OF (group, externally_defined_item);
END_ENTITY;
(*
```

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **externally_defined_-classification** entity:

— subtype_exclusive_externally_defined_item (see 5.2.3.10);

— subtype_exclusive_group (see 5.2.3.11).

5.2.2.1.26 externally_defined_group

An **externally_defined_group** is a **group** and an **externally_defined_item** that specifies a grouping for product data which has a source external to this Part of ISO 10303.

EXPRESS specification:

```
*)
ENTITY externally_defined_group
  SUBTYPE OF (group, externally_defined_item);
END_ENTITY;
(*
```

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **externally_defined_group** entity:

— subtype_exclusive_externally_defined_item (see 5.2.3.10);

— subtype_exclusive_group (see 5.2.3.11).

5.2.2.1.27 externally_defined_plant_item_definition

An **externally_defined_plant_item_definition** is a **product_definition** and an **externally_defined_-item** that specifies a plant item which has a source external to this Part of ISO 10303.

EXPRESS specification:

```
*)
ENTITY externally_defined_plant_item_definition
  SUBTYPE OF (product_definition, externally_defined_item);
END_ENTITY;
(*
```

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **externally_defined_plant_-item_definition** entity:

— subtype_exclusive_externally_defined_item (see 5.2.3.10).

5.2.2.1.28 externally_defined_plant_system

An **externally_defined_plant_system** is a **product_definition** and an **externally_defined_item** that specifies a plant system which has a source external to this Part of ISO 10303.

EXPRESS specification:

```
*)
ENTITY externally_defined_plant_system
  SUBTYPE OF (product_definition, externally_defined_item);
END_ENTITY;
(*
```

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **externally_defined_plant_-system** entity:

— subtype_exclusive_externally_defined_item (see 5.2.3.10).

5.2.2.1.29 externally_defined_representation_item

An **externally_defined_representation_item** is a **representation_item** that has its meaning defined in a source outside of this part of ISO 10303.

EXPRESS specification:

```
*)
ENTITY externally_defined_representation_item
  SUBTYPE OF (representation_item, externally_defined_item);
END_ENTITY;
(*
```

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **externally_defined_-representation_item** entity:

— subtype_exclusive_externally_defined_item (see 5.2.3.10).

5.2.2.1.30 functional_volume_service_case

A **functional_volume_service_case** is a **shape_aspect** and an **action_resource** that describes the state of a space within a plant item that performs some process function.

EXPRESS specification:

```
*)
ENTITY functional_volume_service_case
  SUBTYPE OF (shape_aspect, action_resource);
WHERE
  WR1: SIZEOF (QUERY (sar <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') |
       SIZEOF (QUERY (aga <* USEDIN (sar.relating_shape_aspect,
       'CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT.ITEMS') |
       NOT (aga.assigned_group.name = 'functional_volume'))) = 0)) = 1;
  WR2: SIZEOF (QUERY (sar <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') |
       NOT (SELF.of_shape :=: sar.relating_shape_aspect.of_shape))) = 0;
  WR3: SIZEOF (QUERY (arr <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'ACTION_RESOURCE_RELATIONSHIP.RELATED_RESOURCE') |
       arr.relating_resource.kind.name = 'material amount')) = 1;
  WR4: SIZEOF (SELF.usage) = 1;
  WR5: SIZEOF (QUERY (si <* SELF.usage |
       NOT (('CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF (si)) OR
       (SIZEOF (QUERY (aga <* USEDIN (si, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'APPLIED_GROUP_ASSIGNMENT.ITEMS') |
       NOT (aga.assigned_group.name = 'process service'))) = 0)))) = 0;
END_ENTITY;
(*
```

Formal propositions:

WR1: A **functional_volume_service_case** shall be related to exactly one **shape_aspect** that is classified as a `functional volume'.

WR2: A **functional_volume_service_case** shall be related to **shape_aspect**s that are aspects of the same shape as it.

WR3: A **functional_volume_service_case** shall be related to exactly one **action_resource** that is a `material amount'.

WR4: A **functional_volume_service_case** shall have exactly one usage.

WR5: A **functional_volume_service_case** shall have a usage that is an **action_method** that is classified as a `process service'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **functional_volume_service_case** entity:

— subtype_exclusive_action_resource (see 5.2.3.8);

— subtype_exclusive_shape_aspect (see 5.2.3.18).

5.2.2.1.31 heat_exchanger_component

A **heat_exchanger_component** is a **product_definition** that is used in the composition of a heat exchanger.

EXPRESS specification:

```
*)
ENTITY heat_exchanger_component
  SUBTYPE OF (product_definition);
WHERE
  WR1: SIZEOF (QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
       'RELATED_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
       TYPEOF (pdr))) >= 1;
  WR2: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name =  'exchanger assembly')) = 1)) OR
       (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
       'RELATING_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
       TYPEOF (pdr)) |
       ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
       (acu.related_product_definition)) AND
       (SIZEOF (QUERY (ect <* QUERY (ca <*
       USEDIN (acu.related_product_definition.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name = 'reboiler piping')) = 1))) <= 1);
  WR3: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name =  'exchanger assembly')) = 1)) OR
       (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
       'RELATING_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
       TYPEOF (pdr)) |
       ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
       (acu.related_product_definition)) AND
       (SIZEOF (QUERY (ect <* QUERY (ca <*
       USEDIN (acu.related_product_definition.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name = 'exchanger shell')) = 1))) = 1);
  WR4: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name =  'exchanger assembly')) = 1)) OR
       (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
       'RELATING_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
       TYPEOF (pdr)) |
       ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
       (acu.related_product_definition)) AND
       (SIZEOF (QUERY (ect <* QUERY (ca <*
       USEDIN (acu.related_product_definition.formation.of_product,
```

```
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger bundle')) = 1))) = 1);
  WR5: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger assembly')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (et <* QUERY (ca <*
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment type') |
      et.assigned_group.name =
      'shell and tube heat exchanger unit')) = 1))) = 1);
  WR6: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger bundle')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger assembly')) = 1))) = 1);
  WR7: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger end')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger assembly')) = 1))) = 1);
  WR8: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger nozzle')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
```

```
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger assembly')) = 1))) = 1);
 WR9: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger shell')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger assembly')) = 1))) = 1);
WR10: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'reboiler piping')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger assembly')) = 1))) = 1);
WR11: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name =  'exchanger bundle')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATING_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.related_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.related_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'passlane')) = 1))) <= 1);
WR12: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name =  'exchanger bundle')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATING_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.related_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
```

```
      USEDIN (acu.related_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'u bend support')) = 1))) <= 1);
WR13: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name =  'exchanger bundle')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATING_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.related_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.related_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'detuning plate')) = 1))) <= 1);
WR14: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'cross baffle')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger bundle')) = 1))) = 1);
 WR15: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'passlane')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger bundle')) = 1))) = 1);
WR16: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'u bend support')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
```

```
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger bundle')) = 1))) = 1);
WR17: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'detuning plate')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger bundle')) = 1))) = 1);
WR18: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'longitudinal baffle')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger bundle')) = 1))) = 1);
WR19: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'tubesheet')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger bundle')) = 1))) = 1);
WR20: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'tie rod')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
```

```
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'tubesheet')) = 1))) = 1);
WR21: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'tie rod spacer')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'tie rod')) = 1))) = 1);
WR22: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'tubesheet')) = 1)) OR
      (SIZEOF (QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (pdr.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (pdr.relating_product_definition,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'partition seal rod')) = 1))) <= 1);
WR23: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger end')) = 1)) OR
      (SIZEOF (QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATING_PRODUCT_DEFINITION') |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (pdr.related_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (pdr.related_product_definition,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'end partition plate')) = 1))) <= 1);
WR24: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name =  'exchanger nozzle')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATING_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.related_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.related_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'impingement protection')) = 1))) <= 1);
```

```
WR25: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name =  'exchanger nozzle')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATING_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.related_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.related_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'distribution belt')) = 1))) <= 1);
WR26: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name =  'exchanger nozzle')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATING_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.related_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.related_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'nozzle dome')) = 1))) = 1);
WR27: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name =  'nozzle dome')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATING_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger nozzle')) = 1))) = 1);
WR28: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name =  'impingement protection')) = 1)) OR
      (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF (pdr)) |
      ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
      (acu.relating_product_definition)) AND
      (SIZEOF (QUERY (ect <* QUERY (ca <*
      USEDIN (acu.relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
      ca.role.name = 'equipment component type') |
      ect.assigned_group.name = 'exchanger nozzle')) = 1))) = 1);
```

```
 WR29: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name =  'distribution belt')) = 1)) OR
       (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
       'RELATED_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
       TYPEOF (pdr)) |
       ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
       (acu.relating_product_definition)) AND
       (SIZEOF (QUERY (ect <* QUERY (ca <*
       USEDIN (acu.relating_product_definition.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name = 'exchanger nozzle')) = 1))) = 1);
 WR30: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name =  'external circuit component')) = 1)) OR
       (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
       'RELATED_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
       TYPEOF (pdr)) |
       ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
       (acu.relating_product_definition)) AND
       (SIZEOF (QUERY (ect <* QUERY (ca <*
       USEDIN (acu.relating_product_definition.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name = 'reboiler piping')) = 1))) = 1);
 WR31: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name =  'exchanger shell')) = 1)) OR
       (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
       'RELATING_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
       TYPEOF (pdr)) |
       ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
       (acu.relating_product_definition)) AND
       (SIZEOF (QUERY (ect <* QUERY (ca <*
       USEDIN (acu.relating_product_definition.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name = 'vapour belt')) = 1))) <= 1);
 WR32: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name =  'exchanger shell')) = 1)) OR
       (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
       'RELATING_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
       TYPEOF (pdr)) |
       ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
       (acu.relating_product_definition)) AND
       (SIZEOF (QUERY (ect <* QUERY (ca <*
       USEDIN (acu.relating_product_definition.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name = 'expansion joint')) = 1))) <= 1);
```

```
 WR33: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name =  'vapour belt')) = 1)) OR
       (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
       'RELATED_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
       TYPEOF (pdr)) |
       ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
       (acu.relating_product_definition)) AND
       (SIZEOF (QUERY (ect <* QUERY (ca <*
       USEDIN (acu.relating_product_definition.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name = 'exchanger shell')) = 1))) = 1);
 WR34: (NOT (SIZEOF (QUERY (ect <* QUERY (ca <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name =  'expansion joint')) = 1)) OR
       (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
       'RELATED_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
       TYPEOF (pdr)) |
       ('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN TYPEOF
       (acu.relating_product_definition)) AND
       (SIZEOF (QUERY (ect <* QUERY (ca <*
       USEDIN (acu.relating_product_definition.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name = 'exchanger shell')) = 1))) = 1);
END_ENTITY;
(*
```

Formal propositions:

WR1: The **heat_exchanger_component** shall be the component in at least one **assembly_component_usage**.

WR2: If the **heat_exchanger_component** is classified as an `exchanger assembly', it shall have at most one component that is a **heat_exchanger_component** that is classified as a `reboiler piping'.

WR3: If the **heat_exchanger_component** is classified as an `exchanger assembly', it shall have exactly one component that is a **heat_exchanger_component** that is classified as an `exchanger shell'.

WR4: If the **heat_exchanger_component** is classified as an `exchanger assembly', it shall have exactly one component that is a **heat_exchanger_component** that is classified as an `exchanger bundle'.

WR5: If the **heat_exchanger_component** is classified as an `exchanger assembly', it shall be a component of exactly one **heat_exchanger_component** that is classified as an `shell and tube heat exchanger unit'.

WR6: If the **heat_exchanger_component** is classified as an `exchanger bundle', it shall be a component of exactly one **heat_exchanger_component** that is classified as an `exchanger assembly'.

WR7: If the **heat_exchanger_component** is classified as an `exchanger end', it shall be a component of exactly one **heat_exchanger_component** that is classified as an `exchanger assembly'.

WR8: If the **heat_exchanger_component** is classified as an `exchanger nozzle', it shall be a component of exactly one **heat_exchanger_component** that is classified as an `exchanger assembly'.

WR9: If the **heat_exchanger_component** is classified as an `exchanger shell', it shall be a component of exactly one **heat_exchanger_component** that is classified as an `exchanger assembly'.

WR10: If the **heat_exchanger_component** is classified as a `reboiler piping', it shall be a component of exactly one **heat_exchanger_component** that is classified as an `exchanger assembly'.

WR11: If the **heat_exchanger_component** is classified as an `exchanger bundle', it shall have at most one component that is a **heat_exchanger_component** that is classified as a `passlane'.

WR12: If the **heat_exchanger_component** is classified as an `exchanger bundle', it shall have at most one component that is a **heat_exchanger_component** that is classified as a `u bend support'.

WR13: If the **heat_exchanger_component** is classified as an `exchanger bundle', it shall have at most one component that is a **heat_exchanger_component** that is classified as a `detuning plate'.

WR14: If the **heat_exchanger_component** is classified as a `cross baffle', it shall be a component of exactly one **heat_exchanger_component** that is classified as an `exchanger bundle'.

WR15: If the **heat_exchanger_component** is classified as a `passlane', it shall be a component of exactly one **heat_exchanger_component** that is classified as an `exchanger bundle'.

WR16: If the **heat_exchanger_component** is classified as a `u bend support', it shall be a component of exactly one **heat_exchanger_component** that is classified as an `exchanger bundle'.

WR17: If the **heat_exchanger_component** is classified as a `detuning plate', it shall be a component of exactly one **heat_exchanger_component** that is classified as an `exchanger bundle'.

WR18: If the **heat_exchanger_component** is classified as a `longitudinal baffle', it shall be a component of exactly one **heat_exchanger_component** that is classified as an `exchanger bundle'.

WR19: If the **heat_exchanger_component** is classified as a `tubesheet', it shall be a component of exactly one **heat_exchanger_component** that is classified as an `exchanger bundle'.

WR20: If the **heat_exchanger_component** is classified as a `tie rod', it shall be a component of exactly one **heat_exchanger_component** that is classified as a `tubesheet'.

WR21: If the **heat_exchanger_component** is classified as a `tie rod spacer', it shall be a component of exactly one **heat_exchanger_component** that is classified as a `tie rod'.

WR22: If the **heat_exchanger_component** is classified as a `tubesheet', it shall be a component of at most one **heat_exchanger_component** that is classified as a `partition seal rod'.

WR23: If the **heat_exchanger_component** is classified as an `exchanger end', it shall have at most one component that is a **heat_exchanger_component** that is classified as a `end partition plate'.

WR24: If the **heat_exchanger_component** is classified as an `exchanger nozzle', it shall have at most one component that is a **heat_exchanger_component** that is classified as a `impingement protection'.

WR25: If the **heat_exchanger_component** is classified as an `exchanger nozzle', it shall have at most one component that is a **heat_exchanger_component** that is classified as a `distribution belt'.

WR26: If the **heat_exchanger_component** is classified as an `exchanger nozzle', it shall have exactly one component that is a **heat_exchanger_component** that is classified as a `nozzle dome'.

WR27: If the **heat_exchanger_component** is classified as a `nozzle dome', it shall be a component of exactly one **heat_exchanger_component** that is classified as a `exchanger nozzle'.

WR28: If the **heat_exchanger_component** is classified as a `impingement protection', it shall be a component of exactly one **heat_exchanger_component** that is classified as a `exchanger nozzle'.

WR29: If the **heat_exchanger_component** is classified as a `distribution belt', it shall be a component of exactly one **heat_exchanger_component** that is classified as a `exchanger nozzle'.

WR30: If the **heat_exchanger_component** is classified as a `external circuit component', it shall be a component of exactly one **heat_exchanger_component** that is classified as a `reboiler piping'.

WR31: If the **heat_exchanger_component** is classified as an `exchanger shell', it shall have at most one component that is a **heat_exchanger_component** that is classified as a `vapour belt'.

WR32: If the **heat_exchanger_component** is classified as an `exchanger shell', it shall have at most one component that is a **heat_exchanger_component** that is classified as a `expansion joint'.

WR33: If the **heat_exchanger_component** is classified as a `vapour belt', it shall be a component of exactly one **heat_exchanger_component** that is classified as an `exchanger shell'.

WR34: If the **heat_exchanger_component** is classified as a `expansion joint', it shall be a component of exactly one **heat_exchanger_component** that is classified as an `exchanger shell'.

5.2.2.1.32 heat_exchanger_internal_data

The **heat_exchanger_internal_data** is a **representation** that is a collection of the data about the internal components of a heat exchanger unit operation.

EXPRESS specification:

```
*)
ENTITY heat_exchanger_internal_data
  SUBTYPE OF (representation);
WHERE
  WR1: SIZEOF (QUERY (apr <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'ACTION_PROPERTY_REPRESENTATION.REPRESENTATION') |
       ('CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN
       TYPEOF (apr.property.definition)) AND
```

```
       (SIZEOF (QUERY (ca <* USEDIN (apr.property.definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       NOT (ca.assigned_group.name = 'uo heat exchanger side'))) = 0)))
       = 1;
  WR2: SIZEOF (QUERY (rpr <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'RESOURCE_PROPERTY_REPRESENTATION.REPRESENTATION') |
       ('CONCEPTUAL_PROCESS_DESIGN.SPECIFIC_PHASE' IN
       TYPEOF (rpr.property.definition)) AND
       (rpr.property.definition.kind.name =
       'heat exchanger internal phase'))) >= 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: The **heat_exchanger_internal_data** shall represent exactly one **action_property** of an **action_-method** that is classified as a `uo heat exchanger side'.

WR2: The **heat_exchanger_internal_data** shall represent at least one **resource_property** of an **action_resource** of type `heat exchanger internal phase'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **heat_exchanger_internal_data** entity:

— subtype_exclusive_representation (see 5.2.3.16).

5.2.2.1.33 heat_transfer_equipment

A **heat_transfer_equipment** is a **product_definition** that is a kind of process equipment that is used to provide a means for liquids of different temperature to be thermally contacted to carry out the heat transfer process.

EXPRESS specification:

```
*)
ENTITY heat_transfer_equipment
  SUBTYPE OF (product_definition);
WHERE
  WR1: (NOT (SIZEOF (QUERY (et <* QUERY (ca <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment type') |
       et.assigned_group.name =
       'shell and tube heat exchanger unit')) = 1)) OR
       (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
       'RELATING_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
       TYPEOF (pdr)) |
       SIZEOF (QUERY (ect <* QUERY (ca <*
       USEDIN (acu.related_product_definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name = 'exchanger assembly')) = 1)) >= 1);
END_ENTITY;
(*
```

Formal propositions:

WR1: If the **heat_transfer_equipment** is classified as a `shell and tube heat exchanger unit', it shall have at least one **heat_exchanger_component** as a component that is classified as an `exchanger assembly'.

5.2.2.1.34 inspection_and_tests

The **inspection_and_tests** is an action that specifies the inspections and tests that are performed on a plant item by a manufacturer prior to delivery of the item.

EXPRESS specification:

```
*)
ENTITY inspection_and_tests
  SUBTYPE OF (action);
WHERE
  WR1: SIZEOF (QUERY (aaa <* QUERY (aa <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.ACTION_ASSIGNMENT.ASSIGNED_ACTION') |
       'CONCEPTUAL_PROCESS_DESIGN.APPLIED_ACTION_ASSIGNMENT' IN
       TYPEOF (aa)) |
       (SIZEOF (aaa.items) = 1) AND
       (SIZEOF (QUERY (it <* aaa.items |
       {1 <= SIZEOF (TYPEOF (it) * ['CONCEPTUAL_PROCESS_DESIGN.' +
       'PRODUCT_DEFINITION',
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'EXTERNALLY_DEFINED_PLANT_ITEM_DEFINITION',
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROCESS_DESIGN_CASE_RESOURCE']) <= 3})) = 1))) = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: An **inspection_and_tests** shall be assigned to exactly one item that is of type **product_definition**, **externally_defined_plant_item_definition**, **process_design_case_resource**, or any complex combination of the three types.

5.2.2.1.35 instrumentation_and_control_system

An **instrumentation_and_control_system** is a type of **product_definition** that identifies a system of wiring, switches, controls, and other equipment associated with monitoring and controlling performance characteristics.

EXPRESS specification:

```
*)
ENTITY instrumentation_and_control_system
  SUBTYPE OF (product_definition);
WHERE
  WR1: SIZEOF (QUERY (pdr <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PRODUCT_DEFINITION_RELATIONSHIP.RELATED_PRODUCT_DEFINITION') |
       ('CONCEPTUAL_PROCESS_DESIGN.PLANT' IN TYPEOF
       (pdr.relating_product_definition.formation.of_product)) AND
```

```
       (pdr.relating_product_definition.frame_of_reference.name =
       'functional occurrence'))) = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: An **instrumentation_and_control_system** shall be related to exactly one **product_definition** that is the definition of a plant and has a context of `functional occurrence'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **instrumentation_and_-control_system** entity:

— subtype_exclusive_product_definition (see 5.2.3.14).

5.2.2.1.36 interphase

The **interphase** is an **action_resource_relationship** that is an **action_resource** for an **action** or **action_-method** that is the boundary between two **specific_phase**s.

EXPRESS specification:

```
*)
ENTITY interphase
  SUBTYPE OF (action_resource, action_resource_relationship);
WHERE
  WR1: SELF.usage :=: SELF.relating_resource.usage;
  WR2: SELF.usage :=: SELF.related_resource.usage;
  WR3: 'CONCEPTUAL_PROCESS_DESIGN.SPECIFIC_PHASE' IN
       TYPEOF (SELF.relating_resource);
  WR4: 'CONCEPTUAL_PROCESS_DESIGN.SPECIFIC_PHASE' IN
       TYPEOF (SELF.related_resource);
  WR5: SIZEOF (QUERY (rp <* USEDIN (SELF,  'CONCEPTUAL_PROCESS_DESIGN.' +
       'RESOURCE_PROPERTY.RESOURCE') |
       SIZEOF (QUERY (rpr <* USEDIN (rp, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'RESOURCE_PROPERTY_REPRESENTATION.PROPERTY') |
       rpr.name = 'interphase thermophysical properties')) =1)) = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: An **interphase** shall reference the same **supported_item** as the relating_resource attribute.

WR2: An **interphase** shall reference the same **supported_item** as the related_resource attribute.

WR3: An **interphase** shall reference a **specific_phase** as its relating_resource attribute.

WR4: An **interphase** shall reference a **specific_phase** as its related_resource attribute.

WR5: An **interphase** shall have exactly one **resource_property** with exactly one **representation** with a name of `interphase thermophysical properties'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **interphase** entity:

— subtype_exclusive_action_resource (see 5.2.3.8).

5.2.2.1.37 intersection_description

An **intersection_description** is the descriptive representation of the fit of a boot or a nozzle on a cylindrical pressure vessel cylinder section or head section.

EXPRESS specification:

```
*)
ENTITY intersection_description
  SUBTYPE OF (representation);
WHERE
  WR1: SELF.name IN ['boot on cylinder section',
       'boot on cylinder head section',
       'nozzle on cylinder section', 'nozzle on cylinder head section'];
  WR2: SIZEOF (USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_REPRESENTATION.USED_REPRESENTATION')) = 1;
  WR3: SIZEOF (QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION_REPRESENTATION.' +
       'USED_REPRESENTATION') |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP' IN
       TYPEOF (pdr.definition.definition)))) = 0;
  WR4: (NOT (SELF.name = 'boot on cylinder section')) OR
       (SIZEOF (QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION_REPRESENTATION.' +
       'USED_REPRESENTATION') |
       (SIZEOF (QUERY (ca <*
       USEDIN (pdr.definition.definition.related_product_definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.assigned_group.name = 'boot')) = 1) AND
       (SIZEOF (QUERY (ca <*
       USEDIN (pdr.definition.definition.related_product_definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.assigned_group.name =
       'cylindrical pressure vessel cylinder section')) = 1))) = 1);
  WR5: (NOT (SELF.name = 'boot on cylinder head section')) OR
       (SIZEOF (QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION_REPRESENTATION.' +
       'USED_REPRESENTATION') |
       (SIZEOF (QUERY (ca <*
       USEDIN (pdr.definition.definition.relating_product_definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.assigned_group.name = 'boot')) = 1) AND
       (SIZEOF (QUERY (ca <*
       USEDIN (pdr.definition.definition.related_product_definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.assigned_group.name =
       'cylindrical pressure vessel head section')) = 1))) = 1);
  WR6: (NOT (SELF.name = 'nozzle on cylinder section')) OR
       (SIZEOF (QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION_REPRESENTATION.' +
       'USED_REPRESENTATION') |
       (SIZEOF (QUERY (ca <*
       USEDIN (pdr.definition.definition.relating_product_definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
```

```
       ca.assigned_group.name = 'nozzle section')) = 1) AND
       (SIZEOF (QUERY (ca <*
       USEDIN (pdr.definition.definition.related_product_definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.assigned_group.name =
       'cylindrical pressure vessel cylinder section')) = 1))) = 1);
  WR7: (NOT (SELF.name = 'nozzle on cylinder head section')) OR
       (SIZEOF (QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION_REPRESENTATION.' +
       'USED_REPRESENTATION') |
       (SIZEOF (QUERY (ca <*
       USEDIN (pdr.definition.definition.relating_product_definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.assigned_group.name = 'nozzle section')) = 1) AND
       (SIZEOF (QUERY (ca <*
       USEDIN (pdr.definition.definition.related_product_definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.assigned_group.name =
       'cylindrical pressure vessel head section')) = 1))) = 1);
END_ENTITY;
(*
```

Formal propositions:

WR1: The **intersection_description** shall have a name of `boot on cylinder section', `boot on cylinder head section', `nozzle on cylinder section', or `nozzle on cylinder head section'.

WR2: The **intersection_description** shall be used by exactly one **property_definition** representations.

WR3: The **intersection_description** shall be used to represent a **product_definition_relationship**.

WR4: If the **intersection_description** has a name of `boot on cylinder section', it shall be the representation of a **product_definition_relationship** in which the relating_product_definition is classified as a `boot', and the related_product_definition as a `cylindrical pressure vessel cylinder section'.

WR5: If the **intersection_description** has a name of `boot on cylinder head section', it shall be the representation of a **product_definition_relationship** in which the relating_product_definition is classified as a `boot', and the related_product_definition as a `cylindrical pressure vessel head section'.

WR6: If the **intersection_description** has a name of `nozzle on cylinder section', it shall be the representation of a **product_definition_relationship** in which the relating_product_definition is classified as a `nozzle section', and the related_product_definition as a `cylindrical pressure vessel cylinder section'.

WR7: If the **intersection_description** has a name of `boot on cylinder head section', it shall be the representation of a **product_definition_relationship** in which the relating_product_definition is classified as a `nozzle section', and the related_product_definition as a `cylindrical pressure vessel head section'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **intersection_description** entity:

— subtype_exclusive_representation (see 5.2.3.16).

5.2.2.1.38 known_source

A **known_source** is a type of **external_source** whose identification is standardized for all implementations of this part of ISO 10303. The purpose of the **known_source** entity data type is to identify particular sources of data that are used within the scope of this part of ISO 10303, and to associate specific data formats with the identified data sources. The following known sources of data are identified in this part of ISO 10303:

— ISO 13584 Dictionaries, conforming to the requirements of ISO 13584-42. In this Part of ISO 10303, such Dictionaries are used to hold values of names for **externally_defined_classification**s;

— ISO 13584 Parts Libraries, conforming to the requirements of ISO 13584-24. In this Part of ISO 10303, such Parts Libraries are used to hold collections of **catalogue_connector** and **externally_-defined_plant_item_definition**.

NOTE - There is no specific requirement for **known_source** in this part of ISO 10303. It is included as a general SC4 requirement to permit interfacing with the dictionaries and parts libraries noted above.

EXPRESS specification:

```
*)
ENTITY known_source
SUBTYPE OF (external_source, pre_defined_item);
WHERE
  WR1: SELF\pre_defined_item.name IN
       ['ISO 13584 Dictionary','ISO 13584 Parts Library'];
END_ENTITY;
(*
```

Formal propositions:

WR1: A name of the **known_source** inherited from the **pre_defined_item** shall be `ISO 13584 Dictionary', or `ISO 13584 Parts Library'.

Attribute value definitions:

The **known_source** shall be used as follows, based on the standard values of the name attribute.

ISO 13584 Dictionary: the **known_source** shall be a dictionary as defined in ISO 13584-42. The string value given as the item_id of an **externally_defined_item** that references this **known_source** shall conform to the requirements for a Class_BSU as defined in ISO 13584-42.

ISO 13584 Parts Library: the **known_source** shall be a parts library as defined in ISO 13584-42. The string value given as the item_id of an **externally_defined_item** that references this **known_source** shall conform to the requirements for a BSU as defined in ISO 13584-42.

5.2.2.1.39 logical_operation

A **logical_operation** is a control logic condition that combines two other control logic conditions with a logical relationship.

EXPRESS specification:

```
*)
ENTITY logical_operation
  SUBTYPE OF (action_property, action_property_relationship);
WHERE
  WR1: SELF\action_property_relationship.name IN ['AND', 'OR', 'XOR'];
  WR2: SELF\action_property.description = 'control logic condition';
  WR3: 'CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF
(SELF.definition);
  WR4: SIZEOF (QUERY (ca <* USEDIN (SELF.definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       NOT (ca.assigned_group.name = 'control logic'))) = 0;
END_ENTITY;
(*
```

Formal propositions:

WR1: The **logical_operation** shall have a **name** attribute of its **action_property_relationship** component with a value of `AND', `OR', or `XOR'. The value of `AND' shall specify an AND boolean operation between the relating_action_property and the related_action_property. The value of `OR' shall specify an OR boolean operation between the relating_action_property and the related_action_property. The value of `XOR' shall specify an exclusive OR boolean operation between the relating_action_property and the related_action_property.

WR2: The **logical_operation** shall have a description attribute of its **action_property** component that has a value of `control logic condition'.

WR3: The **logical_operation** shall be an **action_property** of an **action_method**.

WR4: The **logical_operation** shall be an **action_property** of an **action_method** that is classified as `control logic'.

5.2.2.1.40 material_amount_reference_time

A **material_amount_reference_time** is a **resource_property** that specifies a time stamp that may have specific state variables with values for a particular time dependent snapshot of the state of a material amount.

NOTES

1 - A **material_amount_reference_time** may be either an absolute time reference or a relative time reference.

2 - A **material_amount_reference_time** may have an associated date and clock time.

EXPRESS specification:

```
*)
```

```
ENTITY material_amount_reference_time
  SUBTYPE OF (resource_property);
WHERE
  WR1: SELF.description IN ['absolute', 'relative'];
  WR2: 'CONCEPTUAL_PROCESS_DESIGN.ACTION_RESOURCE' IN TYPEOF
(SELF.resource);
  WR3: SELF.resource.kind.name = 'material amount';
END_ENTITY;
(*
```

Formal propositions:

WR1: A **material_amount_reference_time** shall have a description of `absolute' or `relative'.

WR2: A **material_amount_reference_time** shall be a property of an **action_resource**.

WR3: A **material_amount_reference_time** shall be a property of an **action_resource** that has an **action_resource_type** name of `material amount'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **material_amount_reference_-time** entity:

— subtype_exclusive_resource_property (see 5.2.3.17).

5.2.2.1.41 molecular_structural_group

A **molecular_structural_group** is a portion of a molecule that has a particular chemical composition for which certain properties apply.

EXPRESS specification:

```
*)
ENTITY molecular_structural_group
  SUBTYPE OF (characterized_object);
WHERE
  WR1: SIZEOF (QUERY (pd <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION.DEFINITION') |
       NOT (SIZEOF (QUERY (pdr <* USEDIN (pd,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_RELATIONSHIP.' +
       'RELATED_PROPERTY_DEFINITION') |
       NOT (SIZEOF (QUERY (aga <* USEDIN (pdr.definition\
       product_definition.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'APPLIED_GROUP_ASSIGNMENT.ITEMS') |
       NOT (aga.assigned_group.name = 'chemical specie'))) = 0))) = 0)))
       = 0;
 WR2: (NOT (SIZEOF (USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
      'PROPERTY_DEFINITION.DEFINITION')) >=1)) OR
      (SIZEOF (QUERY (pd <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
      'PROPERTY_DEFINITION.DEFINITION') |
      NOT ((pd.name = 'structural') AND
      (SIZEOF (QUERY (pdr <* USEDIN (pd, 'CONCEPTUAL_PROCESS_DESIGN.' +
      'PROPERTY_DEFINITION_RELATIONSHIP.RELATED_PROPERTY_DEFINITION') |
      NOT (pdr.relating_property_definition.name = 'structural')))
```

```
      = 0)))) = 0);
END_ENTITY;
(*
```

Formal propositions:

WR1: A **molecular_structural_group** shall have properties that are related to only properties of a chemical_specie.

WR2: Each **property_definition** defined for a **molecular_structural_group** shall have a name of `structural', and the **property_definition** be related only to a **property_definition** with the name of `structural'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **molecular_structural_group** entity:

— subtype_exclusive_characterized_object (see 5.2.3.9).

5.2.2.1.42 nozzle

A **nozzle** is a type of **product_definition** that is used in certain plant items and that provides an opening through which material is intended to flow.

EXPRESS specification:

```
*)
ENTITY nozzle
  SUBTYPE OF (product_definition);
WHERE
  WR1: SIZEOF (QUERY (pds <* QUERY (pd <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
       TYPEOF (pd)) |
        SIZEOF (QUERY (sa <* USEDIN (pds, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'SHAPE_ASPECT.OF_SHAPE') |
       SIZEOF (QUERY (ca <* USEDIN (sa, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.assigned_group.name = 'material port')) = 1)) = 1)) = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: The **nozzle** shall have exactly one material port.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **nozzle** entity:

— subtype_exclusive_product_definition (see 5.2.3.14).

5.2.2.1.43 particle_size_distribution_values

A **particle_size_distribution_values** is the value of the particle intervals for a particle size distribution in an **action_resource** that is of kind `material amount' or `material stream'.

EXPRESS specification:

```
*)
ENTITY particle_size_distribution_values
  SUBTYPE OF (representation);
WHERE
  WR1: SIZEOF (QUERY (it <* SELF.items |
       'CONCEPTUAL_PROCESS_DESIGN.COMPOUND_REPRESENTATION_ITEM' IN
       TYPEOF (it))) = 1;
  WR2: SIZEOF (QUERY (it <* SELF.items |
       ('CONCEPTUAL_PROCESS_DESIGN.COMPOUND_REPRESENTATION_ITEM' IN
       TYPEOF (it)) AND
       (NOT ('CONCEPTUAL_PROCESS_DESIGN.LIST_REPRESENTATION_ITEM' IN
       TYPEOF (it.item_element))))) = 0;
END_ENTITY;
(*
```

Formal propositions:

WR1: A **particle_size_distribution_values** shall have exactly one **compound_representation_item** in its set of items.

WR2: A **compound_representation_item** in the items set of the **particle_size_distribution_values** shall have an item_element that is a **list_representation_item**.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **particle_size_distribution_-values** entity:

— subtype_exclusive_representation (see 5.2.3.16).

5.2.2.1.44 phase

A phase is a **group** and a **characterized_object** that is a classification according to physical state.

EXPRESS specification:

```
*)
ENTITY phase
  SUBTYPE OF (group, characterized_object);
END_ENTITY;
(*
```

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **phase** entity:

— subtype_exclusive_characterized_object (see 5.2.3.9);

— subtype_exclusive_group (see 5.2.3.11).

5.2.2.1.45 phases_in_equilibrium_group_assignment

A **phases_in_equilibrium_group_assignment** is a grouping of **specific_phase**s that exist in a state of equilibrium.

EXPRESS specification:

```
*)
ENTITY phases_in_equilibrium_group_assignment
  SUBTYPE OF (group_assignment);
  items : SET [1:?] OF equilibrium_item;
WHERE
  WR1: SELF.assigned_group.name = 'phases in equilibrium';
END_ENTITY;
(*
```

Attribute definitions:

items: the set of **specific_phase**s that are assigned to the **group**.

Formal propositions:

WR1: A **phases_in_equilibrium_group_assignment** shall have an assigned_group with a name of `phases in equilibrium'.

5.2.2.1.46 piping_connector_classification

A **piping_connector_classification** is a type of **group** that classifies the items that are assigned to it as being piping connectors.

EXPRESS specification:

```
*)
ENTITY piping_connector_classification
  SUBTYPE OF (group);
END_ENTITY;
(*
```

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **piping_connector_-classification** entity:

— subtype_exclusive_group (see 5.2.3.11).

5.2.2.1.47 plant

A **plant** is a type of **product** that identifies a process plant facility.

EXPRESS specification:

```
*)
ENTITY plant
  SUBTYPE OF (product);
WHERE
  WR1: SIZEOF (QUERY (pc <* SELF.frame_of_reference |
       pc.discipline_type = 'process plant')) = 1;
  WR2:  SIZEOF (QUERY (pdf <* USEDIN (SELF,
        'CONCEPTUAL_PROCESS_DESIGN.' +
        'PRODUCT_DEFINITION_FORMATION.OF_PRODUCT') |
        NOT (SIZEOF (QUERY (pd <* USEDIN (pdf,
        'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION.FORMATION') |
        pd.frame_of_reference.name = 'functional occurrence')) <= 1))) = 0;
END_ENTITY;
(*
```

Formal propositions:

WR1: A **plant** shall have exactly one element in its frame_of_reference that has a discipline_type of `process plant'.

WR2: A **plant** shall be related to at most one **product_definition** that has a context of `functional occurrence'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **plant** entity:

— subtype_exclusive_product (see 5.2.3.13).

5.2.2.1.48 plant_item_reference_time

A **plant_item_reference_time** is a **property_definition** that specifies a time stamp that may have specific state variables with values for a particular time dependent snapshot of the state of a process material.

NOTES

1 - A **plant_item_reference_time** may be either an absolute time reference or a relative time reference.

2 - A **plant_item_reference_time** may have an associated date and clock time.

EXPRESS specification:

```
*)
ENTITY plant_item_reference_time
  SUBTYPE OF (property_definition);
WHERE
  WR1: SELF.description IN ['absolute', 'relative'];
```

```
  WR2: 'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION' IN
       TYPEOF (SELF.definition);
END_ENTITY;
(*
```

Formal propositions:

WR1: A **plant_item_reference_time** shall have a description of `absolute' or `relative'.

WR2: A **plant_item_reference_time** shall be a property of a **product_definition**.

5.2.2.1.49 port_service_case

A **port_service_case** is a **property_definition** of an **equipment_port** that is defined for a plant item in the design case study phase of its life cycle. A **port_service_case** defines a set of data for an **equipment_port** under a particular operating condition.

EXPRESS specification:

```
*)
ENTITY port_service_case
  SUBTYPE OF (property_definition);
WHERE
  WR1: 'CONCEPTUAL_PROCESS_DESIGN.EQUIPMENT_PORT' IN
       TYPEOF (SELF.definition);
  WR2: 'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION' IN
       TYPEOF (SELF.definition.of_shape.definition);
  WR3: SELF.definition.of_shape.definition.
       frame_of_reference.life_cycle_stage
       = 'design case study';
  WR4: SIZEOF (USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION')) >= 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: A **port_service_case** shall be a property of an **equipment_port**.

WR2: A **port_service_case** shall be a property of an aspect of the shape of a **product_definition**.

WR3: A **port_service_case** shall be defined for a plant item within the life cycle stage of `design case study'.

WR4: A **port_service_case** shall have at least one representation.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **port_service_case** entity:

— subtype_exclusive_property_definition (see 5.2.3.15).

5.2.2.1.50 presentation_with_association

A **presentation_with_association** is a type of **presentation_representation** that relates an item to its presentation.

EXPRESS specification:

```
*)
ENTITY presentation_with_association
  SUBTYPE OF (presentation_representation);
WHERE
  WR1: SIZEOF(SELF\representation.items) = 1;
  WR2: SIZEOF(QUERY(pir <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'PRESENTED_ITEM_REPRESENTATION.PRESENTATION') |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.PRESENTED_ITEM_WITH_ASSOCIATION'
       IN TYPEOF(pir.item)))) = 0;
  WR3: SIZEOF (QUERY (it <* SELF.items |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.' +
       'ANNOTATION_SYMBOL_OCCURRENCE',
       'CONCEPTUAL_PROCESS_DESIGN.ANNOTATION_TEXT_OCCURRENCE',
       'CONCEPTUAL_PROCESS_DESIGN.ANNOTATION_CURVE_OCCURRENCE',
       'CONCEPTUAL_PROCESS_DESIGN.ANNOTATION_POINT_OCCURRENCE'] *
       TYPEOF (it)) = 1))) = 0;
END_ENTITY;
(*
```

Formal propositions:

WR1: Each **presentation_with_association** shall contain exactly one element in its set of items.

WR2: Each **presentation_with_association** shall be used as presentation in a **presented_item_-representation** where the item is of type **presented_item_with_association**.

WR3: Each **representation_item** in the set of items of a **presentation_with_association** shall be either a **annotation_symbol_occurrence**, **annotation_text_occurrence**, **annotation_curve_occurrence**, or **annotation_point_occurrence**.

5.2.2.1.51 presented_item_association

A **presented_item_association** is a type of **presented_item** that specifies the item that is being presented.

EXPRESS specification

```
*)
ENTITY presented_item_association
  SUBTYPE OF (presented_item);
  items : SET [1:?] OF presented_item_select;
END_ENTITY;
(*
```

Attribute definitions:

items: the set of **action_method**s that are being presented.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **presented_item_association** entity:

— subtype_exclusive_presented_item (see 5.2.3.12).

5.2.2.1.52 presented_item_with_association

A **presented_item_with_association** is a type of **presented_item** that specifies the item that is presented. The item is associated directly to the schematic elements presenting it.

EXPRESS specification:

```
*)
ENTITY presented_item_with_association
  SUBTYPE OF (presented_item);
  items : SET [1:?] OF associated_item;
WHERE
  WR1: SIZEOF (QUERY (pir <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PRESENTED_ITEM_REPRESENTATION.ITEM') |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.PRESENTATION_WITH_ASSOCIATION'
       IN TYPEOF (pir.presentation)))) = 0;
END_ENTITY;
(*
```

Formal propositions:

WR1: Each **presented_item_with_association** shall be used as item in a **presented_item_-representation** where the presentation is of type **presentation_with_association**.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **presented_item_with_-association** entity:

— subtype_exclusive_presented_item (see 5.2.3.12).

5.2.2.1.53 process_definition_reference_time

A **process_definition_reference_time** is an **action_property** that specifies a time stamp that may have specific state variables with values for a particular time dependent snapshot of the state of a material amount.

NOTES

1 - A **process_definition_reference_time** may be either an absolute time reference or a relative time reference.

2 - A **process_definition_reference_time** may have an associated date and clock time.

EXPRESS specification:

```
*)
ENTITY process_definition_reference_time
  SUBTYPE OF (action_property);
WHERE
  WR1: SELF.description IN ['absolute', 'relative'];
  WR2: 'CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF
(SELF.definition);
END_ENTITY;
(*
```

Formal propositions:

WR1: A **process_definition_reference_time** shall have a description of `absolute' or `relative'.

WR2: A **process_definition_reference_time** shall be a property of an **action_method**.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **process_definition_-reference_time** entity:

— subtype_exclusive_action_property (see 5.2.3.7).

5.2.2.1.54 process_design_case

A **process_design_case** is a **property_definition** of a plant item in the design case study phase of its life cycle. A **process_design_case** defines a set of data for a plant item under a particular operating condition.

EXPRESS specification:

```
*)
ENTITY process_design_case
  SUBTYPE OF (property_definition);
WHERE
  WR1: 'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION' IN
       TYPEOF (SELF.definition);
  WR2: SELF.definition.frame_of_reference.life_cycle_stage =
       'design case study';
  WR3: SIZEOF (USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION')) >= 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: A **process_design_case** shall be a property of an **product_definition**.

WR2: A **process_design_case** shall be defined for a plant item within the life cycle stage of `design case study'

WR3: A **process_design_case** shall have at least one representation.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **process_design_case** entity:

— subtype_exclusive_property_definition (see 5.2.3.15).

5.2.2.1.55 process_design_case_resource

A **process_design_case_resource** is an **action_resource** and a **product_definition** that is a plant item that may be used as a resource to carry out a process.

NOTE - A common use of the **process_design_case_resource** is in design trade-off studies in which different plant items are used as supporting resources to analyze their designs and capabilities to support different processes within a plant.

EXPRESS specification:

```
*)
ENTITY process_design_case_resource
  SUBTYPE OF (action_resource, product_definition);
WHERE
  WR1: SELF\product_definition.frame_of_reference.life_cycle_stage
       = 'design';
  WR2: SIZEOF (USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'REQUIREMENT_FOR_ACTION_RESOURCE.RESOURCES')) >= 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: A **process_design_case_resource** shall be defined for the `design' life cycle stage.

WR2: A **process_design_case_resource** shall be a resource for at least one **action_resource_-requirement**.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **process_design_case_resource** entity:

— subtype_exclusive_action_resource (see 5.2.3.8).

5.2.2.1.56 process_design_property_value

A **process_design_property_value** is a **representation** and an **externally_defined_item** that is an element of technical data and its possible values.

EXPRESS specification:

```
*)
ENTITY process_design_property_value
  SUBTYPE OF (representation, externally_defined_item);
END_ENTITY;
(*
```

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **process_design_property_-value** entity:

— subtype_exclusive_externally_defined_item (see 5.2.3.10);

— subtype_exclusive_representation (see 5.2.3.16).

5.2.2.1.57 process_material

A **process_material** is an **action_resource** and a **product_definition** that is the process abstraction of a material substance.

EXPRESS specification:

```
*)
ENTITY process_material
  SUBTYPE OF (action_resource, product_definition);
WHERE
  WR1: SIZEOF (QUERY (mu <* QUERY (arr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'ACTION_RESOURCE_RELATIONSHIP.RELATED_RESOURCE') |
       arr.name = 'material usage') |
       ('CONCEPTUAL_PROCESS_DESIGN.SPECIFIC_PHASE' IN
       TYPEOF (mu.relating_action_resource)) XOR
       (('CONCEPTUAL_PROCESS_DESIGN.ACTION_RESOURCE' IN
       TYPEOF (mu.relating_action_resource)) AND
       (mu.relating_action_resource.kind.name IN ['material stream',
       'material amount'])))) = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: A **process_material** shall be related to exactly one **specific_phase** or **action_resource** that has a **action_resource_type** name of `material stream' or `material amount'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **process_material** entity:

— subtype_exclusive_action_resource (see 5.2.3.8);

— subtype_exclusive_product_definition (see 5.2.3.14).

5.2.2.1.58 process_material_reference_time

A **process_material_reference_time** is a **resource_property** that specifies a time stamp that may have specific state variables with values for a particular time dependent snapshot of the state of a process material.

NOTES

1 - A **process_material_reference_time** may be either an absolute time reference or a relative time reference.

2 - A **process_material_reference_time** may have an associated date and clock time.

EXPRESS specification:

```
*)
ENTITY process_material_reference_time
  SUBTYPE OF (resource_property);
WHERE
  WR1: SELF.description IN ['absolute', 'relative'];
  WR2: 'CONCEPTUAL_PROCESS_DESIGN.PROCESS_MATERIAL' IN
       TYPEOF (SELF.resource);
END_ENTITY;
(*
```

Formal propositions:

WR1: A **process_material_reference_time** shall have a description of `absolute' or `relative'.

WR2: A **process_material_reference_time** shall be a property of an **action_resource**.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **process_material_reference_-time** entity:

— subtype_exclusive_resource_property (see 5.2.3.17).

5.2.2.1.59 process_port

A **process_port** is the logical connection point between two processes.

EXPRESS specification:

```
*)
ENTITY process_port
  SUBTYPE OF (action_resource, characterized_object);
WHERE
  WR1: SIZEOF (QUERY (usg <* SELF.usage |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF (usg))))
       = 0;
END_ENTITY;
(*
```

Formal propositions:

WR1: A **process_port** shall be used as a support resource for only **action_method**s.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **process_port** entity:

— subtype_exclusive_action_resource (see 5.2.3.8);

— subtype_exclusive_characterized_object (see 5.2.3.9).

5.2.2.1.60 process_port_connection

A **process_port_connection** is a relationship between two **process_port**s that is used by a process to specify connectivity.

EXPRESS specification:

```
*)
ENTITY process_port_connection
  SUBTYPE OF (action_resource, characterized_object_relationship);
WHERE
  WR1: ('CONCEPTUAL_PROCESS_DESIGN.PROCESS_PORT' IN
       TYPEOF(SELF.relating_object)) AND
       ('CONCEPTUAL_PROCESS_DESIGN.PROCESS_PORT' IN
       TYPEOF(SELF.related_object));
END_ENTITY;
(*
```

Formal propositions:

WR1: A **process_port_connection** shall relate two **process_port**s.

5.2.2.1.61 process_resource_plant_item

A **process_resource_plant_item** is an **action_resource** and a **product** that is a plant item exclusively designed to support a process in a plant as a resource used to carry out the process.

EXPRESS specification:

```
*)
ENTITY process_resource_plant_item
  SUBTYPE OF (action_resource, product);
WHERE
  WR1: SIZEOF (QUERY (pc <* SELF\product.frame_of_reference |
       pc.discipline_type = 'process plant')) = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: A **process_resource_plant_item** shall have exactly one **product_context** in its frame_of_-reference with a discipline_type value of 'process plant'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **process_resource_plant_item** entity:

— subtype_exclusive_action_resource (see 5.2.3.8);

— subtype_exclusive_product (see 5.2.3.13).

5.2.2.1.62 process_simulation

A **process_simulation** is an **action_method** by which a particular process or group of processes are simulated to analyze a potential process design.

EXPRESS specification:

```
*)
ENTITY process_simulation
  SUBTYPE OF (action_method);
WHERE
  WR1: SIZEOF (QUERY (amr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'ACTION_METHOD_RELATIONSHIP.RELATED_METHOD') |
       'CONCEPTUAL_PROCESS_DESIGN.SIMULATED_PROCESS_DEFINITION' IN
       TYPEOF (amr))) >= 1;
  WR2: SIZEOF (QUERY (ap <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'ACTION_PROPERTY.DEFINITION') |
       ap.description = 'thermophysical property option')) >= 1;
  WR3: (NOT (SELF.purpose = 'variable convergence block')) OR
       (SIZEOF (QUERY (ap <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'ACTION_PROPERTY.DEFINITION') |
       NOT (SIZEOF (QUERY (apr <* USEDIN
       (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'ACTION_PROPERTY_REPRESENTATION.PROPERTY') |
       apr.representation.name =
       'variable adjustment specification')) >= 1))) = 1);
END_ENTITY;
(*
```

Formal propositions:

WR1: A **process_simulation** shall be related to at least one process definition as the simulated process definition.

WR2: A **process_simulation** shall have at least one **action_property** with a name of `thermophysical property option'.

WR3: If a **process_simulation** is for the purpose of a `variable convergence block', the **process_-simulation** shall have exactly one **action_property** with at least on representation with the name of `variable adjustment specification'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **process_simulation** entity:

— subtype_exclusive_action_method (see 5.2.3.5).

5.2.2.1.63 process_simulation_reference_time

A **process_simulation_reference_time** is an **action_property** that specifies a time stamp that may have specific state variables with values for a particular time dependent snapshot of the state of a material amount.

NOTES

1 - A **process_simulation_reference_time** may be either an absolute time reference or a relative time reference.

2 - A **process_simulation_reference_time** may have an associated date and clock time.

EXPRESS specification:

```
*)
ENTITY process_simulation_reference_time
  SUBTYPE OF (action_property);
WHERE
  WR1: SELF.description IN ['absolute', 'relative'];
  WR2: 'CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN
       TYPEOF (SELF.definition);
END_ENTITY;
(*
```

Formal propositions:

WR1: A **process_simulation_reference_time** shall have a description of `absolute' or `relative'.

WR2: A **process_simulation_reference_time** shall be a property of an **action_method**.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **process_simulation_-reference_time** entity:

— subtype_exclusive_action_property (see 5.2.3.7).

5.2.2.1.64 reactor_yield

A **reactor_yield** is a **representation** that specifies the yield of the yield specified reactor unit operation for one substance in one phase.

EXPRESS specification:

```
*)
ENTITY reactor_yield
  SUBTYPE OF (representation);
WHERE
  WR1: SIZEOF (QUERY (apr <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'ACTION_PROPERTY_REPRESENTATION.REPRESENTATION') |
       ('CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN
       TYPEOF (apr.property.definition)) AND
       (SIZEOF (QUERY (ca <* USEDIN (apr.property.definition,
```

```
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       NOT (ca.assigned_group.name =
       'uo specified yield reactor'))) = 0))) = 1;
  WR2: SIZEOF (QUERY (pdr <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_REPRESENTATION.USED_REPRESENTATION') |
       ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION' IN
       TYPEOF (pdr.definition.definition)) AND
       (SIZEOF (QUERY (prpc <*
       USEDIN (pdr.definition.definition.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'PRODUCT_RELATED_PRODUCT_CATEGORY.PRODUCTS') |
       NOT (prpc.name = 'substance'))) = 0))) = 1;
  WR3: SIZEOF (QUERY (aga <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'APPLIED_GROUP_ASSIGNMENT.ITEMS') |
       'CONCEPTUAL_PROCESS_DESIGN.PHASE' IN TYPEOF (aga.assigned_group)))
       = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: A **reactor_yield** shall represent a property of exactly one specified yield reactor unit operation.

WR2: A **reactor_yield** shall represent a property of exactly one substance.

WR3: A **reactor_yield** shall apply in exactly one phase.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **reactor_yield** entity:

— subtype_exclusive_representation (see 5.2.3.16).

5.2.2.1.65 reference_state

A **reference_state** is a value of property that provides a basis measurement for comparison of other property values.

EXPRESS specification:

```
*)
ENTITY reference_state
  SUBTYPE OF (compound_representation_item);
WHERE
  WR1: 'CONCEPTUAL_PROCESS_DESIGN.SET_REPRESENTATION_ITEM' IN
       TYPEOF (SELF.item_element);
  WR2: SIZEOF (SELF.item_element) = 2;
  WR3: SIZEOF (QUERY (elem <* SELF.item_element |
       ('CONCEPTUAL_PROCESS_DESIGN.DESCRIPTIVE_REPRESENTATION_ITEM' IN
       TYPEOF (elem)) AND
       (elem.name = 'basis'))) = 1;
  WR4: SIZEOF (QUERY (elem <* SELF.item_element |
       'CONCEPTUAL_PROCESS_DESIGN.MEASURE_REPRESENTATION_ITEM' IN
       TYPEOF (elem))) = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: An item_element of the **reference_state** shall be a **set_representation_item**.

WR2: There shall be exactly two item_elements in the **reference_state**.

WR3: Exactly one item_element in a **reference_state** shall be a **descriptive_representation_item** with a name of `basis'.

WR4: Exactly one item_element in a **reference_state** shall be a **measure_representation_item**.

5.2.2.1.66 reserved_space

A **reserved_space** is a type of **shape_aspect** that identifies a space that is reserved for a plant item.

```
*)
ENTITY reserved_space
  SUBTYPE OF (shape_aspect);
WHERE
  WR1: SELF.of_shape.definition.
       frame_of_reference\application_context_element.name =
       'physical occurrence';
END_ENTITY;
(*
```

Formal propositions:

WR1: A **reserved_space** shall be an aspect of the definition of the shape of a **product_definition** with a context with the name `physical occurrence'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **reserved_space** entity:

— subtype_exclusive_shape_aspect (see 5.2.3.18).

5.2.2.1.67 separation_tower

A **separation_tower** is a type of **product_definition** that is used to perform a chemical separation of process material.

EXPRESS specification:

```
*)
ENTITY separation_tower
  SUBTYPE OF (product_definition);
WHERE
  WR1: SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'PRODUCT_DEFINITION_RELATIONSHIP.RELATING_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
       TYPEOF (pdr)) |
       SIZEOF (QUERY (ca <* USEDIN (acu.related_product_definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
```

```
       ca.assigned_group.name = 'cylindrical pressure vessel')) = 1)) >= 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: A **separation_tower** shall have at least one cylindrical pressure vessel as a component in an **assembly_component_usage** relationship.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **separation_tower** entity:

— subtype_exclusive_product_definition (see 5.2.3.14).

5.2.2.1.68 separation_tray_component_definition

A **separation_tray_component_definition** is a type of **product_definition** that is a typical item used to specify the design parameters for use in the design of one or more separation trays.

EXPRESS specification:

```
*)
ENTITY separation_tray_component_definition
  SUBTYPE OF (product_definition);
WHERE
  WR1: SELF.frame_of_reference.name = 'functional definition';
  WR2: (NOT (SELF.description IN ['separation tray baffle',
       'blinding strip', 'downcomer', 'weir', 'tray panel'])) OR
       (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'PRODUCT_DEFINITION_RELATIONSHIP.RELATED_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
       TYPEOF (pdr)) |
       (SIZEOF (QUERY (ca <* USEDIN (acu.relating_product_definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       (ca.assigned_group.name = 'separation tray') AND
       (acu.relating_product_definition.frame_of_reference.name =
       'functional definition'))) = 1))) = 1);
  WR3: (NOT (SELF.description = 'bubble cap')) OR
       (SIZEOF (QUERY (acu <* QUERY (pdr <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'PRODUCT_DEFINITION_RELATIONSHIP.RELATING_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
       TYPEOF (pdr)) |
       ('CONCEPTUAL_PROCESS_DESIGN.SEPARATION_TRAY_COMPONENT_DEFINITION' IN
       TYPEOF (acu.related_product_definition)) AND
       (acu.related_product_definition.description = 'riser'))) = 1);
  WR4: (NOT (SELF.description = 'bubble cap')) OR
       (SIZEOF (QUERY (pds <* QUERY (pd <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
       TYPEOF (pd)) |
       SIZEOF (QUERY (sa <* USEDIN (pds, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'SHAPE_ASPECT.OF_SHAPE') |
       sa.description = 'cap')) = 1)) = 1);
  WR5: (NOT (SELF.description IN ['bubble cap', 'perforation cover',
       'valve cap'])) OR
```

```
       (SIZEOF (QUERY (pds <* QUERY (pd <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
       TYPEOF (pd)) |
       SIZEOF (QUERY (sa <* USEDIN (pds, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'SHAPE_ASPECT.OF_SHAPE') |
       sa.description = 'active area')) = 1)) = 1);
END_ENTITY;
(*
```

Formal propositions:

WR1: A **separation_tray_component_definition** shall have a frame_of_reference attribute that references an **application_context_element** with a name of `functional definition'.

WR2: If the **separation_tray_component_definition** has a description of `separation tray baffle', `blinding strip', `downcomer', `weir', `tray panel' it shall be a component of exactly one separation tray.

WR3: If the **separation_tray_component_definition** has a description of `bubble cap', it shall have exactly one component that is a `riser'.

WR4: If the **separation_tray_component_definition** has a description of `bubble cap', it shall have exactly one aspect of it's shape that is the `cap'.

WR5: If the **separation_tray_component_definition** has a description of `bubble cap', `perforation cover' or `valve cap', it shall have exactly one aspect of it's shape that is the `active area'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **separation_tray_component_-definition** entity:

— subtype_exclusive_product_definition (see 5.2.3.14).

5.2.2.1.69 separation_tray_component_feature

A **separation_tray_component_feature** is a type of **shape_aspect** that describes a particular element of the shape of a separation tray based on its behavior within the separation tray.

EXPRESS specification:

```
*)
ENTITY separation_tray_component_feature
  SUBTYPE OF (shape_aspect);
WHERE
  WR1: (NOT (SELF.description IN ['downcomer apron',
       'downcomer apron section', 'downcomer disengaging panel',
       'disengaging panel opening', 'downcomer liquid flow channel',
       'escape area', 'pressure equalization channel'])) OR
       (('CONCEPTUAL_PROCESS_DESIGN.SEPARATION_TRAY_COMPONENT_DEFINITION'
       IN TYPEOF (SELF.of_shape.definition)) AND
       (SELF.of_shape.definition.description = 'downcomer'));
  WR2: (NOT (SELF.description = 'downcomer apron')) OR
       (SIZEOF (QUERY (comp <* QUERY (sar <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.' +
```

```
      'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') |
      sar.name = 'composition') |
      comp.related_shape_aspect.description =
      'downcomer apron section')) >= 1);
 WR3: (NOT (SELF.description = 'downcomer apron section')) OR
      (SIZEOF (QUERY (comp <* QUERY (sar <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.' +
      'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') |
      sar.name = 'composition') |
      comp.relating_shape_aspect.description =
      'downcomer apron')) = 1);
 WR4: (NOT (SELF.description = 'downcomer apron section')) OR
      (SIZEOF (QUERY (comp <* QUERY (sar <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.' +
      'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') |
      sar.name = 'composition') |
      comp.related_shape_aspect.description =
      'downcomer liquid flow channel')) <= 1);
 WR5: (NOT (SELF.description = 'downcomer liquid flow channel')) OR
      (SIZEOF (QUERY (comp <* QUERY (sar <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.' +
      'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') |
      sar.name = 'composition') |
      comp.relating_shape_aspect.description =
      'downcomer apron section')) = 1);
 WR6: (NOT (SELF.description = 'pressure equalization channel')) OR
      (SIZEOF (QUERY (comp <* QUERY (sar <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.' +
      'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') |
      sar.name = 'composition') |
      comp.relating_shape_aspect.description =
      'downcomer apron section')) = 1);
 WR7: (NOT (SELF.description IN ['riser', 'riser and tray panel'])) OR
      (('CONCEPTUAL_PROCESS_DESIGN.SEPARATION_TRAY_COMPONENT_DEFINITION'
      IN TYPEOF (SELF.of_shape.definition)) AND
      (SELF.of_shape.definition.description = 'bubble cap'));
 WR8: (NOT (SELF.description = 'riser')) OR
      (SIZEOF (QUERY (comp <* QUERY (sar <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.' +
      'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') |
      sar.name = 'composition') |
      comp.relating_shape_aspect.description =
      'riser and tray panel')) >= 1);
 WR9: (NOT (SELF.description = 'riser and tray panel')) OR
      (SIZEOF (QUERY (comp <* QUERY (sar <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.' +
      'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') |
      sar.name = 'composition') |
      comp.related_shape_aspect.description =
      'riser')) = 1);
WR10: (NOT (SELF.description = 'seal pan recess')) OR
      (('CONCEPTUAL_PROCESS_DESIGN.SEPARATION_TRAY_COMPONENT_DEFINITION'
      IN TYPEOF (SELF.of_shape.definition)) AND
      (SELF.of_shape.definition.description = 'seal pan'));
WR11: (NOT (SELF.description = 'tray panel and perforation')) OR
      (('CONCEPTUAL_PROCESS_DESIGN.SEPARATION_TRAY_COMPONENT_DEFINITION'
      IN TYPEOF (SELF.of_shape.definition)) AND
      (SELF.of_shape.definition.description = 'tray panel'));
WR12: (NOT (SELF.description = 'tray panel and perforation')) OR
      (SIZEOF (QUERY (comp <* QUERY (sar <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.' +
      'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') |
      sar.name = 'composition') |
      comp.related_shape_aspect.description =
```

```
       'perforation')) = 1);
 WR13: (NOT (SELF.description = 'tray panel and slot')) OR
       (('CONCEPTUAL_PROCESS_DESIGN.SEPARATION_TRAY_COMPONENT_DEFINITION'
       IN TYPEOF (SELF.of_shape.definition)) AND
       (SELF.of_shape.definition.description = 'tray panel'));
 WR14: (NOT (SELF.description = 'tray panel and slot')) OR
       (SIZEOF (QUERY (comp <* QUERY (sar <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') |
       sar.name = 'composition') |
       comp.related_shape_aspect.description =
       'tray slot')) = 1);
END_ENTITY;
(*
```

Formal propositions

WR1: If the **separation_tray_component_feature** has a description of `downcomer apron', `downcomer apron section', it shall be the an aspect of the shape of a `downcomer'.

WR2: If the **separation_tray_component_feature** has a description of `downcomer apron', it shall have at least one component that is a `downcomer apron section'.

WR3: If the **separation_tray_component_feature** has a description of `downcomer apron section', it shall be the component of exactly one `downcomer apron'.

WR4: If the **separation_tray_component_feature** has a description of `downcomer apron section', it shall have at most one component that is a `downcomer liquid flow channel'.

WR5: If the **separation_tray_component_feature** has a description of `downcomer liquid flow channel', it shall be the component of exactly one `downcomer apron section'.

WR6: If the **separation_tray_component_feature** has a description of `pressure equalization channel', it shall be the component of exactly one `downcomer apron section'.

WR7: If the **separation_tray_component_feature** has a description of `riser', `riser and tray panel', it shall be the aspect of the shape of a `bubble cap'.

WR8: If the **separation_tray_component_feature** has a description of `riser', it shall be the component of at least one `riser and tray panel'.

WR9: If the **separation_tray_component_feature** has a description of `riser and tray panel', it shall have exactly one component that is a `riser'.

WR10: If the **separation_tray_component_feature** has a description of `seal pan recess' it shall be the aspect of the shape of a `seal pan'.

WR11: If the **separation_tray_component_feature** has a description of `tray panel and perforation', it shall be the aspect of the shape of a `tray panel'.

WR12: If the **separation_tray_component_feature** has a description of `tray panel and perforation', it shall have exactly one component that is a `perforation'.

WR13: If the **separation_tray_component_feature** has a description of `tray panel and slot', it shall be the aspect of the shape of a `tray panel'.

WR14: If the **separation_tray_component_feature** has a description of `tray panel and slot', it shall have exactly one component that is a `tray slot'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **separation_tray_component_-feature** entity:

— subtype_exclusive_shape_aspect (see 5.2.3.18).

5.2.2.1.70 separation_tray_component_feature_definition

A **separation_tray_component_feature_definition** is a **shape_aspect** that is reusable to describe an element of the shape of a component of a separation tray.

EXPRESS specification:

```
*)
ENTITY separation_tray_component_feature_definition
  SUBTYPE OF (shape_aspect);
WHERE
  WR1: 'CONCEPTUAL_PROCESS_DESIGN.CHARACTERIZED_OBJECT' IN
       TYPEOF (SELF.of_shape.definition);
  WR2: SELF.of_shape.definition.name = 'feature definition';
  WR3: SELF.description IN ['tray slot', 'pattern', 'perforation',
       'perimeter', 'perimeter segment'];
  WR4: (NOT (SELF.description = 'perimeter')) OR
       (SIZEOF (QUERY (comp <* QUERY (sar <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') |
       sar.name = 'composition') |
       ('CONCEPTUAL_PROCESS_DESIGN.' +
       'SEPARATION_TRAY_COMPONENT_FEATURE_DEFINITION' IN
       TYPEOF (comp.related_shape_aspect)) AND
       (comp.related_shape_aspect.description = 'perimeter segment')))
       >= 1);
  WR5: (NOT (SELF.description = 'perimeter segment')) OR
       (SIZEOF (QUERY (comp <* QUERY (sar <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') |
       sar.name = 'composition') |
       ('CONCEPTUAL_PROCESS_DESIGN.' +
       'SEPARATION_TRAY_COMPONENT_FEATURE_DEFINITION' IN
       TYPEOF (comp.relating_shape_aspect)) AND
       (comp.relating_shape_aspect.description = 'perimeter'))) = 1);
  WR6: (NOT (SELF.description = 'perimeter segment')) OR
       (SIZEOF (QUERY (pdr <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') |
       SIZEOF (QUERY (it <* pdr.used_representation.items |
       'CONCEPTUAL_PROCESS_DESIGN.CURVE' IN TYPEOF (it))) = 1)) = 1);
  WR7: (NOT (SELF.description = 'tray slot')) OR
       (SIZEOF (QUERY (sar <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') |
       (sar.name = 'slot opening') AND
       ('CONCEPTUAL_PROCESS_DESIGN.' +
```

```
       'SEPARATION_TRAY_COMPONENT_FEATURE_DEFINITION' IN
       TYPEOF (sar.relating_shape_aspect)) AND
       (sar.relating_shape_aspect.description = 'perimeter'))) <= 1);
  WR8: (NOT (SELF.description = 'tray slot')) OR
       (SIZEOF (QUERY (sar <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') |
       (sar.name = 'horizontal projection') AND
       ('CONCEPTUAL_PROCESS_DESIGN.' +
       'SEPARATION_TRAY_COMPONENT_FEATURE_DEFINITION' IN
       TYPEOF (sar.relating_shape_aspect)) AND
       (sar.relating_shape_aspect.description = 'perimeter'))) <= 1);
  WR9: (NOT (SELF.description = 'pattern')) OR
       (SIZEOF (QUERY (sar <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') |
       (sar.name = 'composition') AND
       ('CONCEPTUAL_PROCESS_DESIGN.' +
       'SEPARATION_TRAY_COMPONENT_FEATURE_DEFINITION' IN
       TYPEOF (sar.relating_shape_aspect)) AND
       (sar.relating_shape_aspect.description = 'perforation'))) >= 1);
END_ENTITY;
(*
```

Formal propositions:

WR1: A **separation_tray_component_feature_definition** shall be an aspect of the shape of a **characterized_object**.

WR2: The description attribute of the **characterized_object** of which the **separation_tray_-component_feature_definition** is an aspect shall be `feature definition'.

WR3: A **separation_tray_component_feature_definition** shall have a description of `tray slot', `pattern', `perforation', `perimeter', or `perimeter segment'.

WR4: A **separation_tray_component_feature_definition** with a description of `perimeter' shall be composed of at least one **separation_tray_component_feature_definition** with a description of `perimeter segment'.

WR5: A **separation_tray_component_feature_definition** with a description of `perimeter segment' shall compose exactly one **separation_tray_component_feature_definition** with a description of `perimeter'.

WR6: A **separation_tray_component_feature_definition** with a description of `perimeter segment' shall be represented by exactly one **representation** with exactly one **curve** in its items set.

WR7: A **separation_tray_component_feature_definition** with a description of `tray slot' shall relate at most one **separation_tray_component_feature_definition** with a description of `perimeter' as the `slot opening'.

WR8: A **separation_tray_component_feature_definition** with a description of `tray slot' shall relate at most one **separation_tray_component_feature_definition** with a description of `perimeter' as the `horizontal projection'.

WR9: A **separation_tray_component_feature_definition** with a description of `pattern' shall relate at most one **separation_tray_component_feature_definition** with a description of `perforation' as its `composition'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **separation_tray_component_-feature_definition** entity:

— subtype_exclusive_shape_aspect (see 5.2.3.18).

5.2.2.1.71 simulated_process_definition

A **simulated_process_definition** is an **action_method_relationship** that relates a **process_simulation** to the **action_method** that is simulating.

EXPRESS specification:

```
*)
ENTITY simulated_process_definition
  SUBTYPE OF (action_method_relationship);
WHERE
  WR1: 'CONCEPTUAL_PROCESS_DESIGN.PROCESS_SIMULATION' IN
       TYPEOF (SELF.related_method);
END_ENTITY;
(*
```

Formal propositions:

WR1: A **simulated_process_definition** shall specify a **process_simulation** as the related_action_-method.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **simulated_process_definition** entity:

— subtype_exclusive_action_method_relationship (see 5.2.3.6).

5.2.2.1.72 site

A **site** is a type of **characterized_object** and **property_definition** that identifies the geographic and topographic characteristics of the location of a plant.

EXPRESS specification:

```
*)
ENTITY site
  SUBTYPE OF (characterized_object, property_definition);
WHERE
  WR1: 'CONCEPTUAL_PROCESS_DESIGN.PLANT' IN
       TYPEOF (SELF\property_definition.definition\product_definition.
       formation.of_product);
```

```
END_ENTITY;
(*
```

Formal propositions:

WR1: Each **site** shall be a property of a **plant**.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **site** entity:

— subtype_exclusive_characterized_object (see 5.2.3.9).

5.2.2.1.73 site_reference_time

A **site_reference_time** is a **property_definition** that specifies a time stamp that may have specific state variables with values for a particular time dependent snapshot of the state of a process material.

NOTES

1 - A **site_reference_time** may be either an absolute time reference or a relative time reference.

2 - A **site_reference_time** may have an associated date and clock time.

EXPRESS specification:

```
*)
ENTITY site_reference_time
  SUBTYPE OF (property_definition);
WHERE
  WR1: SELF.description IN ['absolute', 'relative'];
  WR2: 'CONCEPTUAL_PROCESS_DESIGN.SITE' IN TYPEOF (SELF.definition);
END_ENTITY;
(*
```

Formal propositions:

WR1: A **site_reference_time** shall have a description of `absolute' or `relative'.

WR2: A **site_reference_time** shall be a property of a **site**.

5.2.2.1.74 sited_plant

A **sited_plant** is a **property_definition** that specifies the location of a plant on a site.

EXPRESS specification:

```
*)
ENTITY sited_plant
  SUBTYPE OF (property_definition);
UNIQUE
  UR1: SELF\property_definition.definition;
WHERE
```

```
  WR1: 'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION' IN TYPEOF
       (SELF.definition);
  WR2: SELF.definition.frame_of_reference.name = 'physical occurrence';
END_ENTITY;
(*
```

Formal propositions:

WR1: A **sited_plant** shall be a property of a **product_definition**.

WR2: A **sited_plant** shall be a property of a physical occurrence.

5.2.2.1.75 site_standard_condition

A **site_standard_condition** is a **property_definition** that specifies the legally accepted values for temperature and pressure for custody transfer of volumetric liquids and gasses on a volumetric basis.

EXPRESS specification:

```
*)
ENTITY site_standard_condition
  SUBTYPE OF (property_definition);
WHERE
  WR1: 'CONCEPTUAL_PROCESS_DESIGN.SITE' IN TYPEOF (SELF.definition);
END_ENTITY;
(*
```

Formal propositions:

WR1: A **site_standard_condition** shall be a property of a **site**.

5.2.2.1.76 solids_storage_bin

A **solids_storage_bin** is a type of **product_definition** that is used primarily for the storage of solid material.

EXPRESS specification:

```
*)
ENTITY solids_storage_bin
  SUBTYPE OF (product_definition);
WHERE
  WR1: SIZEOF (QUERY (pdr <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PRODUCT_DEFINITION_RELATIONSHIP.RELATING_PRODUCT_DEFINITION') |
       'CONCEPTUAL_PROCESS_DESIGN.BIN_SECTION' IN
       TYPEOF (pdr.related_product_definition))) >= 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: The **solids_storage_bin** shall relate to at least one **bin_section**.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **solids_storage_bin** entity:

— subtype_exclusive_product_definition (see 5.2.3.14).

5.2.2.1.77 specific_equation

A **specific_equation** is a **representation** in which tabular property data for one or more substances is collected.

EXPRESS specification:

```
*)
ENTITY specific_equation
  SUBTYPE OF (representation);
WHERE
  WR1: SIZEOF (QUERY (it <* SELF.items |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.COMPOUND_REPRESENTATION_ITEM' IN
       TYPEOF (it)))) = 0;
  WR2: SIZEOF (QUERY (cpr <* QUERY (it <* SELF.items |
       'CONCEPTUAL_PROCESS_DESIGN.COMPOUND_REPRESENTATION_ITEM' IN
       TYPEOF (it)) |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.SET_REPRESENTATION_ITEM' IN
       TYPEOF (cpr.item_element)))) = 0;
  WR3: SIZEOF (QUERY (it <* SELF.items |
       NOT (SIZEOF (QUERY (aga <* USEDIN (it,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'APPLIED_GROUP_ASSIGNMENT.ITEMS') |
       aga.role.name = 'specific equation parameter type')) = 1))) = 0;
  WR4: SIZEOF (QUERY (it <* SELF.items |
       NOT (SIZEOF (QUERY (spt <* QUERY (aga <* USEDIN (it,
       'CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT.ITEMS') |
       aga.role.name = 'specific equation parameter type') |
       (spt.assigned_group.name IN
       ['coefficient', 'substance property', 'binary parameter']) AND
       (spt.assigned_group.description = 'parameter type'))) = 1))) = 0;
  WR5: SIZEOF (QUERY (it <* SELF.items |
       NOT ((NOT (SIZEOF (QUERY (spt <* QUERY (aga <* USEDIN (it,
       'CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT.ITEMS') |
       aga.role.name = 'specific equation parameter type') |
       spt.assigned_group.name IN
       ['coefficient', 'substance property'])) = 1)) OR
       (SIZEOF (QUERY (elem <*
       it\compound_representation_item.item_element |
       NOT (SIZEOF (QUERY (pdr <* USEDIN (elem,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'ITEM_IDENTIFIED_REPRESENTATION_USAGE.IDENTIFIED_ITEM') |
       SIZEOF (QUERY (aga <* USEDIN (pdr.definition.definition\
       product_definition.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'APPLIED_GROUP_ASSIGNMENT.ITEMS') |
       aga.assigned_group.name = 'chemical component'))
       = 1)) = 1))) = 0)))) = 0;
  WR6: SIZEOF (QUERY (it <* SELF.items |
       NOT ((NOT (SIZEOF (QUERY (spt <* QUERY (aga <* USEDIN (it,
       'CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT.ITEMS') |
       aga.role.name = 'specific equation parameter type') |
       spt.assigned_group.name = 'binary parameter')) = 1)) OR
       (SIZEOF (QUERY (elem <*
```

```
       it\compound_representation_item.item_element |
       NOT (SIZEOF (QUERY (pdr <* USEDIN (elem,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'ITEM_IDENTIFIED_REPRESENTATION_USAGE.IDENTIFIED_ITEM') |
       SIZEOF (QUERY (aga <* USEDIN (pdr.definition.definition\
       product_definition.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'APPLIED_GROUP_ASSIGNMENT.ITEMS') |
       aga.assigned_group.name = 'chemical component'))
       = 1)) = 2))) = 0)))) = 0;
END_ENTITY;
(*
```

Formal propositions:

WR1: Every **representation_item** in the set of items of a **specific_equation** shall be a **compound_-representation_item**.

WR2: Every item_element in each **compound_representation_item** of a **specific_equation** shall be a **set_representation_item**.

WR3: Every **representation_item** in the set of items of a **specific_equation** shall be referenced by exactly one **group** with a role of `specific equation parameter type'.

WR4: Every **representation_item** in the set of items of a **specific_equation** shall be classified as either a `coefficient', `substance property', or `binary parameter' as a `parameter type'.

WR5: If the **compound_representation_item** in the set of items of a **specific_equation** is classified as a `coefficient' or `substance property', every element in the item_element set shall be related to exactly one chemical component.

WR6: If the **compound_representation_item** in the set of items of a **specific_equation** is classified as a `binary parameter', every element in the item_element set shall be related to exactly two chemical components.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **specific_equation** entity:

— subtype_exclusive_representation (see 5.2.3.16).

5.2.2.1.78 specific_phase

A **specific_phase** is an **action_resource** that is a single logical or physical phase of a mixture at a given condition.

EXPRESS specification:

```
*)
ENTITY specific_phase
  SUBTYPE OF (action_resource);
WHERE
  WR1: SELF.kind.name IN ['material stream phase', 'material amount phase',
```

```
      'internal stream phase', 'distillation stage phase',
      'heat exchanger internal phase'];
  WR2: SIZEOF (QUERY (aga <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
      'APPLIED_GROUP_ASSIGNMENT.ITEMS') |
      (aga.role.name = 'phase type') AND
      (aga.assigned_group.name IN ['physical', 'logical']))) = 1;
  WR3: SIZEOF (QUERY (aga <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
      'APPLIED_GROUP_ASSIGNMENT.ITEMS') |
      'CONCEPTUAL_PROCESS_DESIGN.PHASE' IN
      TYPEOF (aga.assigned_group))) <= 1;
  WR4: (NOT (SELF.kind.name = 'material amount phase')) OR
      (SIZEOF (QUERY (pos <* QUERY (arr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.' +
      'ACTION_RESOURCE_RELATIONSHIP.RELATED_RESOURCE') |
      arr.name = 'specific phase possession') |
      pos.relating_action_resource.kind.name = 'material amount')) = 1);
  WR5: (NOT (SELF.kind.name = 'material stream phase')) OR
      (SIZEOF (QUERY (pos <* QUERY (arr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.' +
      'ACTION_RESOURCE_RELATIONSHIP.RELATED_RESOURCE') |
      arr.name = 'specific phase possession') |
      pos.relating_action_resource.kind.name = 'material stream')) = 1);
  WR6: (NOT (SELF.kind.name IN ['internal stream phase',
      'distillation stage phase', 'heat exchanger internal phase'])) OR
      (SIZEOF (QUERY (pos <* QUERY (arr <* USEDIN (SELF,
      'CONCEPTUAL_PROCESS_DESIGN.' +
      'ACTION_RESOURCE_RELATIONSHIP.RELATED_RESOURCE') |
      arr.name = 'specific phase possession') |
      'CONCEPTUAL_PROCESS_DESIGN.STREAM' IN
      TYPEOF (pos.relating_action_resource))) = 1);
  WR7: SIZEOF (QUERY (rp <* USEDIN (SELF,  'CONCEPTUAL_PROCESS_DESIGN.' +
      'RESOURCE_PROPERTY.RESOURCE') |
      NOT (SIZEOF (QUERY (rpr <* USEDIN (rp,
      'CONCEPTUAL_PROCESS_DESIGN.' +
      'RESOURCE_PROPERTY_REPRESENTATION.PROPERTY') |
      NOT (SIZEOF (QUERY (pdr <* USEDIN (rpr.representation,
      'CONCEPTUAL_PROCESS_DESIGN.' +
      'PROPERTY_DEFINITION_REPRESENTATION.USED_REPRESENTATION') |
      NOT (SIZEOF (QUERY (denv <* USEDIN (pdr,
      'CONCEPTUAL_PROCESS_DESIGN.' +
      'DATA_ENVIRONMENT.ELEMENTS') |
      'CONCEPTUAL_PROCESS_DESIGN.THERMODYNAMIC_CONDITION' IN
      TYPEOF (denv))) = 1))) = 0))) = 0))) = 0;
END_ENTITY;
(*
```

Formal propositions:

WR1: A **specific_phase** shall have a resource_type name of either `material stream phase', `material amount phase', `internal stream phase', `distillation stage phase', or `heat exchanger internal phase'.

WR2: A **specific_phase** shall be referenced by exactly one **applied_group_assignment** in the role of `phase type' with a **group** name of `physical' or `logical'.

WR3: A **specific_phase** shall be associated with at most one **phase**.

WR4: If the **specific_phase** has a kind of `material amount phase', it shall be related to exactly one **action_resource** that has a kind of `material amount' as the `specific phase possession'.

WR5: If the **specific_phase** has a kind of `material stream phase', it shall be related to exactly one **action_resource** that has a kind of `material stream' as the `specific phase possession'.

WR6: If the **specific_phase** has a kind of `internal stream phase', `distillation stage phase', or `heat exchanger internal phase', it shall be related to exactly one **stream** as the `specific phase possession'.

WR7: A **specific_phase** shall have exactly one **thermodynamic_condition**.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **specific_phase** entity:

— subtype_exclusive_action_resource (see 5.2.3.8).

5.2.2.1.79 stage_column_section

A **stage_column_section** is a group of unit operation distillation stages that have some common or average properties across a section.

EXPRESS specification:

```
*)
ENTITY stage_column_section
  SUBTYPE OF (group, characterized_object);
WHERE
  WR1: SIZEOF (QUERY (aga <* QUERY (ag <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.GROUP_ASSIGNMENT.ASSIGNED_GROUP') |
       'CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT' IN
       TYPEOF (ag)) |
       NOT (SIZEOF (QUERY (it <* aga.items |
       ('CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF (it)) AND
       (NOT (SIZEOF (QUERY (ca <* USEDIN (it,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'CLASSIFICATION_ASSIGNMENT.ITEMS') |
       NOT (ca.assigned_group.name IN
       ['uo distillation stage', 'uo distillation'])))  = 0)))) = 0))) = 0;
  WR2: SIZEOF (QUERY (aga <* QUERY (ag <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.GROUP_ASSIGNMENT.ASSIGNED_GROUP') |
       'CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT' IN
       TYPEOF (ag)) |
       SIZEOF (QUERY (it <* aga.items |
       ('CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF (it)) AND
       (SIZEOF (QUERY (ca <* USEDIN (it, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.assigned_group.name = 'uo distillation')) = 1))) = 1)) = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: The **stage_column_section** shall be related to only **action_method**s that are classified as either `uo distillation stage' or `uo distillation'.

WR2: The **stage_column_section** shall have exactly one **applied_group_assignment** containing exactly one **action_method** in its set of items that is classified as a `uo distillation'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **stage_column_section** entity:

— subtype_exclusive_characterized_object (see 5.2.3.9);

— subtype_exclusive_group (see 5.2.3.11).

5.2.2.1.80 stream

A **stream** is an **action_resource** and a **characterized_object** that is a flow past a point.

EXPRESS specification:

```
*)
ENTITY stream
  SUBTYPE OF (action_resource, characterized_object);
END_ENTITY;
(*
```

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **stream** entity:

— subtype_exclusive_action_resource (see 5.2.3.8);

— subtype_exclusive_characterized_object (see 5.2.3.9).

5.2.2.1.81 stream_reference_time

A **stream_reference_time** is a **resource_property** that specifies a time stamp that may have specific state variables with values for a particular time dependent snapshot of the state of a material amount.

NOTES

1 - A **stream_reference_time** may be either an absolute time reference or a relative time reference.

2 - A **stream_reference_time** may have an associated date and clock time.

EXPRESS specification:

```
*)
ENTITY stream_reference_time
  SUBTYPE OF (resource_property);
WHERE
  WR1: SELF.description IN ['absolute', 'relative'];
  WR2: 'CONCEPTUAL_PROCESS_DESIGN.STREAM' IN TYPEOF (SELF.resource);
END_ENTITY;
(*
```

Formal propositions:

WR1: A **stream_reference_time** shall have a description of `absolute' or `relative'.

WR2: A **stream_reference_time** shall be a property of a **stream**.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **stream_reference_time** entity:

— subtype_exclusive_resource_property (see 5.2.3.17).

5.2.2.1.82 stream_separation_specification

A **stream_separation_specification** is a **representation** that collects the data to specify the separation of the substance splitter unit operation for one substance.

EXPRESS specification:

```
*)
ENTITY stream_separation_specification
  SUBTYPE OF (representation);
WHERE
  WR1: SIZEOF (QUERY (apr <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'ACTION_PROPERTY_REPRESENTATION.REPRESENTATION') |
       ('CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN
       TYPEOF (apr.property.definition)) AND
       (SIZEOF (QUERY (ca <* USEDIN (apr.property.definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       NOT (ca.assigned_group.name =
       'uo substance splitter'))) = 0))) = 1;
  WR2: SIZEOF (QUERY (pdr <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_REPRESENTATION.USED_REPRESENTATION') |
       ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION' IN
       TYPEOF (pdr.definition.definition)) AND
       (SIZEOF (QUERY (prpc <*
       USEDIN (pdr.definition.definition.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'PRODUCT_RELATED_PRODUCT_CATEGORY.PRODUCTS') |
       NOT (prpc.name = 'substance'))) = 0))) = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: A stream_separation_specification shall represent a property of exactly one uo substance splitter unit operation.

WR2: A stream_separation_specification shall represent a property of exactly one substance.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **stream_separation_-specification** entity:

— subtype_exclusive_representation (see 5.2.3.16).

5.2.2.1.83 stream_split_specification

A **stream_split_specification** is a **representation** that collects the data to specify the split of an inlet stream of the stream split unit operation for one outlet material stream.

EXPRESS specification:

```
*)
ENTITY stream_split_specification
  SUBTYPE OF (representation);
WHERE
  WR1: SIZEOF (QUERY (apr <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'ACTION_PROPERTY_REPRESENTATION.REPRESENTATION') |
       ('CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN
       TYPEOF (apr.property.definition)) AND
       (SIZEOF (QUERY (ca <* USEDIN (apr.property.definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       NOT (ca.assigned_group.name =
       'uo stream splitter'))) = 0))) = 1;
  WR2: SIZEOF (QUERY (rpr <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'RESOURCE_PROPERTY_REPRESENTATION.REPRESENTATION') |
       (rpr.property.name = 'outlet specification') AND
       ('CONCEPTUAL_PROCESS_DESIGN.ACTION_RESOURCE' IN
       TYPEOF (rpr.property.definition)) AND
       (rpr.property.definition.kind.name = 'material stream'))) = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: A stream_split_specification shall represent a property of exactly one uo stream splitter unit operation.

WR2: A stream_split_specification shall represent a property with name of `outlet specification' of exactly one material stream.

5.2.2.1.84 thermodynamic_condition

A **thermodynamic_condition** establishes the temperature, pressure, or enthalpy values for which all property data is valid for a material amount, material stream, specific phase or material cost.

EXPRESS specification:

```
*)
ENTITY thermodynamic_condition
  SUBTYPE OF (data_environment);
WHERE
  WR1: SIZEOF (SELF.elements) = 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: A **thermodynamic_condition** shall have exactly one element.

5.2.2.1.85 thermophysical_property_classification

A **thermophysical_property_classification** is a **group** that classifies thermophysical property values according to their type.

EXPRESS specification:

```
*)
ENTITY thermophysical_property_classification
  SUBTYPE OF (group);
WHERE
  WR1: SELF.name IN ['bulk thermodynamic', 'bulk vapor liquid equilibrium',
       'transport', 'density', 'thermodynamic', 'component in mixture',
       'excess'];
  WR2: SIZEOF (QUERY (ga <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'GROUP_ASSIGNMENT.ASSIGNED_GROUP') |
       NOT (ga.role.name = 'property class'))) = 0;
  WR3: SIZEOF (QUERY (aga <* QUERY (ga <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.GROUP_ASSIGNMENT.ASSIGNED_GROUP') |
       'CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT' IN
       TYPEOF (ga)) |
       NOT (SIZEOF (QUERY (it <* aga.items |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.REPRESENTATION_ITEM' IN
       TYPEOF (it)))) = 0))) = 0;
  WR4: SIZEOF (QUERY (aga <* QUERY (ga <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.GROUP_ASSIGNMENT.ASSIGNED_GROUP') |
       'CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT' IN
       TYPEOF (ga)) |
       NOT (SIZEOF (QUERY (ri <* QUERY (it <* aga.items |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.REPRESENTATION_ITEM' IN
       TYPEOF (it))) |
       NOT (SIZEOF (QUERY (rep <* USEDIN (ri,
       'CONCEPTUAL_PROCESS_DESIGN.REPRESENTATION.ITEMS') |
       NOT (rep.name IN ['bulk thermophysical properties',
       'single phase thermophysical properties'])))  = 0))) = 0))) = 0;
END_ENTITY;
(*
```

WR1: The name of the **thermophysical_property_classification** shall be `bulk thermodynamic', `bulk vapor liquid equilibrium', `transport', `density', `thermodynamic', `component in mixture', or `excess'

WR2: A **thermophysical_property_classification** shall be assigned by a **group_assignment**s with a role of `property class'.

WR3: A **thermophysical_property_classification** shall be assigned by **applied_group_assignment**s in which the items are **representation_item**s

WR4: A **representation_item**s in the set of items of the **applied_group_assignment**s that assign the **thermophysical_property_classification** shall be items in a **representation** with a name of `bulk thermophysical properties' or `single phase thermophysical properties'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **thermophysical_property_-classification** entity:

— subtype_exclusive_group (see 5.2.3.11).

5.2.2.1.86 trigger

A **trigger** is an **action_property** that is used as a control logic condition. It specifies an **action_method** that is the process definition and the property is a state of the **action_method.**

EXPRESS specification:

```
*)
ENTITY trigger
  SUBTYPE OF (action_property);
WHERE
  WR1: SELF.description = 'control logic condition';
  WR2: 'CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF
(SELF.definition);
  WR3: SIZEOF (QUERY (ca <* USEDIN (SELF.definition,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       NOT (ca.assigned_group.name = 'control logic'))) = 0;
END_ENTITY;
(*
```

Formal propositions:

WR1: The **trigger** shall have a description attribute that has a value of `control logic condition'.

WR2: The **trigger** shall be an **action_property** of an **action_method**.

WR3: The **trigger** shall be an **action_property** of an **action_method** that is classified as `control logic'.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **trigger** entity:

— subtype_exclusive_action_property (see 5.2.3.7).

5.2.2.1.87 tube_type

A **tube_type** is a **group** and **characterized_object** that specifies common characteristics for a family of tubes.

EXPRESS specification:

```
*)
ENTITY tube_type
  SUBTYPE OF (group, characterized_object);
WHERE
  WR1: SIZEOF (QUERY (ca <* QUERY (ga <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.GROUP_ASSIGNMENT.ASSIGNED_GROUP') |
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT' IN
       TYPEOF (ga)) |
       SIZEOF (QUERY (it <* ca.items |
       NOT (('CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
       TYPEOF (it)) AND
       (SIZEOF (QUERY (ect <* QUERY (ca <*
```

```
       USEDIN (it.of_shape.definition.formation.of_product,
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS') |
       ca.role.name = 'equipment component type') |
       ect.assigned_group.name = 'exchanger bundle')) = 1)))) = 0)) >= 1;
  WR2: (SIZEOF (QUERY (pd <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION') |
       SIZEOF (QUERY (pdr <* USEDIN (pd, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') |
       pdr.used_representation.name =
       'tube internal characteristics')) <= 1)) <= 1) AND
       (SIZEOF (QUERY (pd <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION') |
       SIZEOF (QUERY (pdr <* USEDIN (pd, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') |
       pdr.used_representation.name =
       'tube internal characteristics')) >= 2)) = 0);
  WR3: (SIZEOF (QUERY (pd <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION') |
       SIZEOF (QUERY (pdr <* USEDIN (pd, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') |
       pdr.used_representation.name =
       'tube external characteristics')) <= 1)) <= 1) AND
       (SIZEOF (QUERY (pd <* USEDIN (SELF,
       'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION') |
       SIZEOF (QUERY (pdr <* USEDIN (pd, 'CONCEPTUAL_PROCESS_DESIGN.' +
       'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') |
       pdr.used_representation.name =
       'tube external characteristics')) >= 2)) = 0);
END_ENTITY;
(*
```

Formal propositions:

WR1: A **tube_type** shall classify at least one **heat_exchanger_component** that are classified as `exchanger bundle'.

WR2: A **tube_type** shall have at most one tube internal characteristics.

WR3: A **tube_type** shall have at most one tube external characteristics.

Associated global rules:

The following global rules defined in this part of ISO 10303 apply to the **tube_type** entity:

— subtype_exclusive_characterized_object (see 5.2.3.9);

— subtype_exclusive_group (see 5.2.3.11).

5.2.2.2 AIM EXPRESS short listing imported entity modifications

5.2.2.2.1 action_method

The base definition of the **action_method** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_action_method (see 5.2.3.5).

5.2.2.2.2 action_method_relationship

The base definition of the **action_method_relationship** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_action_method_relationship (see 5.2.3.6).

5.2.2.2.3 action_property

The base definition of the **action_property** entity is given in ISO 10303-49. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_action_property (see 5.2.3.7).

5.2.2.2.4 action_resource

The base definition of the **action_resource** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_action_resource (see 5.2.3.8).

5.2.2.2.5 application_context

The base definition of the **application_context** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— application_context_requires_ap_definition (see 5.2.3.1);

— dependent_instantiable_application_context (see 5.2.3.2).

5.2.2.2.6 application_protocol_definition

The base definition of the **application_protocol_definition** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— application_context_requires_ap_definition (see 5.2.3.1);

5.2.2.2.7 approval_assignment

The base definition of the **approval_assignment** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_mandatory_approval_assignment (see 5.2.3.19).

5.2.2.2.8 certification_assignment

The base definition of the **certification_assignment** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_mandatory_certification_assignment (see 5.2.3.20).

5.2.2.2.9 characterized_object

The base definition of the **characterized_object** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_characterized_object (see 5.2.3.9).

5.2.2.2.10 date_assignment

The base definition of the **date_assignment** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_mandatory_date_assignment (see 5.2.3.21).

5.2.2.2.11 date_and_time_assignment

The base definition of the **date_and_time_assignment** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_mandatory_date_and_time_assignment (see 5.2.3.22).

5.2.2.2.12 document_reference

The base definition of the **document_reference** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_mandatory_document_reference (see 5.2.3.23).

5.2.2.2.13 externally_defined_item

The base definition of the **externally_defined_item** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_externally_defined_item (see 5.2.3.10).

5.2.2.2.14 group

The base definition of the **group** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_group (see 5.2.3.11).

5.2.2.2.15 group_assignment

The base definition of the **group_assignment** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_mandatory_group_assignment (see 5.2.3.24).

5.2.2.2.16 identification_assignment

The base definition of the **identification_assignment** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_mandatory_identification_assignment (see 5.2.3.25).

5.2.2.2.17 organization_assignment

The base definition of the **organization_assignment** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_mandatory_organization_assignment (see 5.2.3.26).

5.2.2.2.18 person_assignment

The base definition of the **person_assignment** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_mandatory_person_assignment (see 5.2.3.27).

5.2.2.2.19 presented_item

The base definition of the **presented_item** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_presented_item (see 5.2.3.12).

5.2.2.2.20 presentation_representation

The base definition of the **presentation_representation** entity is given in ISO 10303-46. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_representation (see 5.2.3.16).

5.2.2.2.21 product

The base definition of the **product** entity is given in ISO 10303-4. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_product (see 5.2.3.13).

5.2.2.2.22 product_context

The base definition of the **product_context** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— dependent_instantiable_product_context (see 5.2.3.3).

5.2.2.2.23 product_definition

The base definition of the **product_definition** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_product_definition (see 5.2.3.14).

5.2.2.2.24 product_definition_context

The base definition of the **product_definition_context** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— dependent_instantiable_product_definition_context (see 5.2.3.4).

5.2.2.2.25 property_definition

The base definition of the **property_definition** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_property_definition (see 5.2.3.15).

5.2.2.2.26 representation

The base definition of the **representation** entity is given in ISO 10303-43. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_representation (see 5.2.3.16).

5.2.2.2.27 resource_property

The base definition of the **resource_property** entity is given in ISO 10303-49. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_resource_property (see 5.2.3.17).

5.2.2.2.28 shape_aspect

The base definition of the **shape_aspect** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_shape_aspect (see 5.2.3.18).

5.2.2.2.29 shape_representation

The base definition of the **shape_representation** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_representation (see 5.2.3.16).

5.2.2.2.30 symbol_representation

The base definition of the **symbol_representation** entity is given in ISO 10303-46. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_exclusive_representation (see 5.2.3.16).

5.2.2.2.31 versioned_action_request

The base definition of the **versioned_action_request** entity is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

Associated global rules:

— subtype_mandatory_versioned_action_request (see 5.2.3.28).

5.2.3 AIM EXPRESS short listing rules

5.2.3.1 application_context_requires_ap_definition

The **application_context_requires_ap_definition** rule specifies that each instance of **application_-context** shall be referenced by exactly one **application_protocol_definition** that specifies this part of ISO 10303.

EXPRESS specification:

```
*)
RULE application_context_requires_ap_definition FOR
  (application_context, application_protocol_definition);
WHERE
  WR1: SIZEOF (QUERY (ac <* application_context |
       NOT (SIZEOF (QUERY (apd <* application_protocol_definition |
       (ac :=: apd.application) AND
       (apd.application_interpreted_model_schema_name =
       'conceptual_process_design'))) = 1 ))) = 0;
END_RULE;
(*
```

Argument definitions:

application_context: the set of all instances of **application_context** entities.

application_protocol_definition: the set of all instances of **application_protocol_definition** entities.

Formal propositions:

WR1: For each instance of **application_context**, there shall be exactly one instance of **application_-protocol_definition** that references the instance of **application_context** as its application with a value of `plant_spatial_configuration' as its application_interpreted_model_schema_name.

5.2.3.2 dependent_instantiable_application_context

The **dependent_instantiable_application_context** rule specifies that all instances of **application_-context** are dependent on their usage to define another entity.

EXPRESS specification:

```
*)
RULE dependent_instantiable_application_context FOR (application_context);
WHERE
  WR1: SIZEOF (QUERY (ac <* application_context |
       NOT (SIZEOF (USEDIN (ac, '')) >= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

application_context: the set of all instances of **application_context**.

Formal propositions:

WR1: For each instance of **application_context**, there shall be a reference to the **application_context** instance from an attribute of another entity.

5.2.3.3 dependent_instantiable_product_context

The **dependent_instantiable_product_context** rule specifies that all instances of **product_context** are dependent on their usage to define another entity.

EXPRESS specification:

```
*)
RULE dependent_instantiable_product_context FOR (product_context);
WHERE
  WR1: SIZEOF (QUERY (pc <* product_context |
       NOT (SIZEOF (USEDIN (pc, '')) >= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

product_context: the set of all instances of **product_context**.

Formal propositions:

WR1: For each instance of **product_context**, there shall be a reference to the **product_context** instance from an attribute of another entity.

5.2.3.4 dependent_instantiable_product_definition_context

The **dependent_instantiable_product_definition_context** rule specifies that all instances of **product_-definition_context** are dependent on their usage to define another entity.

EXPRESS specification:

```
*)
RULE dependent_instantiable_product_definition_context FOR
  (product_definition_context);
WHERE
  WR1: SIZEOF (QUERY (pdc <* product_definition_context |
       NOT (SIZEOF (USEDIN (pdc, '')) >= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

product_definition_context: the set of all instances of **product_definition_context**.

Formal propositions:

WR1: For each instance of **product_definition_context**, there shall be a reference to the **product_-definition_context** instance from an attribute of another entity.

5.2.3.5 subtype_exclusive_action_method

All instances of **action_method** shall be an instance of at most one of **event_sequence_with_condition**, **externally_defined_action_method** or **process_simulation**.

EXPRESS specification:

```
*)
RULE subtype_exclusive_action_method FOR
  (action_method);
WHERE
  WR1: SIZEOF (QUERY (am <* action_method |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.' +
       'EVENT_SEQUENCE_WITH_CONDITION',
       'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_ACTION_METHOD',
       'CONCEPTUAL_PROCESS_DESIGN.PROCESS_SIMULATION']
       * TYPEOF (am)) <= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

action_method: the set of all instances of **action_method** entities.

Formal propositions:

WR1: Every instance of **action_method** shall be an instance of at most one of **event_sequence_with_-condition**, **externally_defined_action_method** or **process_simulation**.

5.2.3.6 subtype_exclusive_action_method_relationship

All instances of **action_method_relationship** shall be an instance of at most one of **event_sequence_-with_condition** or **simulated_process_definition**.

EXPRESS specification:

```
*)
RULE subtype_exclusive_action_method_relationship FOR
  (action_method_relationship);
WHERE
  WR1: SIZEOF (QUERY (amr <* action_method_relationship |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.' +
       'SIMULATED_PROCESS_DEFINITION',
       'CONCEPTUAL_PROCESS_DESIGN.EVENT_SEQUENCE_WITH_CONDITION']
       * TYPEOF (amr)) <= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

action_method_relationship: the set of all instances of **action_method_relationship** entities.

Formal propositions:

WR1: Every instance of **action_method_relationship** shall be an instance of at most one of **event_-sequence_with_condition** or **simulated_process_definition**.

5.2.3.7 subtype_exclusive_action_property

All instances of **action_property** shall be an instance of at most one of **process_definition_reference_-time**, **process_simulation_reference_time**, or **trigger**.

EXPRESS specification:

```
*)
RULE subtype_exclusive_action_property FOR
  (action_property);
WHERE
  WR1: SIZEOF (QUERY (ap <* action_property |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.' +
       'PROCESS_DEFINITION_REFERENCE_TIME',
       'CONCEPTUAL_PROCESS_DESIGN.PROCESS_SIMULATION_REFERENCE_TIME',
       'CONCEPTUAL_PROCESS_DESIGN.TRIGGER']
       * TYPEOF (ap)) <= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

action_property: the set of all instances of **action_property** entities.

Formal propositions:

WR1: Every instance of **action_property** shall be an instance of at most one of **process_definition_-reference_time**, **process_simulation_reference_time**, or **trigger**.

5.2.3.8 subtype_exclusive_action_resource

All instances of **action_resource** shall be an instance of at most one of **functional_volume_service_-case**, **interphase**, **process_design_case_resource**, **process_material**, **process_port**, **process_-resource_plant_item**, **specific_phase**, or **stream**.

EXPRESS specification:

```
*)
RULE subtype_exclusive_action_resource FOR
  (action_resource);
WHERE
  WR1: SIZEOF (QUERY (ar <* action_resource |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.' +
       'FUNCTIONAL_VOLUME_SERVICE_CASE',
       'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_ACTION_RESOURCE',
       'CONCEPTUAL_PROCESS_DESIGN.INTERPHASE',
       'CONCEPTUAL_PROCESS_DESIGN.PROCESS_DESIGN_CASE_RESOURCE',
       'CONCEPTUAL_PROCESS_DESIGN.PROCESS_MATERIAL',
       'CONCEPTUAL_PROCESS_DESIGN.PROCESS_PORT',
       'CONCEPTUAL_PROCESS_DESIGN.PROCESS_RESOURCE_PLANT_ITEM',
       'CONCEPTUAL_PROCESS_DESIGN.SPECIFIC_PHASE',
       'CONCEPTUAL_PROCESS_DESIGN.STREAM']
```

```
       * TYPEOF (ar)) <= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

action_resource: the set of all instances of **action_resource** entities.

Formal propositions:

WR1: Every instance of **action_resource** shall be an instance of at most one of **functional_volume_-service_case**, **externally_defined_action_resource**, **interphase**, **process_design_case_resource**, **process_material**, **process_port**, **process_resource_plant_item**, **specific_phase**, or **stream**.

5.2.3.9 subtype_exclusive_characterized_object

All instances of **characterized_object** shall be an instance of at most one of **control_objective**, **document_with_properties**, **molecular_structural_group**, **phase**, **process_port**, **stage_column_-section**, **site**, **stream**, or **tube_type**.

EXPRESS specification:

```
*)
RULE subtype_exclusive_characterized_object FOR
  (characterized_object);
WHERE
  WR1: SIZEOF (QUERY (co <* characterized_object |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.CONTROL_OBJECTIVE',
       'CONCEPTUAL_PROCESS_DESIGN.DOCUMENT_WITH_PROPERTIES',
       'CONCEPTUAL_PROCESS_DESIGN.MOLECULAR_STRUCTURAL_GROUP',
       'CONCEPTUAL_PROCESS_DESIGN.PHASE',
       'CONCEPTUAL_PROCESS_DESIGN.PROCESS_PORT',
       'CONCEPTUAL_PROCESS_DESIGN.STAGE_COLUMN_SECTION',
       'CONCEPTUAL_PROCESS_DESIGN.SITE',
       'CONCEPTUAL_PROCESS_DESIGN.STREAM',
       'CONCEPTUAL_PROCESS_DESIGN.TUBE_TYPE']
       * TYPEOF (co)) <= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

characterized_object: the set of all instances of **characterized_object** entities.

Formal propositions:

WR1: Every instance of **characterized_object** shall be an instance of at most one of **control_objective**, **document_with_properties**, **molecular_structural_group**, **phase**, **process_port**, **stage_column_-section**, **site, stream**, or **tube_type**.

5.2.3.10 subtype_exclusive_externally_defined_item

All instances of **externally_defined_item** shall be an instance of at most one of **externally_defined_-action_method**, **externally_defined_action_resource**, **externally_defined_classification**, **externally_-defined_group**, **externally_defined_plant_item_definition**, **externally_defined_plant_system**, **externally_defined_representation_item**, or **process_design_property_value**.

EXPRESS specification:

```
*)
RULE subtype_exclusive_externally_defined_item FOR
  (externally_defined_item);
WHERE
  WR1: SIZEOF (QUERY (edi <* externally_defined_item |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.' +
       'EXTERNALLY_DEFINED_ATION_METHOD',
       'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_ACTION_RESOURCE',
       'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_CLASSIFICATION',
       'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_GROUP',
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'EXTERNALLY_DEFINED_PLANT_ITEM_DEFINITION',
       'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_PLANT_SYSTEM',
       'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_REPRESENTATION_ITEM',
       'CONCEPTUAL_PROCESS_DESIGN.PROCESS_DESIGN_PROPERTY_VALUE']
       * TYPEOF (edi)) <= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

externally_defined_item: the set of all instances of **externally_defined_item** entities.

Formal propositions:

WR1: Every instance of **externally_defined_item** shall be an instance of at most one of **externally_-defined_action_method**, **externally_defined_action_resource**, **externally_defined_classification**, **externally_defined_group**, **externally_defined_plant_item_definition**, **externally_defined_plant_-system**, **externally_defined_representation_item**, or **process_design_property_value**.

5.2.3.11 subtype_exclusive_group

All instances of **group** shall be an instance of at most one of **connector_end_type_classification**, **externally_defined_classification**, **externally_defined_group**, **phase**, **piping_connector_-classification**, **stage_column_section**, **thermophysical_property_classification**, or **tube_type**.

EXPRESS specifications:

```
*)
RULE subtype_exclusive_group FOR
  (group);
WHERE
  WR1: SIZEOF (QUERY (grp <* group |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.' +
       'CONNECTOR_END_TYPE_CLASSIFICATION',
       'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_CLASSIFICATION',
```

```
       'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_GROUP',
       'CONCEPTUAL_PROCESS_DESIGN.PHASE',
       'CONCEPTUAL_PROCESS_DESIGN.PIPING_CONNECTOR_CLASSIFICATION',
       'CONCEPTUAL_PROCESS_DESIGN.STAGE_COLUMN_SECTION',
       'CONCEPTUAL_PROCESS_DESIGN.THERMOPHYSICAL_PROPERTY_CLASSIFICATION',
       'CONCEPTUAL_PROCESS_DESIGN.TUBE_TYPE']
       * TYPEOF (grp)) <= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

group: the set of all instances of **group** entities.

Formal propositions:

WR1: Every instance of **group** shall be an instance of at most one of **connector_end_type_-classification**, **externally_defined_classification**, **externally_defined_group**, **phase**, **piping_-connector_classification**, **stage_column_section**, **thermophysical_property_classification**, or **tube_-type**.

5.2.3.12 subtype_exclusive_presented_item

All instances of **presented_item** shall be an instance of at most one of **presented_item_association** or **presented_item_with_association**.

EXPRESS specification:

```
*)
RULE subtype_exclusive_presented_item FOR
  (presented_item);
WHERE
  WR1: SIZEOF (QUERY (pres_i <* presented_item |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.' +
       'PRESENTED_ITEM_ASSOCIATION',
       'CONCEPTUAL_PROCESS_DESIGN.PRESENTED_ITEM_WITH_ASSOCIATION']
       * TYPEOF (pres_i)) <= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

presented_item: the set of all instances of **presented_item** entities.

Formal propositions:

WR1: Every instance of **presented_item** shall be an instance of at most one of **presented_item_-association** or **presented_item_with_association**.

5.2.3.13 subtype_exclusive_product

All instances of **product** shall be an instance of at most one of **plant** or **process_resource_plant_item**.

EXPRESS specification:

```
*)
RULE subtype_exclusive_product FOR
  (product);
WHERE
  WR1: SIZEOF (QUERY (prod <* product |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.PLANT',
       'CONCEPTUAL_PROCESS_DESIGN.PROCESS_RESOURCE_PLANT_ITEM']
       * TYPEOF (prod)) <= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

product: the set of all instances of **product** entities.

Formal propositions:

WR1: Every instance of **product** shall be an instance of at most one of **plant** or **process_resource_-plant_item**.

5.2.3.14 subtype_exclusive_product_definition

All instances of **product_definition** shall be an instance of at most one of **bin_section**, **boot**, **instrumentation_and_control_system**, **nozzle**, **process_material**, **separation_tower**, **separation_-tray_component_definition**, or **solids_storage_bin**.

NOTES

1 - This rule excludes **externally_defined_plant_item_definition** and **externally_defined_plant_system** so that the entities constrained in this clause may be combined with them to create specific externally defined plant items and plant systems.

2 - This rule excludes **process_design_case_resource** so that the entities constrained in this clause may be combined with it to specify design cases for specified subtypes of **product_definition**s.

EXPRESS specification:

```
*)
RULE subtype_exclusive_product_definition FOR
  (product_definition);
WHERE
  WR1: SIZEOF (QUERY (pd <* product_definition |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.BIN_SECTION',
       'CONCEPTUAL_PROCESS_DESIGN.BOOT',
       'CONCEPTUAL_PROCESS_DESIGN.INSTRUMENTATION_AND_CONTROL_SYSTEM',
       'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT',
       'CONCEPTUAL_PROCESS_DESIGN.HEAT_TRANSFER_EQUIPMENT',
       'CONCEPTUAL_PROCESS_DESIGN.NOZZLE',
       'CONCEPTUAL_PROCESS_DESIGN.SEPARATION_TOWER',
       'CONCEPTUAL_PROCESS_DESIGN.SEPARATION_TRAY_COMPONENT_DEFINITION',
       'CONCEPTUAL_PROCESS_DESIGN.SOLIDS_STORAGE_BIN',
       'CONCEPTUAL_PROCESS_DESIGN.PROCESS_MATERIAL']
       * TYPEOF (pd)) <= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

product_definition: the set of all instances of **product_definition** entities.

Formal propositions:

WR1: Every instance of **product_definition** shall be an instance of at most one of **bin_section**, **boot**, **instrumentation_and_control_system**, **nozzle**, **process_material**, **separation_tower**, **separation_-tray_component_definition**, or **solids_storage_bin**.

5.2.3.15 subtype_exclusive_property_definition

All instances of **property_definition** shall be an instance of at most one of **port_service_case** or **process_design_case**.

EXPRESS specification:

```
*)
RULE subtype_exclusive_property_definition FOR
  (property_definition);
WHERE
  WR1: SIZEOF (QUERY (pd <* property_definition |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.PLANT_ITEM_REFERENCE_TIME',
       'CONCEPTUAL_PROCESS_DESIGN.PORT_SERVICE_CASE',
       'CONCEPTUAL_PROCESS_DESIGN.PROCESS_DESIGN_CASE',
       'CONCEPTUAL_PROCESS_DESIGN.SITE',
       'CONCEPTUAL_PROCESS_DESIGN.SITE_REFERENCE_TIME',
       'CONCEPTUAL_PROCESS_DESIGN.SITED_PLANT',
       'CONCEPTUAL_PROCESS_DESIGN.SITE_STANDARD_CONDITION']
       * TYPEOF (pd)) <= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

property_definition: the set of all instances of **property_definition** entities.

Formal propositions:

WR1: Every instance of **property_definition** shall be an instance of at most one of **plant_item_-reference_time**, **port_service_case**, **process_design_case**, **site**, **site_reference_time**, **sited_plant**, or **site_standard_condition**.

5.2.3.16 subtype_exclusive_representation

All instances of **representation** shall be an instance of at most one of **data_curve**, **heat_exchanger_-internal_data**, **intersection_description**, **particle_size_distribution_values**, **presentation_-representation**, **process_design_property_value**, **reactor_yield**, **specific_equation**, **stream_-separation_specification**, **stream_split_specification**, **shape_representation**, or **symbol_-representation**.

EXPRESS specification:

```
*)
RULE subtype_exclusive_representation FOR
  (representation);
WHERE
  WR1: SIZEOF (QUERY (rep <* representation |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.DATA_CURVE',
       'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_INTERNAL_DATA',
       'CONCEPTUAL_PROCESS_DESIGN.INTERSECTION_DESCRIPTION',
       'CONCEPTUAL_PROCESS_DESIGN.PARTICLE_SIZE_DISTRIBUTION_VALUES',
       'CONCEPTUAL_PROCESS_DESIGN.PRESENTATION_REPRESENTATION',
       'CONCEPTUAL_PROCESS_DESIGN.PROCESS_DESIGN_PROPERTY_VALUE',
       'CONCEPTUAL_PROCESS_DESIGN.REACTOR_YIELD',
       'CONCEPTUAL_PROCESS_DESIGN.SPECIFIC_EQUATION',
       'CONCEPTUAL_PROCESS_DESIGN.STREAM_SEPARATION_SPECIFICATION',
       'CONCEPTUAL_PROCESS_DESIGN.STREAM_SPLIT_SPECIFICATION',
       'CONCEPTUAL_PROCESS_DESIGN.SHAPE_REPRESENTATION',
       'CONCEPTUAL_PROCESS_DESIGN.SYMBOL_REPRESENTATION']
       * TYPEOF (rep)) <= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

representation: the set of all instances of **representation** entities.

Formal propositions:

WR1: Every instance of **representation** shall be an instance of at most one of **data_curve**, **heat_-exchanger_internal_data**, **intersection_description**, **particle_size_distribution_values**, **presentation_representation**, **process_design_property_value**, **reactor_yield**, **specific_equation**, **stream_separation_specification**, **stream_split_specification**, **shape_representation**, or **symbol_-representation**.

5.2.3.17 subtype_exclusive_resource_property

All instances of **resource_property** shall be an instance of at most one of **material_amount_-reference_time**, **process_material_reference_time**, or **stream_reference_time**.

EXPRESS specification:

```
*)
RULE subtype_exclusive_resource_property FOR
  (resource_property);
WHERE
  WR1: SIZEOF (QUERY (rp <* resource_property |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.' +
       'MATERIAL_AMOUNT_REFERENCE_TIME',
       'CONCEPTUAL_PROCESS_DESIGN.PROCESS_MATERIAL_REFERENCE_TIME',
       'CONCEPTUAL_PROCESS_DESIGN.STREAM_REFERENCE_TIME']
       * TYPEOF (rp)) <= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

resource_property: the set of all instances of **resource_property** entities.

Formal propositions:

WR1: Every instance of **resource_property** shall be an instance of at most one of **material_amount_-reference_time**, **process_material_reference_time**, or **stream_reference_time**.

5.2.3.18 subtype_exclusive_shape_aspect

All instances of **shape_aspect** shall be an instance of at most one of **equipment_port**, **exchanger_zone**, **functional_volume_service_case**, **reserved_space**, **separation_tray_component_feature**, **separation_tray_component_feature_definition**.

EXPRESS specification:

```
*)
RULE subtype_exclusive_shape_aspect FOR
  (shape_aspect);
WHERE
  WR1: SIZEOF (QUERY (sa <* shape_aspect |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.EQUIPMENT_PORT',
       'CONCEPTUAL_PROCESS_DESIGN.EXCHANGER_ZONE',
       'CONCEPTUAL_PROCESS_DESIGN.FUNCTIONAL_VOLUME_SERVICE_CASE',
       'CONCEPTUAL_PROCESS_DESIGN.RESERVED_SPACE',
       'CONCEPTUAL_PROCESS_DESIGN.SEPARATION_TRAY_COMPONENT_FEATURE',
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'SEPARATION_TRAY_COMPONENT_FEATURE_DEFINITION']
       * TYPEOF (sa)) <= 1))) = 0;
END_RULE;
(*
```

Argument definitions:

shape_aspect: the set of all instances of **shape_aspect** entities.

Formal propositions:

WR1: Every instance of **shape_aspect** shall be an instance of at most one of **equipment_port**, **exchanger_zone**, **functional_volume_service_case**, **reserved_space**, **separation_tray_component_-feature**, **separation_tray_component_feature_definition**.

5.2.3.19 subtype_mandatory_approval_assignment

All instances of **approval_assignment** shall be an instance of **applied_approval_assignment**.

EXPRESS specification:

```
*)
RULE subtype_mandatory_approval_assignment FOR
  (approval_assignment);
WHERE
  WR1: SIZEOF (QUERY (aa <* approval_assignment |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.APPLIED_APPROVAL_ASSIGNMENT'
       IN TYPEOF (aa)))) = 0;
```

```
END_RULE;
(*
```

Argument definitions:

approval_assignment: the set of all instances of **approval_assignment** entities.

Formal propositions:

WR1: Every instance of **approval_assignment** shall be an instance of **applied_approval_assignment**.

5.2.3.20 subtype_mandatory_certification_assignment

All instances of **certification_assignment** shall be an instance of **applied_certification_assignment**.

EXPRESS specification:

```
*)
RULE subtype_mandatory_certification_assignment FOR
  (certification_assignment);
WHERE
  WR1: SIZEOF (QUERY (ca <* certification_assignment |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.APPLIED_CERTIFICATION_ASSIGNMENT'
       IN TYPEOF (ca)))) = 0;
END_RULE;
(*
```

Argument definitions:

certification_assignment: the set of all instances of **certification_assignment** entities.

Formal propositions:

WR1: Every instance of **certification_assignment** shall be an instance of **applied_certification_-assignment**.

5.2.3.21 subtype_mandatory_date_assignment

All instances of **date_assignment** shall be an instance of **applied_date_assignment**.

EXPRESS specification:

```
*)
RULE subtype_mandatory_date_assignment FOR
  (date_assignment);
WHERE
  WR1: SIZEOF (QUERY (da <* date_assignment |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.APPLIED_DATE_ASSIGNMENT'
       IN TYPEOF (da)))) = 0;
END_RULE;
(*
```

Argument definitions:

date_assignment: the set of all instances of **date_assignment** entities.

Formal propositions:

WR1: Every instance of **date_assignment** shall be an instance of **applied_date_assignment**.

5.2.3.22 subtype_mandatory_date_and_time_assignment

All instances of **date_and_time_assignment** shall be an instance of **applied_date_time_assignment**.

EXPRESS specification:

```
*)
RULE subtype_mandatory_date_and_time_assignment FOR
  (date_and_time_assignment);
WHERE
  WR1: SIZEOF (QUERY (dta <* date_and_time_assignment |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.APPLIED_DATE_TIME_ASSIGNMENT'
       IN TYPEOF (dta)))) = 0;
END_RULE;
(*
```

Argument definitions:

date_and_time_assignment: the set of all instances of **date_and_time_assignment** entities.

Formal propositions:

WR1: Every instance of **date_and_time_assignment** shall be an instance of **applied_date_time_-assignment**.

5.2.3.23 subtype_mandatory_document_reference

All instances of **document_reference** shall be an instance of **applied_document_reference**.

EXPRESS specification:

```
*)
RULE subtype_mandatory_document_reference FOR
  (document_reference);
WHERE
  WR1: SIZEOF (QUERY (dr <* document_reference |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.APPLIED_DOCUMENT_REFERENCE'
       IN TYPEOF (dr)))) = 0;
END_RULE;
(*
```

Argument definitions:

document_reference: the set of all instances of **document_reference** entities.

Formal propositions:

WR1: Every instance of **document_reference** shall be an instance of **applied_document_reference**.

5.2.3.24 subtype_mandatory_group_assignment

All instances of **group_assignment** shall be an instance of exactly one of **applied_group_assignment** or **classification_assignment**.

EXPRESS specification:

```
*)
RULE subtype_mandatory_group_assignment FOR
  (group_assignment);
WHERE
  WR1: SIZEOF (QUERY (ga <* group_assignment |
       NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT',
       'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT',
       'CONCEPTUAL_PROCESS_DESIGN.PHASES_IN_EQUILIBRIUM_GROUP_ASSIGNMENT']
       * TYPEOF (ga)) = 1))) = 0;
END_RULE;
(*
```

Argument definitions:

group_assignment: the set of all instances of **group_assignment** entities.

Formal propositions:

WR1: Every instance of **group_assignment** shall be an instance of exactly one of **applied_group_assignment**, **classification_assignment**, or **phases_in_equilibrium_group_assignment**.

5.2.3.25 subtype_mandatory_identification_assignment

All instances of **identification_assignment** shall be an instance of **applied_identification_assignment**.

EXPRESS specification:

```
*)
RULE subtype_mandatory_identification_assignment FOR
  (identification_assignment);
WHERE
  WR1: SIZEOF (QUERY (ia <* identification_assignment |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.APPLIED_IDENTIFICATION_ASSIGNMENT'
       IN TYPEOF (ia)))) = 0;
END_RULE;
(*
```

Argument definitions:

identification_assignment: the set of all instances of **identification_assignment** entities.

Formal propositions:

WR1: Every instance of **identification_assignment** shall be an instance of **applied_identification_assignment**.

5.2.3.26 subtype_mandatory_organization_assignment

All instances of **organization_assignment** shall be an instance of **applied_organization_assignment**.

EXPRESS specification:

```
*)
RULE subtype_mandatory_organization_assignment FOR
  (organization_assignment);
WHERE
  WR1: SIZEOF (QUERY (oa <* organization_assignment |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.APPLIED_ORGANIZATION_ASSIGNMENT' IN
       TYPEOF (oa)))) = 0;
END_RULE;
(*
```

Argument definitions:

organization_assignment: the set of all instances of **organization_assignment** entities.

Formal propositions:

WR1: Every instance of **organization_assignment** shall be an instance of **applied_organization_-assignment**.

5.2.3.27 subtype_mandatory_person_assignment

All instances of **person_assignment** shall be an instance of **applied_person_assignment**.

EXPRESS specification:

```
*)
RULE subtype_mandatory_person_assignment FOR
  (person_assignment);
WHERE
  WR1: SIZEOF (QUERY (pa <* person_assignment |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.APPLIED_PERSON_ASSIGNMENT' IN
       TYPEOF (pa)))) = 0;
END_RULE;
(*
```

Argument definitions:

person_assignment: the set of all instances of **person_assignment** entities.

Formal propositions:

WR1: Every instance of **person_assignment** shall be an instance of **applied_person_assignment**.

5.2.3.28 subtype_mandatory_versioned_action_request

All instances of **versioned_action_request** shall be an instance of **control_scheme**.

EXPRESS specification:

```
*)
RULE subtype_mandatory_versioned_action_request FOR
  (versioned_action_request);
WHERE
  WR1: SIZEOF (QUERY (ver_ar <* versioned_action_request |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.CONTROL_SCHEME'
       IN TYPEOF (ver_ar)))) = 0;
END_RULE;
(*
```

Argument definitions:

versioned_action_request: the set of all instances of **versioned_action_request** entities.

Formal propositions:

WR1: Every instance of **versioned_action_request** shall be an instance of **control_scheme**.

5.2.4 AIM EXPRESS short listing functions

5.2.4.1 class_name_in_hierarchy

The **class_name_in_hierarchy** function is a boolean function that accepts a **group** instance and a string as input and returns true if the input **group** instance is in a hierarchy of **group_relationship** instances that have a higher level **group** with the input string as its name.

EXPRESS specification:

```
*)
FUNCTION class_name_in_hierarchy (class: group; str : STRING): BOOLEAN;
  IF class.name = str THEN RETURN (TRUE);
    ELSE
    IF SIZEOF (USEDIN (class,
      'CONCEPTUAL_PROCESS_DESIGN.GROUP_RELATIONSHIP.RELATED_GROUP')) >= 1
      THEN RETURN (SIZEOF (QUERY (grp_rel <* USEDIN (class,
      'CONCEPTUAL_PROCESS_DESIGN.GROUP_RELATIONSHIP.RELATED_GROUP') |
      class_name_in_hierarchy (grp_rel.relating_group, str))) = 1);
    END_IF;
  END_IF;
  RETURN (FALSE);
END_FUNCTION;
(*
```

Argument definitions:

class: (input) the **group** that is to be evaluated.

str: (input) the value that is to be checked against.

```
*)
END_SCHEMA;
(*
```

6 Conformance requirements

Conformance to this part of ISO 10303 includes satisfying the requirements stated in this part, the requirements of the implementation method(s) supported, and the relevant requirements of the normative references.

An implementation shall support at least one of the following implementation methods:

— ISO 10303-21.

Requirements with respect to implementation methods-specific requirements are specified in annex C.

The Protocol Information Conformance Statement (PICS) proforma lists the options or the combinations of options that may be included in the implementation. The PICS proforma is provided in annex D.

This part of ISO 10303 provides for a number of options that may be supported by an implementation. These options have been grouped into the following conformance classes:

— Class 1 - stream property information;

— Class 2 - stream and substance model information;

— Class 3 - experimental VLE and property information;

— Class 4 - chemical reaction and substance model information;

— Class 5 - unit operations information;

— Class 6 - process simulation information;

— Class 7 - plant test information;

— Class 8 - plant item information;

— Class 9 - heat exchanger unit operation information;

— Class 10 - heat exchanger equipment design information;

— Class 11 - pump unit operation information;

— Class 12 - pump equipment design information;

— Class 13 - compressor unit operation information;

— Class 14 - compressor equipment design information;

— Class 15 - separation tower unit operation information;

— Class 16 - separation tower internals tray design information;

— Class 17 - separation tower internals packing design information;

— Class 18 - process vessel unit operations information;

— Class 19 - process vessel equipment design information;

— Class 20 - basic process control strategies information;

— Class 21 - process simulation quantities flowsheet information;

— Class 22 - process flow diagram information;

— Class 23 - process engineering information package.

Support for a particular conformance class requires support of all the options specified in that class.

Table 19 defines the units of functionality within each conformance class.

Conformance to a particular class requires that all AIM elements defined as part of that class be supported. Table 20 defines the classes to which each AIM element belongs.

NOTE 1 - ISO 10303-331:[1] defines the abstract test suite (ATS) to be used in the assessment of conformance. ISO 10303-32:[3)] describes the conformance assessment process.

6.1 Class 1 - Stream property information

This conformance class includes stream information. It is related to the following data flows between the AAM activities:

— A22333 to A22334;

— A22333 to A22335.

EXAMPLE 73 - Export process simulator or in-house property-generation program data to equipment design program, to a spreadsheet program or a database.

6.2 Class 2 - Stream and substance model information

This conformance class includes stream information and substance model data. It is related to the following data flows between the AAM activities:

— A223323 to A22333;

[1)]To be published.

— A22333 to A22334;

— A22333 to A22335;

— A2233 to A2234;

— A223 to A224;

— A222 to A223.

EXAMPLE 74 - Export data from a program used for substance model development or a spreadsheet program to a process simulator. Export data from Process simulator A to process simulator B.

6.3 Class 3 - Experimental VLE and property information

This conformance class includes experimental vapor-liquid equilibrium and measured property information. It is related to the following data flows within the AAM activity:

— within A22332;

— A22332 to A22333.

EXAMPLE 75 - Export experimental VLE and thermodynamic data from a database to a program used for substance model development or a process simulator.

6.4 Class 4 - Chemical reaction and substance model information

This conformance class includes chemical reaction information and substance model information. It is related to the following data flows between the AAM activities:

— A223324 to A22333;

— A22332 to A22333;

— A22332 to A22334.

EXAMPLE 76 - Export chemical reaction and substance model data from a database or spreadsheet to a reaction analysis program, a regression program or a process simulator. Export chemical reaction and substance model data from process simulator A to process simulator B.

6.5 Class 5 - Unit operations information

This conformance class includes inputs, results and stream connections for various unit operations that are used to model a process. It is related to the following data flows between the AAM activities:

— A223326 to A22333;

— A22333 to A22334;

— A22333 to A22335;

— A22333 to A22336;

— A22333 to A22337;

— A2233 to A2234;

— A222 to A223.

EXAMPLE 77 - Export unit operations data from a process simulator to an equipment design program, a spreadsheet program, an equipment data sheet program, a costing program, an engineering database or a CAD system. Export unit operations data from process simulator A to process simulator B.

6.6 Class 6 - Process simulation information

This conformance class includes inputs, results and stream connections for various unit operations, process stream data, substance model data and chemical reaction data that are used to model a process in a process simulation. It is related to the following data flows between the AAM activities:

— A22333;

— A22333 to A22334;

— A22333 to A22335;

— A22333 to A22336;

— A22333 to A22337;

— A2233 to A2234;

— A223 to A224;

— A222 to A223.

EXAMPLE 78 - Export process simulation data from a process simulator to an equipment design program, a spreadsheet program, an equipment data sheet program, a costing program, an engineering database or a CAD system. Export process simulation data from process simulator A to process simulator B.

6.7 Class 7 - Plant test information

This conformance class includes measured data related to process plant performance, including process stream and unit operations data. It is related to the following data flows between the AAM activities:

— A222.

EXAMPLE 79 - Export plant test data from a database or a spreadsheet program to a process simulator, a heat exchanger rating program, an equipment rating program, or a data regression program.

6.8 Class 8 - Plant item information

This conformance class includes information about plant items. It is related to the following data flows between the AAM activities:

— A22334 to A22335;

— A22334 to A22336;

— A22334 to A22337;

— A2233 to A2234;

— A222 to A223.

EXAMPLE 80 - Export plant item data, such as an equipment list, from a database, a spreadsheet program, or a CAD program to a spreadsheet program, an engineering documentation program, an intelligent diagramming program, or a CAD program.

6.9 Class 9 - Heat exchanger unit operation information

This conformance class includes information about heat exchanger unit operations and the associated material and stream property data that are sufficient to design and select a heat exchanger equipment item. It is related to the following data flows between the AAM activities:

— A223326 to A22333;

— A22333 to A22334;

— A22333 to A22335;

— A22333 to A22336;

— A22333 to A22337;

— A22335 to A22334;

— A22335 to A22332;

— A2233 to A2234;

— A222 to A223.

EXAMPLE 81 - Export heat exchanger unit operations and stream properties data from a process simulator to a heat exchanger design and rating program, a costing program, an equipment data sheet program or a CAD program.

6.10 Class 10 - Heat exchanger equipment design information

This conformance class includes equipment design information for heat exchanger equipment plant items. This includes all the data to be transferred from the heat exchanger design program or heat exchanger equipment catalogue database to be transferred onto equipment data sheets or recycled to a process simulation model to enable simulation of heat exchanger performance. It is related to the following data flows between the AAM activities:

— A2233433 to A22335;

— A2233433 to A22336;

— A2233433 to A22337;

— A22334 to A22335;

— A22334 to A22336;

— A22334 to A22337;

— A22335 to A22334;

— A22335 to A22332;

— A2233 to A2234.

EXAMPLE 82 - Export heat exchanger detailed design and performance data from a heat exchanger design and rating program or a heat exchanger equipment catalogue database to a costing program, an equipment data sheet program, a CAD program or a process simulator. Export heat exchanger detailed design and performance data from heat exchanger design and rating program A to heat exchanger design and rating program B.

6.11 Class 11 - Pump unit operation information

This conformance class includes information about pump unit operations and the associated stream property data that are sufficient to design and select a pump equipment item. It is related to the following data flows between the AAM activities:

— A223326 to A22333;

— A22333 to A22334;

— A22333 to A22335;

— A22333 to A22336;

— A22333 to A22337;

— A22335 to A22334;

— A22335 to A22332;

— A2233 to A2234;

— A222 to A223.

EXAMPLE 83 - Export pump unit operations and stream properties data from a process simulator to a pump design and rating program, a costing program, an equipment data sheet program or a CAD program.

6.12 Class 12 - Pump equipment design information

This conformance class includes equipment design information for pump equipment plant items. This includes all the data to be transferred from the pump design program or pump equipment catalogue database to be transferred onto equipment data sheets or recycled to a process simulation model to enable simulation of pump performance. It is related to the following data flows between the AAM activities:

— A2233432 to A22335;

— A2233432 to A22336;

— A2233432 to A22337;

— A22334 to A22335;

— A22334 to A22336;

— A22334 to A22337;

— A22335 to A22334;

— A22335 to A22332;

— A2233 to A2234.

EXAMPLE 84 - Export pump detailed design and performance data from a pump design and rating program or a pump equipment catalogue database to a costing program, an equipment data sheet program, a CAD program or a process simulator. Export pump detailed design and performance data from pump design and rating program A to pump design and rating program B.

6.13 Class 13 - Compressor unit operation information

This conformance class includes information about compressor unit operations and the associated stream property data that are sufficient to design and select a compressor equipment item. It is related to the following data flows between the AAM activities:

— A223326 to A22333;

— A22333 to A22334;

— A22333 to A22335;

— A22333 to A22336;

— A22333 to A22337;

— A22335 to A22334;

— A22335 to A22332;

— A2233 to A2234;

— A222 to A223.

EXAMPLE 85 - Export compressor unit operations and stream properties data from a process simulator to a compressor design and rating program, a costing program, an equipment data sheet program or a CAD program.

6.14 Class 14 - Compressor equipment design information

This conformance class includes equipment design information for compressor equipment plant items. This includes all the data to be transferred from the compressor design program or compressor equipment catalogue database to be transferred onto equipment data sheets or recycled to a process simulation model to enable simulation of compressor performance. It is related to the following data flows between the AAM activities:

— A2233432 to A22335;

— A2233432 to A22336;

— A2233432 to A22337;

— A22334 to A22335;

— A22334 to A22336;

— A22334 to A22337;

— A22335 to A22334;

— A22335 to A22332;

— A2233 to A2234.

EXAMPLE 86 - Export compressor detailed design and performance data from a compressor design and rating program or a compressor equipment catalogue database to a costing program, an equipment data sheet program, a CAD program or a process simulator. Export compressor detailed design and performance data from compressor design and rating program A to compressor design and rating program B.

6.15 Class 15 - Separation tower unit operation information

This conformance class includes information about separation tower unit operations and the associated stream property data that are sufficient to design and select separation tower internals equipment data such as trays or packing. It is related to the following data flows between the AAM activities:

— A223326 to A22333;

— A22333 to A22334;

— A22333 to A22335;

— A22333 to A22336;

— A22333 to A22337;

— A22335 to A22334;

— A22335 to A22332;

— A2233 to A2234;

— A222 to A223.

EXAMPLE 87 - Export separation tower unit operations and stream properties data from a process simulator to a tray or packing design and rating program, a costing program, an equipment data sheet program or a CAD program.

6.16 Class 16 - Separation tower internals tray design information

This conformance class includes equipment design information for separation tower tray design. This includes all the data to be transferred from the tray design program or tray equipment catalogue database to be transferred onto equipment data sheets or recycled to a process simulation model to enable simulation of tray performance in a separation tower. It is related to the following data flows between the AAM activities:

— A22334 to A22335;

— A22334 to A22336;

— A22334 to A22337;

— A22335 to A22334;

— A22335 to A22332;

— A2233 to A2234.

EXAMPLE 88 - Export separation tray detailed design and performance data from a separation tray design and rating program or a tray equipment catalogue database to a costing program, an equipment data sheet

program, a CAD program or a process simulator. Export tray detailed design and performance data from tray design and rating program A to tray design and rating program B.

6.17 Class 17 - Separation tower internals packing design information

This conformance class includes equipment design information for separation tower packing design. This includes all the data to be transferred from the packing design program or packing equipment catalogue database to be transferred onto equipment data sheets or recycled to a process simulation model to enable simulation of packing performance in a separation tower. It is related to the following data flows between the AAM activities:

— A22334 to A22335;

— A22334 to A22336;

— A22334 to A22337;

— A22335 to A22334;

— A22335 to A22332;

— A2233 to A2234.

EXAMPLE 89 - Export separation tower packing detailed design and performance data from a separation tower packing design and rating program or a separation tower packing equipment catalogue database to a costing program, an equipment data sheet program, a CAD program or a process simulator. Export separation tower packing detailed design and performance data from packing design and rating program A to packing design and rating program B.

6.18 Class 18 - Process vessel unit operations information

This conformance class includes information about process vessel unit operations and the associated stream property data that are sufficient to design and select process vessel equipment items. It is related to the following data flows between the AAM activities:

— A223326 to A22333;

— A22333 to A22334;

— A22333 to A22335;

— A22333 to A22336;

— A22333 to A22337;

— A22335 to A22334;

— A22335 to A22332;

— A2233 to A2234;

— A222 to A223.

EXAMPLE 90 - Export process vessel unit operations and stream properties data from a process simulator to a process vessel design and rating program, a costing program, an equipment data sheet program or a CAD program.

6.19 Class 19 - Process vessel equipment design information

This conformance class includes equipment design information for process vessel design. This includes all the data to be transferred from the process vessel design program or process vessel equipment catalogue database to be transferred onto equipment data sheets or recycled to a process simulation model to enable simulation of process vessel performance. It is related to the following data flows between the AAM activities:

— A22334 to A22335;

— A22334 to A22336;

— A22334 to A22337;

— A22335 to A22334;

— A22335 to A22332;

— A2233 to A2234.

EXAMPLE 91 - Export pressure vessel detailed design and performance data from a pressure vessel design and rating program or a pressure vessel equipment catalogue database to a costing program, an equipment data sheet program, a CAD program or a process simulator. Export pressure vessel detailed design and performance data from pressure vessel design and rating program A to pressure vessel design and rating program B.

6.20 Class 20 - Basic process control strategies information

This conformance class includes describing the basic regulatory and event-based control requirements of the process. It is suitable for expressing the needed process control loops, control events and control event sequences to be designed and shown in PFD's and control logic diagrams. It is related to the following data flows between the AAM activities:

— A22336 to A22337;

— A22336 to A223.

EXAMPLE 92 - Export process control strategies from a dynamic process simulator to an intelligent process diagram program, or from an intelligent process diagram program to a dynamic process simulator. Export from either a dynamic process simulator or an intelligent diagram program to a control loop summary report in a spreadsheet program. Export process control strategies from dynamic process simulator A to dynamic process simulator B, or from intelligent process diagram program A to intelligent process diagram program B. Intelligent process diagram programs can include CAD programs.

6.21 Class 21 - Process simulation quantities flowsheet information

This conformance class includes process definition, stream, and unit operation information sufficient to describe key process simulation heat and material balance results in the context of a process simulation flow diagram (quantities flowsheet). Included in this class is the ability to express the compositions, flows, and properties of material streams. It is related to the following data flows between the AAM activities:

— A22333;

— A22333 to A22334;

— A22333 to A22335;

— A22333 to A22336;

— A22333 to A22337;

— A2233 to A2234;

— A223 to A224;

— A222 to A223.

EXAMPLE 93 - Export process simulation quantities flowsheet information from a process simulator to an engineering database, an intelligent diagram program, equipment data sheets program, a spreadsheet program, a process engineering document generation and management program, a CAD program or a drawing program. Export process simulation quantities flowsheet information from process simulator A to process simulator B.

6.22 Class 22 - Process flow diagram information

This conformance class includes the ability to associate process engineering information associated with process simulation quantities flowsheets, and information about process equipment sizes and capacities, equipment plant items and basic control information, with the symbols and presentations of these symbols on the process flow diagrams. It is related to the following data flows between the AAM activities:

— A22337 to A223.

EXAMPLE 94 - Export process flow diagram information from a process simulator or an intelligent diagram program to an engineering database, equipment data sheets program, a spreadsheet program, a process engineering document generation and management program, a CAD program or a drawing program. Export process flow diagram information from intelligent diagram program A to intelligent diagram program B.

6.23 Class 23 - Process engineering information

This conformance class includes all of the UoFs specified in this part of ISO 10303. This class is suitable for transfer of the complete process design and process equipment design information from one organization to another, including the process flow diagrams. It is related to the following data flows between the AAM activities:

— A222 to A223.

EXAMPLE 95 - Export a complete or partial preliminary process engineering design package from an owner-operator company engineering database to an engineering and construction company engineering database. Export a completed full process engineering design package (including major equipment selection) from an engineering and construction company engineering database to a owner-operator engineering database.

Table 19 - Conformance classes

Unit of functionality	Conformance class																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
chemical_reaction_data				X	P	X																	X
control_strategy																				X		X	X
heat_transfer_equipment_data					X					X												X	X
major_process_equipment_data					X					X		X		X		X	X		X				X
mass_transfer_equipment_data					X											P	P						X
material_data	P	P	P	P	P	X	X	P	P	P	P	P	P	P	P	P	P	P	P	P	P	X	X
material_transfer_equipment_data												P		P									X
plant_context	P	P			P	X	X	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	X
plant_item_data								X		X		X		X		X	X					X	X
plant_system_definition						X	X	X												X		X	X
process_description	P	P			P	X	X		P	P	P	P	P	P	P	P	P	P	P	P	X	X	X
process_flow_diagram																					P	X	X
process_simulation_data					X	X																	X
process_vessel_equipment_data																			X			P	X
stream_data	X	X			P	X	X		P		P		P		P			P			X	X	X
substance_experimental_data			X				X																X

Table 19 - Conformance classes (concluded)

Unit of functionality	Conformance class																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
substance_model_data		X	P	X		X	X														P	P	X
unit_operation					X	X	X		P	P	P	P	P	P	P	P	P	P	P		X	X	X

KEY: X = Full coverage - All the AIM elements in the UoF are required to support this conformance class.
P = Partial coverage - Some of the AIM elements in the UoF are required to support this conformance class. A complete assessment of which AIM elements are required by the conformance class has not been completed at this time. Therefore, the listing of AIM elements for each conformance class in tables 20 and 21 reflects all of the elements in the UoF. A revised listing will be incorporated into the DIS version of this part of ISO 10303.

Table 20 - Conformance class elements - part 1

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
action	X	X		X	X	X	X		X	X	X	X
action_assignment	X	X			X	X	X		X	X	X	X
action_method	X	X		X	X	X	X		X	X	X	X
action_method_assignment	X	X			X	X	X		X	X	X	X
action_method_relationship	X	X			X	X	X		X	X	X	X
action_method_role	X	X			X	X	X		X	X	X	X
action_property	X	X		X	X	X	X		X	X	X	X
action_property_relationship	X	X			X	X	X		X	X	X	X
action_property_representation	X	X		X	X	X	X		X	X	X	X
action_relationship	X	X			X	X	X		X	X	X	X

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
action_request_assignment												
action_request_role												
action_request_solution						X						
action_resource	X	X		X	X	X						
action_resource_relationship	X	X		X	X	X						
action_resource_requirement	X	X		X		X						
action_resource_type	X	X		X		X						
action_role	X	X				X						
amount_of_substance_measure_with_unit	X	X	X	X	X	X						
amount_of_substance_unit	X	X	X	X	X	X						
annotation_curve_occurrence												
annotation_fill_area												
annotation_fill_area_occurrence												
annotation_occurrence												
annotation_occurrence_relationship												
annotation_point_occurrence												
annotation_symbol												
annotation_symbol_occurrence												
annotation_text												
annotation_text_occurrence												

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
annotation_text_with_extent												
application_context	X	X	X	X	X	X	X	X	X	X	X	X
application_context_element	X	X	X	X	X	X	X	X	X	X	X	X
application_protocol_definition	X	X	X	X	X	X	X		X	X	X	X
applied_action_assignment	X	X				X	X		X		X	X
applied_action_method_assignment	X	X				X	X		X		X	X
applied_approval_assignment						X	X					
applied_certification_assignment								X	X		X	X
applied_date_assignment	X	X				X	X					
applied_date_time_assignment	X	X				X	X					
applied_document_reference						X	X	X				
applied_group_assignment	X	X	X	X	X	X	X	X	X	X	X	X
applied_identification_assignment	X	X	X	X		X	X	X	X	X	X	X
applied_organization_assignment	X	X				X	X	X		X		X
applied_person_assignment	X	X				X	X					
approval			X				X					
approval_assignment			X				X					
approval_date_time			X				X					
approval_date_time_role			X				X					
approval_person_organization			X				X					

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
approval_role			X				X					
approval_status			X				X					
approver_role			X				X					
area_in_set												
area_measure_with_unit	X	X	X	X		X	X	X	X	X	X	X
area_unit	X	X	X	X		X	X	X	X	X	X	X
assembly_component_usage	X	X	X	X		X	X	X	X		X	X
axis2_placement_2d	X	X				X	X	X	X	X	X	X
axis2_placement_3d	X	X				X	X	X	X	X	X	X
b_spline_curve												
b_spline_curve_with_knots												
bezier_curve												
bin_section												
boot												
bounded_curve												
calendar_date	X	X	X			X	X					
camera_model												
camera_model_d2												
camera_model_d2_shape_clipping												
cartesian_point	X	X			X	X	X	X	X	X	X	X

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
certification								X	X		X	X
certification_assignment								X	X		X	X
certification_role								X	X		X	X
certification_type								X	X		X	X
characterized_object	X	X	X	X	X	X	X	X	X	X	X	X
circle												
classification_assignment	X	X	X	X	X	X	X	X	X	X	X	X
colour												
colour_rgb												
colour_specification												
composite_curve												
composite_curve_segment												
compound_representation_item	X	X	X	X	X	X	X	X	X		X	X
conic												
connector_end_type_classification								X	X		X	X
context_dependent_invisibility												
context_dependent_unit	X	X	X	X	X	X	X	X	X	X	X	X
control_objective												
control_scheme												
conversion_based_unit	X	X	X	X	X	X	X	X	X	X	X	X

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
coordinated_universal_time_offset	X	X			X	X	X					
curve												
curve_style												
curve_style_font												
curve_style_font_pattern												
data_curve	X	X	X	X	X	X	X	X	X	X	X	X
data_environment	X	X	X	X	X	X	X	X	X	X	X	X
date	X	X	X		X	X	X					
date_and_time	X	X	X		X	X	X					
date_and_time_assignment	X	X	X		X	X	X					
date_assignment	X	X	X		X	X	X					
date_role	X	X	X		X	X	X					
date_time_role	X	X	X		X	X	X					
defined_symbol												
derived_unit	X	X	X	X	X	X	X	X	X	X	X	X
derived_unit_element	X	X	X	X	X	X	X	X	X	X	X	X
descriptive_representation_item	X	X	X	X	X	X	X	X	X	X	X	X
dimensional_exponents	X	X	X	X	X	X	X	X	X	X	X	X
direction	X	X			X	X	X	X	X	X	X	X
document			X			X	X	X	X	X	X	X

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
document_reference			X			X	X	X	X	X	X	X
document_relationship			X			X	X	X	X	X	X	X
document_role			X			X	X	X	X	X	X	X
document_type			X			X	X	X	X	X	X	X
document_usage_constraint			X			X	X	X	X	X	X	X
document_with_properties			X			X	X					
drawing_definition												
drawing_revision												
drawing_revision_sequence												
drawing_sheet_revision												
drawing_sheet_revision_usage												
electric_current_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X	X
electric_current_unit	X	X	X	X	X	X	X	X	X	X	X	X
ellipse												
equipment_port	X	X			X	X	X	X	X	X	X	X
event_sequence_with_condition					X	X	X		X	X	X	X
exchanger_zone										X		
external_identification_assignment	X	X	X	X	X	X	X	X	X	X	X	X
external_source	X	X	X	X	X	X	X	X	X	X	X	X
external_source_relationship	X	X	X	X	X	X	X	X	X	X	X	X

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
externally_defined_action_method					X	X	X		X	X	X	X
externally_defined_action_resource	X	X	X	X	X	X	X		X	X	X	X
externally_defined_classification	X	X	X	X	X	X	X	X	X	X	X	X
externally_defined_curve_font												
externally_defined_group	X	X	X	X	X	X	X	X	X	X	X	X
externally_defined_hatch_style												
externally_defined_item	X	X	X	X	X	X	X	X	X	X	X	X
externally_defined_plant_item_definition	X	X				X	X	X	X	X	X	X
externally_defined_plant_system	X	X				X	X	X				
externally_defined_representation_item	X	X	X	X	X	X	X	X	X	X	X	X
externally_defined_symbol												
externally_defined_text_font												
externally_defined_tile_style												
fill_area_style												
fill_area_style_colour												
fill_area_style_hatching												
fill_area_style_tile_symbol_with_style												
fill_area_style_tiles												
functional_volume_service_case								X	X	X	X	X
geometric_representation_context	X	X			X	X	X	X	X	X	X	X

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
geometric_representation_item	X	X			X	X	X	X	X	X	X	X
global_unit_assigned_context	X	X			X	X	X	X	X	X	X	X
graphical_transformation												
group	X	X	X	X	X	X	X	X	X	X	X	X
group_assignment	X	X	X	X	X	X	X	X	X	X	X	X
group_relationship	X	X	X	X	X	X	X	X	X	X	X	X
group_role	X	X	X	X	X	X	X	X	X	X	X	X
heat_exchanger_component										X		
heat_exchanger_internal_data										X		
heat_transfer_equipment										X		
hyperbola												
identification_assignment	X	X	X	X	X	X	X	X	X	X	X	X
identification_role	X	X	X	X	X	X	X	X	X	X	X	X
inspection_and_tests								X	X	X	X	X
instrumentation_and_control_system						X	X	X				
interphase	X	X	X	X	X	X	X					
intersection_description												
invisibility												
item_defined_transformation								X	X	X	X	X
known_source	X	X	X	X	X	X	X	X	X	X	X	X

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
length_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X	X
length_unit	X	X	X	X	X	X	X	X	X	X	X	X
line												
local_time	X	X	X		X	X	X					
logical_operation												
luminous_intensity_measure_with_unit	X	X		X	X	X	X	X	X	X	X	X
luminous_intensity_unit	X	X		X	X	X	X	X	X	X	X	X
make_from_usage_option	X	X	X		X	X	X	X	X		X	X
mapped_item								X	X	X	X	X
mass_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X	X
mass_unit	X	X	X	X	X	X	X	X	X	X	X	X
material_amount_reference_time					X	X						
material_designation	X	X	X	X	X	X	X	X	X	X	X	X
material_designation_characterization	X	X	X	X	X	X	X	X	X	X	X	X
material_property	X	X	X	X	X	X	X	X	X	X	X	X
material_property_representation	X	X	X	X	X	X	X	X	X	X	X	X
measure_representation_item	X	X	X	X	X	X	X	X	X	X	X	X
measure_with_unit	X	X	X	X	X	X	X	X	X	X	X	X
molecular_structural_group		X	X	X	X	X	X					
named_unit	X	X	X	X	X	X	X	X	X	X	X	X

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
next_assembly_usage_occurrence								X	X	X	X	X
nozzle									X	X	X	X
offset_curve_2d												
one_direction_repeat_factor												
organization	X	X	X		X	X	X	X		X		X
organization_assignment	X	X	X		X	X	X	X		X		X
organization_relationship	X	X	X		X	X	X	X		X		X
organization_role	X	X	X		X	X	X	X		X		X
organizational_project	X	X	X		X	X	X	X		X		X
parabola												
particle_size_distribution_values	X	X			X	X	X					
person	X	X	X		X	X	X					
person_and_organization	X	X	X		X	X	X					
person_assignment	X	X	X		X	X	X					
person_role	X	X	X		X	X	X					
phase	X	X	X	X	X	X	X					
phases_in_equilibrium_group_assignment	X	X			X	X	X					
piping_connector_classification								X	X	X	X	X
placement	X	X			X	X	X	X	X	X	X	X
planar_box												

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
planar_extent												
plant	X	X			X	X	X	X	X	X	X	X
plant_item_reference_time	X	X			X	X						
point	X	X			X	X	X	X	X	X	X	X
point_on_curve												
point_style												
polyline												
port_service_case	X	X			X	X	X	X	X	X	X	X
pre_defined_colour												
pre_defined_curve_font												
pre_defined_item												
pre_defined_text_font												
precision_qualifier	X	X	X	X	X	X	X	X	X	X	X	X
presentation_area												
presentation_layer_assignment												
presentation_layer_usage												
presentation_representation												
presentation_representation_relationship												
presentation_scaled_placement												
presentation_set												

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
presentation_size												
presentation_style_assignment												
presentation_style_by_context												
presentation_view												
presentation_with_association												
presented_item												
presented_item_association												
presented_item_representation												
presented_item_with_association												
process_definition_reference_time	X	X			X	X						
process_design_case	X	X			X	X	X	X	X	X	X	X
process_design_case_resource	X	X			X	X	X	X	X	X	X	X
process_design_property_value	X	X	X	X	X	X	X	X	X	X	X	X
process_material	X	X	X	X	X	X	X	X	X	X	X	X
process_material_reference_time	X	X	X	X	X	X						
process_port	X	X			X	X	X		X	X	X	X
process_port_connection	X	X			X	X	X		X	X	X	X
process_product_association	X	X		X	X	X	X		X	X	X	X
process_property_association	X	X			X	X	X		X	X	X	X
process_resource_plant_item	X	X			X	X	X	X	X	X	X	X

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
process_simulation					X	X						
process_simulation_reference_time					X	X						
product	X	X	X	X	X	X	X		X	X	X	X
product_category												
product_category_relationship												
product_context	X	X	X	X	X	X	X	X	X	X	X	X
product_data_representation_view												
product_definition	X	X	X	X	X	X	X	X	X	X	X	X
product_definition_context	X	X	X	X	X	X	X	X	X	X	X	X
product_definition_formation	X	X	X	X	X	X	X	X	X	X	X	X
product_definition_process	X	X		X	X	X	X		X	X	X	X
product_definition_relationship	X	X	X	X	X	X	X	X	X	X	X	X
product_definition_shape	X	X			X	X	X	X	X	X	X	X
product_definition_usage	X	X	X		X	X	X	X	X	X	X	X
product_definition_with_associated_documents			X					X	X		X	X
product_related_product_category												
property_definition	X	X	X	X	X	X	X	X	X	X	X	X
property_definition_relationship	X	X	X	X	X	X	X	X	X	X	X	X
property_definition_representation	X	X	X	X	X	X	X	X	X	X	X	X
property_process	X	X			X	X	X	X	X	X	X	X

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
qualified_representation_item	X	X	X	X	X	X		X	X	X	X	X
quantified_assembly_component_usage			X									
quasi_uniform_curve												
ratio_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X	X
ratio_unit	X	X	X	X	X	X	X	X	X	X	X	X
rational_b_spline_curve												
reactor_yield					X	X	X	X	X	X	X	X
reference_state		X	X	X	X	X	X					
representation	X	X	X	X	X	X	X	X	X	X	X	X
representation_context	X	X	X	X	X	X	X	X	X	X	X	X
representation_item	X	X	X	X	X	X	X	X	X	X	X	X
representation_item_relationship	X	X	X		X	X	X					
representation_map								X	X		X	X
representation_relationship	X	X	X	X	X	X	X	X	X	X	X	X
representation_relationship_with_transformation								X	X	X	X	X
requirement_for_action_resource	X	X		X	X	X	X		X	X	X	X
reserved_space								X		X		
resource_property	X	X		X	X	X	X		X	X	X	X
resource_property_relationship	X	X		X	X	X	X		X	X	X	X
resource_property_representation	X	X		X	X	X	X		X	X	X	X

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
resource_requirement_type	X	X		X	X	X	X		X	X	X	X
separation_tower												
separation_tray_component_definition												
separation_tray_component_feature												
separation_tray_component_feature_definition												
shape_aspect	X	X			X	X	X	X	X	X	X	X
shape_aspect_relationship	X	X			X	X	X	X	X	X	X	X
shape_representation	X	X			X	X	X	X	X	X	X	X
si_unit	X	X	X	X	X	X	X	X	X	X	X	X
simulated_process_definition												
site	X	X		X	X	X	X	X	X	X	X	X
site_reference_time	X	X			X	X						
site_standard_condition	X	X		X	X	X	X	X	X	X	X	X
sited_plant	X	X			X	X	X	X				
solid_angle_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X	X
solid_angle_unit	X	X	X	X	X	X	X	X	X	X	X	X
solids_storage_bin												
specific_equation	X	X	X	X	X	X	X					
specific_phase	X	X	X	X	X	X	X					
stage_column_section							X					

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
stream	X	X	X		X	X	X		X		X	
stream_reference_time	X	X	X	X	X	X						
stream_separation_specification	X	X	X		X	X	X		X		X	
stream_split_specification	X	X	X		X	X	X		X		X	
styled_item												
symbol_colour												
symbol_representation												
symbol_representation_map												
symbol_representation_relationship												
symbol_style												
symbol_target												
text_literal												
text_literal_with_associated_curves												
text_literal_with_blanking_box												
text_literal_with_delineation												
text_literal_with_extent												
text_string_representation												
text_style												
text_style_for_defined_font												
text_style_with_box_characteristics												

Table 20 - Conformance class elements - part 1 (continued)

AIM Element	Conformance Class											
	1	2	3	4	5	6	7	8	9	10	11	12
text_style_with_mirror												
thermodynamic_condition	X	X	X	X	X	X	X		X	X	X	X
thermodynamic_temperature_measure_with_unit	X	X	X	X	X	X	X		X	X	X	X
thermodynamic_temperature_unit	X	X	X	X	X	X	X		X	X	X	X
thermophysical_property_classification	X	X	X	X	X	X	X		X	X	X	X
time_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X	X
time_unit	X	X	X	X	X	X	X	X	X	X	X	X
trigger	X	X			X	X	X					
trimmed_curve												
tube_type										X		
two_direction_repeat_factor												
type_qualifier	X	X	X	X	X	X	X	X	X	X	X	X
uniform_curve												
vector												
versioned_action_request	X	X			X	X	X		X		X	
volume_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X	X
volume_unit	X	X	X	X	X	X	X	X	X	X	X	X

Table 21 - Conformance class elements - part 2

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
action	X	X	X	X	X	X	X	X	X	X	X
action_assignment	X	X	X	X	X	X	X	X	X	X	X
action_method	X	X	X	X	X	X	X	X	X	X	X
action_method_assignment	X	X	X	X	X	X	X	X	X	X	X
action_method_relationship	X	X	X	X	X	X	X	X	X	X	X
action_method_role	X	X	X	X	X	X	X	X	X	X	X
action_property	X	X	X	X	X	X	X	X	X	X	X
action_property_relationship	X	X	X	X	X	X	X	X	X	X	X
action_property_representation	X	X	X	X	X	X	X	X	X	X	X
action_relationship	X	X	X	X	X	X	X	X	X	X	X
action_request_assignment											
action_request_role											
action_request_solution								X		X	X
action_resource	X	X	X	X	X	X	X	X	X	X	X
action_resource_relationship	X	X	X	X	X	X	X	X	X	X	X
action_resource_requirement											X
action_resource_type	X	X	X	X	X	X	X	X		X	X
action_role	X	X	X	X	X	X	X	X			X
amount_of_substance_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X
amount_of_substance_unit	X	X	X	X	X	X	X	X	X	X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
annotation_curve_occurrence									X	X	X
annotation_fill_area									X	X	X
annotation_fill_area_occurrence									X	X	X
annotation_occurrence									X	X	X
annotation_occurrence_relationship									X	X	X
annotation_point_occurrence									X	X	X
annotation_symbol									X	X	X
annotation_symbol_occurrence									X	X	X
annotation_text									X	X	X
annotation_text_occurrence									X	X	X
annotation_text_with_extent									X	X	X
application_context	X	X	X	X	X	X	X	X	X	X	X
application_context_element	X	X	X	X	X	X	X	X	X	X	X
application_protocol_definition	X	X	X	X	X	X	X	X	X	X	X
applied_action_assignment	X	X	X	X	X	X	X	X			X
applied_action_method_assignment	X	X	X	X	X	X	X				X
applied_approval_assignment									X	X	X
applied_certification_assignment	X	X	X	X	X	X	X				X
applied_date_assignment								X		X	X
applied_date_time_assignment								X		X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
applied_document_reference									X	X	X
applied_group_assignment	X	X	X	X	X	X	X	X	X	X	X
applied_identification_assignment	X	X	X	X	X	X	X	X	X	X	X
applied_organization_assignment		X		X	X		X		X	X	X
applied_person_assignment									X	X	X
approval									X	X	X
approval_assignment									X	X	X
approval_date_time									X	X	X
approval_date_time_role									X	X	X
approval_person_organization									X	X	X
approval_role									X	X	X
approval_status									X	X	X
approver_role									X	X	X
area_in_set									X	X	X
area_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X
area_unit	X	X	X	X	X	X	X	X	X	X	X
assembly_component_usage	X	X	X	X	X	X	X				X
axis2_placement_2d	X	X	X	X	X	X	X		X	X	X
axis2_placement_3d	X	X	X	X	X	X	X			X	X
b_spline_curve				X	X				X	X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
b_spline_curve_with_knots				X	X				X	X	X
bezier_curve				X	X				X	X	X
bin_section							X			X	X
boot							X			X	X
bounded_curve				X	X				X	X	X
calendar_date								X	X	X	X
camera_model									X	X	X
camera_model_d2									X	X	X
camera_model_d2_shape_clipping									X	X	X
cartesian_point	X	X	X	X	X	X	X		X	X	X
certification	X	X	X	X	X	X	X				X
certification_assignment	X	X	X	X	X	X	X				X
certification_role	X	X	X	X	X	X	X				X
certification_type	X	X	X	X	X	X	X				X
characterized_object	X	X	X	X	X	X	X	X	X	X	X
circle				X	X				X	X	X
classification_assignment	X	X	X	X	X	X	X	X	X	X	X
colour									X	X	X
colour_rgb									X	X	X
colour_specification									X	X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
composite_curve				X	X				X	X	X
composite_curve_segment				X	X				X	X	X
compound_representation_item	X	X	X	X	X	X	X	X		X	X
conic				X	X				X	X	
connector_end_type_classification	X	X	X	X	X	X	X			X	X
context_dependent_invisibility									X	X	X
context_dependent_unit	X	X	X	X	X	X	X	X	X	X	X
control_objective								X		X	X
control_scheme								X		X	X
conversion_based_unit	X	X	X	X	X	X	X	X		X	X
coordinated_universal_time_offset									X	X	X
curve				X					X	X	X
curve_style									X	X	X
curve_style_font									X	X	X
curve_style_font_pattern									X	X	X
data_curve	X	X	X	X	X	X	X	X		X	X
data_environment	X	X	X	X	X	X	X	X			X
date								X	X	X	X
date_and_time								X	X	X	X
date_and_time_assignment								X		X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
date_assignment								X		X	X
date_role								X		X	X
date_time_role								X		X	X
defined_symbol									X	X	X
derived_unit	X	X	X	X	X	X	X	X	X	X	X
derived_unit_element	X	X	X	X	X	X	X	X	X	X	X
descriptive_representation_item	X	X	X	X	X	X	X	X	X	X	X
dimensional_exponents	X	X	X	X	X	X	X	X	X	X	X
direction	X	X	X	X	X	X	X		X	X	X
document	X	X	X	X	X	X	X		X	X	X
document_reference	X	X	X	X	X	X	X		X	X	X
document_relationship	X	X	X	X	X	X	X		X	X	X
document_role	X	X	X	X	X	X	X		X	X	X
document_type	X	X	X	X	X	X	X		X	X	X
document_usage_constraint	X	X	X	X	X	X	X		X	X	X
document_with_properties											X
drawing_definition									X	X	X
drawing_revision									X	X	X
drawing_revision_sequence									X	X	X
drawing_sheet_revision									X	X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
drawing_sheet_revision_usage									X	X	X
electric_current_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X
electric_current_unit	X	X	X	X	X	X	X	X	X	X	X
ellipse				X	X				X	X	X
equipment_port	X	X	X	X	X	X	X			X	X
event_sequence_with_condition	X	X	X	X	X	X	X		X	X	X
exchanger_zone											X
external_identification_assignment	X	X	X	X	X	X	X	X	X	X	X
external_source	X	X	X	X	X	X	X	X	X	X	X
external_source_relationship	X	X	X	X	X	X	X	X	X	X	X
externally_defined_action_method	X	X	X	X	X	X	X	X	X	X	X
externally_defined_action_resource	X	X	X	X	X	X	X	X	X	X	X
externally_defined_classification	X	X	X	X	X	X	X	X	X	X	X
externally_defined_curve_font									X	X	X
externally_defined_group	X	X	X	X	X	X	X	X	X	X	X
externally_defined_hatch_style									X	X	X
externally_defined_item	X	X	X	X	X	X	X	X	X	X	X
externally_defined_plant_item_definition	X	X	X	X	X	X	X	X		X	X
externally_defined_plant_system										X	X
externally_defined_representation_item	X	X	X	X	X	X	X	X	X	X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
externally_defined_symbol									X	X	X
externally_defined_text_font									X	X	X
externally_defined_tile_style									X	X	X
fill_area_style									X	X	X
fill_area_style_colour									X	X	X
fill_area_style_hatching									X	X	X
fill_area_style_tile_symbol_with_style									X	X	X
fill_area_style_tiles									X	X	X
functional_volume_service_case	X	X	X	X	X	X	X		X	X	X
geometric_representation_context	X	X	X	X	X	X	X	X	X	X	X
geometric_representation_item	X	X	X	X	X	X	X	X	X	X	X
global_unit_assigned_context	X	X	X	X	X	X	X	X	X	X	X
graphical_transformation									X	X	X
group	X	X	X	X	X	X	X	X	X	X	X
group_assignment	X	X	X	X	X	X	X	X	X	X	X
group_relationship	X	X	X	X	X	X	X	X	X	X	X
group_role	X	X	X	X	X	X	X	X	X	X	X
heat_exchanger_component										X	X
heat_exchanger_internal_data										X	X
heat_transfer_equipment										X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
hyperbola				X	X				X	X	X
identification_assignment	X	X	X	X	X	X	X	X	X	X	X
identification_role	X	X	X	X	X	X	X	X	X	X	X
inspection_and_tests	X	X	X	X	X	X	X			X	X
instrumentation_and_control_system										X	X
interphase											X
intersection_description							X		X	X	X
invisibility									X	X	X
item_defined_transformation	X	X	X	X	X	X	X		X	X	X
known_source	X	X	X	X	X	X	X	X	X	X	X
length_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X
length_unit	X	X	X	X	X	X	X	X	X	X	X
line									X	X	X
local_time								X	X	X	X
logical_operation								X		X	X
luminous_intensity_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X
luminous_intensity_unit	X	X	X	X	X	X	X	X	X	X	X
make_from_usage_option	X	X	X	X	X	X	X				X
mapped_item	X	X	X	X	X	X	X		X	X	X
mass_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
mass_unit	X	X	X	X	X	X	X	X	X	X	X
material_amount_reference_time									X	X	X
material_designation	X	X	X	X	X	X	X	X	X	X	X
material_designation_characterization	X	X	X	X	X	X	X	X	X	X	X
material_property	X	X	X	X	X	X	X	X	X	X	X
material_property_representation	X	X	X	X	X	X	X	X	X	X	X
measure_representation_item	X	X	X	X	X	X	X	X	X	X	X
measure_with_unit	X	X	X	X	X	X	X	X	X	X	X
molecular_structural_group											X
named_unit	X	X	X	X	X	X	X	X	X	X	X
next_assembly_usage_occurrence	X	X	X	X	X	X	X				X
nozzle	X	X	X	X	X	X	X		X	X	X
offset_curve_2d									X	X	X
one_direction_repeat_factor									X	X	X
organization		X		X	X	X			X	X	X
organization_assignment		X		X	X	X			X	X	X
organization_relationship		X		X	X	X			X	X	X
organization_role		X		X	X	X			X	X	X
organizational_project		X		X	X	X			X	X	X
parabola				X	X				X	X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
particle_size_distribution_values									X	X	X
person									X	X	X
person_and_organization									X	X	X
person_assignment									X	X	X
person_role									X	X	X
phase								X	X	X	X
phases_in_equilibrium_group_assignment								X	X	X	X
piping_connector_classification	X	X	X	X	X	X	X		X	X	X
placement	X	X	X	X	X	X	X		X	X	X
planar_box									X	X	X
planar_extent									X	X	X
plant	X	X	X	X	X	X	X			X	X
plant_item_reference_time									X	X	X
point	X	X	X	X	X	X	X		X	X	X
point_on_curve				X	X				X	X	X
point_style									X	X	X
polyline				X	X				X	X	X
port_service_case	X	X	X	X	X	X	X				X
pre_defined_colour									X	X	X
pre_defined_curve_font									X	X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
pre_defined_item									X	X	X
pre_defined_text_font									X	X	X
precision_qualifier	X	X	X	X	X	X	X	X	X	X	X
presentation_area									X	X	X
presentation_layer_assignment									X	X	X
presentation_layer_usage									X	X	X
presentation_representation									X	X	X
presentation_representation_relationship									X	X	X
presentation_scaled_placement									X	X	X
presentation_set									X	X	X
presentation_size									X	X	X
presentation_style_assignment									X	X	X
presentation_style_by_context									X	X	X
presentation_view									X	X	X
presentation_with_association									X	X	X
presented_item									X	X	X
presented_item_association									X	X	X
presented_item_representation									X	X	X
presented_item_with_association									X	X	X
process_definition_reference_time								X	X	X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
process_design_case	X	X	X	X	X	X	X				X
process_design_case_resource	X	X	X	X	X	X	X				X
process_design_property_value	X	X	X	X	X	X	X	X	X	X	X
process_material	X	X	X	X	X	X	X	X	X	X	X
process_material_reference_time									X	X	X
process_port	X	X	X	X	X	X	X		X	X	X
process_port_connection	X	X	X	X	X	X	X		X	X	X
process_product_association	X	X	X	X	X	X	X	X	X	X	X
process_property_association	X	X	X	X	X	X	X	X	X	X	X
process_resource_plant_item	X	X	X	X	X	X	X	X	X	X	X
process_simulation									X	X	X
process_simulation_reference_time									X	X	X
product	X	X	X	X	X	X	X	X	X	X	X
product_category											
product_category_relationship											
product_context	X	X	X	X	X	X	X	X	X	X	X
product_data_representation_view									X	X	X
product_definition	X	X	X	X	X	X	X	X	X	X	X
product_definition_context	X	X	X	X	X	X	X	X	X	X	X
product_definition_formation	X	X	X	X	X	X	X	X	X	X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
product_definition_process	X	X	X	X	X	X	X		X	X	X
product_definition_relationship	X	X	X	X	X	X	X	X	X	X	X
product_definition_shape	X	X	X	X	X	X	X		X	X	X
product_definition_usage	X	X	X	X	X	X	X			X	X
product_definition_with_associated_documents	X	X	X	X	X	X	X		X	X	X
product_related_product_category											
property_definition	X	X	X	X	X	X	X	X	X	X	X
property_definition_relationship	X	X	X	X	X	X	X	X	X	X	X
property_definition_representation	X	X	X	X	X	X	X	X	X	X	X
property_process	X	X	X	X	X	X	X	X	X	X	X
qualified_representation_item	X	X	X	X	X	X	X	X	X	X	X
quantified_assembly_component_usage	X	X	X	X	X	X	X				X
quasi_uniform_curve				X	X				X	X	X
ratio_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X
ratio_unit	X	X	X	X	X	X	X	X	X	X	X
rational_b_spline_curve				X	X				X	X	X
reactor_yield	X	X	X	X	X	X	X		X	X	X
reference_state								X	X	X	X
representation	X	X	X	X	X	X	X	X	X	X	X
representation_context	X	X	X	X	X	X	X	X	X	X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
representation_item	X	X	X	X	X	X	X	X	X	X	X
representation_item_relationship									X	X	X
representation_map	X	X	X	X	X	X	X		X	X	X
representation_relationship	X	X	X	X	X	X	X	X	X	X	X
representation_relationship_with_transformation	X	X	X	X	X	X	X		X	X	X
requirement_for_action_resource	X	X	X	X	X		X				X
reserved_space									X	X	X
resource_property	X	X	X	X	X	X	X	X	X	X	X
resource_property_relationship	X	X	X	X	X	X	X	X	X	X	X
resource_property_representation	X	X	X	X	X	X	X	X	X	X	X
resource_requirement_type	X	X	X	X	X	X	X		X	X	X
separation_tower				X	X					X	X
separation_tray_component_definition				X						X	X
separation_tray_component_feature				X						X	X
separation_tray_component_feature_definition				X							X
shape_aspect	X	X	X	X	X	X	X		X	X	X
shape_aspect_relationship	X	X	X	X	X	X	X		X	X	X
shape_representation	X	X	X	X	X	X	X		X	X	X
si_unit	X	X	X	X	X	X	X	X	X	X	X
simulated_process_definition									X	X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
site	X	X	X	X	X	X	X	X	X	X	X
site_reference_time								X	X	X	X
site_standard_condition	X	X	X	X	X	X	X	X	X	X	X
sited_plant										X	X
solid_angle_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X
solid_angle_unit	X	X	X	X	X	X	X	X	X	X	X
solids_storage_bin							X			X	X
specific_equation									X	X	X
specific_phase								X	X	X	X
stage_column_section	X		X			X			X	X	X
stream	X		X			X		X	X	X	X
stream_reference_time									X	X	X
stream_separation_specification	X		X			X			X	X	X
stream_split_specification	X		X			X			X	X	X
styled_item									X	X	X
symbol_colour									X	X	X
symbol_representation									X	X	X
symbol_representation_map									X	X	X
symbol_representation_relationship									X	X	X
symbol_style									X	X	X

Table 21 - Conformance class elements - part 2 (continued)

AIM Element	Conformance Class										
	13	14	15	16	17	18	19	20	21	22	23
symbol_target									X	X	X
text_literal									X	X	X
text_literal_with_associated_curves									X	X	X
text_literal_with_blanking_box									X	X	X
text_literal_with_delineation									X	X	X
text_literal_with_extent									X	X	X
text_string_representation									X	X	X
text_style									X	X	X
text_style_for_defined_font									X	X	X
text_style_with_box_characteristics									X	X	X
text_style_with_mirror									X	X	X
thermodynamic_condition	X	X	X	X	X	X	X		X	X	X
thermodynamic_temperature_measure_with_unit	X	X	X	X	X	X	X		X	X	X
thermodynamic_temperature_unit	X	X	X	X	X	X	X		X	X	X
thermophysical_property_classification	X	X	X	X	X	X	X		X	X	X
time_measure_with_unit	X	X	X	X	X	X	X		X	X	X
time_unit	X	X	X	X	X	X	X		X	X	X
trigger								X	X	X	X
trimmed_curve									X	X	X
tube_type										X	X

Table 20 - Conformance class elements - part 1 (concluded)

AIM Element	Conformance Class										
	13	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
two_direction_repeat_factor									X	X	X
type_qualifier	X	X	X	X	X	X	X		X	X	X
uniform_curve									X	X	X
vector				X	X				X	X	X
versioned_action_request	X		X			X		X			X
volume_measure_with_unit	X	X	X	X	X	X	X	X	X	X	X
volume_unit	X	X	X	X	X	X	X	X	X	X	X

Annex A
(normative)

AIM EXPRESS expanded listing

The following EXPRESS is the expanded form of the short form schema given in 5.2. In the event of any discrepancy between the short form and this expanded listing, the expanded listing shall be used.

```
SCHEMA conceptual_process_design;

  TYPE action_item = SELECT
    (product_definition);
  END_TYPE; -- action_item

  TYPE action_method_item = SELECT
    (action_resource,
     product);
  END_TYPE; -- action_method_item

  TYPE ahead_or_behind = ENUMERATION OF
    (ahead,
     behind);
  END_TYPE; -- ahead_or_behind

  TYPE amount_of_substance_measure = REAL;
  END_TYPE; -- amount_of_substance_measure

  TYPE approved_item = SELECT
    (document,
     measure_representation_item,
     representation);
  END_TYPE; -- approved_item

  TYPE area_measure = REAL;
  END_TYPE; -- area_measure

  TYPE area_or_view = SELECT
    (presentation_area,
     presentation_view);
  END_TYPE; -- area_or_view

  TYPE associated_item = SELECT
    (action_method,
     action_resource_requirement,
     equipment_port,
     organizational_project,
     process_port,
     product_definition,
     representation,
     representation_item,
     stream);
  END_TYPE; -- associated_item

  TYPE attribute_type = SELECT
    (label,
     text);
  END_TYPE; -- attribute_type

  TYPE axis2_placement = SELECT
    (axis2_placement_2d,
     axis2_placement_3d);
```

```
  END_TYPE; -- axis2_placement

  TYPE b_spline_curve_form = ENUMERATION OF
    (polyline_form,
     circular_arc,
     elliptic_arc,
     parabolic_arc,
     hyperbolic_arc,
     unspecified);
  END_TYPE; -- b_spline_curve_form

  TYPE box_characteristic_select = SELECT
    (box_height,
     box_width,
     box_slant_angle,
     box_rotate_angle);
  END_TYPE; -- box_characteristic_select

  TYPE box_height = positive_ratio_measure;
  END_TYPE; -- box_height

  TYPE box_rotate_angle = plane_angle_measure;
  END_TYPE; -- box_rotate_angle

  TYPE box_slant_angle = plane_angle_measure;
  END_TYPE; -- box_slant_angle

  TYPE box_width = positive_ratio_measure;
  END_TYPE; -- box_width

  TYPE certified_item = SELECT
    (action);
  END_TYPE; -- certified_item

  TYPE character_spacing_select = SELECT
    (length_measure,
     ratio_measure,
     measure_with_unit);
  END_TYPE; -- character_spacing_select

  TYPE character_style_select = SELECT
    (text_style_for_defined_font);
  END_TYPE; -- character_style_select

  TYPE characterized_action_definition = SELECT
    (action,
     action_method,
     action_method_relationship,
     action_relationship,
     process_product_association,
     process_property_association);
  END_TYPE; -- characterized_action_definition

  TYPE characterized_definition = SELECT
    (characterized_object,
     characterized_product_definition,
     shape_definition);
  END_TYPE; -- characterized_definition

  TYPE characterized_material_property = SELECT
    (material_property_representation);
  END_TYPE; -- characterized_material_property

  TYPE characterized_product_definition = SELECT
```

```
  (product_definition,
   product_definition_relationship);
END_TYPE; -- characterized_product_definition

TYPE characterized_resource_definition = SELECT
  (action_resource,
   action_resource_relationship,
   action_resource_requirement);
END_TYPE; -- characterized_resource_definition

TYPE classified_item = SELECT
  (action,
   action_method,
   action_property,
   action_property_representation,
   action_resource,
   compound_representation_item,
   material_designation,
   product,
   product_definition,
   product_definition_relationship,
   property_definition,
   representation,
   representation_context,
   shape_aspect,
   shape_aspect_relationship);
END_TYPE; -- classified_item

TYPE compound_item_definition = SELECT
  (list_representation_item,
   set_representation_item);
END_TYPE; -- compound_item_definition

TYPE condition_definition = SELECT
  (action_property_representation,
   property_definition_representation,
   resource_property_representation);
END_TYPE; -- condition_definition

TYPE context_dependent_measure = REAL;
END_TYPE; -- context_dependent_measure

TYPE count_measure = NUMBER;
END_TYPE; -- count_measure

TYPE curve_font_or_scaled_curve_font_select = SELECT
  (curve_style_font_select);
END_TYPE; -- curve_font_or_scaled_curve_font_select

TYPE curve_or_annotation_curve_occurrence = SELECT
  (curve,
   annotation_curve_occurrence);
END_TYPE; -- curve_or_annotation_curve_occurrence

TYPE curve_or_render = SELECT
  (curve_style);
END_TYPE; -- curve_or_render

TYPE curve_style_font_select = SELECT
  (curve_style_font,
   pre_defined_curve_font,
   externally_defined_curve_font);
END_TYPE; -- curve_style_font_select
```

```
  TYPE date_time_item = SELECT
    (applied_date_time_assignment,
     date_and_time,
     material_amount_reference_time,
     plant_item_reference_time,
     process_definition_reference_time,
     process_material_reference_time,
     process_simulation_reference_time,
     site_reference_time);
  END_TYPE; -- date_time_item

  TYPE date_time_select = SELECT
    (date,
     local_time,
     date_and_time);
  END_TYPE; -- date_time_select

  TYPE dated_item = SELECT
    (document);
  END_TYPE; -- dated_item

  TYPE day_in_month_number = INTEGER;
  END_TYPE; -- day_in_month_number

  TYPE defined_symbol_select = SELECT
    (externally_defined_symbol);
  END_TYPE; -- defined_symbol_select

  TYPE dimension_count = INTEGER;
  WHERE
    wr1: (SELF > 0);
  END_TYPE; -- dimension_count

  TYPE document_reference_item = SELECT
    (action,
     action_method,
     action_property,
     measure_representation_item,
     property_definition,
     representation);
  END_TYPE; -- document_reference_item

  TYPE draughting_titled_item = SELECT
    (drawing_revision,
     drawing_sheet_revision);
  END_TYPE; -- draughting_titled_item

  TYPE electric_current_measure = REAL;
  END_TYPE; -- electric_current_measure

  TYPE equilibrium_item = SELECT
    (specific_phase);
  END_TYPE; -- equilibrium_item

  TYPE expression_operand = SELECT
    (measure_with_unit);
  END_TYPE; -- expression_operand

  TYPE fill_area_style_tile_shape_select = SELECT
    (fill_area_style_tile_symbol_with_style);
  END_TYPE; -- fill_area_style_tile_shape_select

  TYPE fill_style_select = SELECT
    (fill_area_style_colour,
```

```
   externally_defined_tile_style,
   fill_area_style_tiles,
   externally_defined_hatch_style,
   fill_area_style_hatching);
END_TYPE; -- fill_style_select

TYPE font_select = SELECT
  (pre_defined_text_font,
   externally_defined_text_font);
END_TYPE; -- font_select

TYPE grouped_item = SELECT
  (action,
   action_method,
   action_resource,
   characterized_object,
   material_designation,
   process_material,
   product,
   product_definition,
   property_definition,
   representation,
   representation_context,
   representation_item,
   shape_aspect);
END_TYPE; -- grouped_item

TYPE hiding_or_blanking_select = SELECT
  (presentation_area,
   presentation_view,
   product_data_representation_view,
   annotation_fill_area);
END_TYPE; -- hiding_or_blanking_select

TYPE hour_in_day = INTEGER;
WHERE
  wr1: ((0 <= SELF) AND (SELF < 24));
END_TYPE; -- hour_in_day

TYPE identified_item = SELECT
  (material_amount_reference_time,
   plant_item_reference_time,
   process_definition_reference_time,
   process_material_reference_time,
   process_simulation_reference_time,
   product,
   representation_item,
   site_reference_time);
END_TYPE; -- identified_item

TYPE identifier = STRING;
END_TYPE; -- identifier

TYPE invisibility_context = SELECT
  (presentation_layer_usage,
   presentation_representation,
   presentation_set);
END_TYPE; -- invisibility_context

TYPE invisible_item = SELECT
  (styled_item,
   presentation_layer_assignment,
   presentation_representation);
END_TYPE; -- invisible_item
```

```
  TYPE knot_type = ENUMERATION OF
    (uniform_knots,
     unspecified,
     quasi_uniform_knots,
     piecewise_bezier_knots);
  END_TYPE; -- knot_type

  TYPE label = STRING;
  END_TYPE; -- label

  TYPE layered_item = SELECT
    (presentation_representation,
     representation_item);
  END_TYPE; -- layered_item

  TYPE length_measure = REAL;
  END_TYPE; -- length_measure

  TYPE list_representation_item = LIST [1:?] OF representation_item;
  END_TYPE; -- list_representation_item

  TYPE luminous_intensity_measure = REAL;
  END_TYPE; -- luminous_intensity_measure

  TYPE marker_select = SELECT
    (marker_type);
  END_TYPE; -- marker_select

  TYPE marker_type = ENUMERATION OF
    (dot,
     x,
     plus,
     asterisk,
     ring,
     square,
     triangle);
  END_TYPE; -- marker_type

  TYPE mass_measure = REAL;
  END_TYPE; -- mass_measure

  TYPE measure_value = SELECT
    (length_measure,
     mass_measure,
     time_measure,
     electric_current_measure,
     thermodynamic_temperature_measure,
     amount_of_substance_measure,
     luminous_intensity_measure,
     plane_angle_measure,
     solid_angle_measure,
     area_measure,
     volume_measure,
     ratio_measure,
     parameter_value,
     numeric_measure,
     context_dependent_measure,
     positive_length_measure,
     positive_plane_angle_measure,
     positive_ratio_measure,
     count_measure);
  END_TYPE; -- measure_value

  TYPE minute_in_hour = INTEGER;
```

```
WHERE
  wr1: ((0 <= SELF) AND (SELF <= 59));
END_TYPE; -- minute_in_hour

TYPE month_in_year_number = INTEGER;
WHERE
  wr1: ((1 <= SELF) AND (SELF <= 12));
END_TYPE; -- month_in_year_number

TYPE numeric_measure = NUMBER;
END_TYPE; -- numeric_measure

TYPE organization_item = SELECT
  (action,
   action_resource,
   document,
   product_definition,
   site);
END_TYPE; -- organization_item

TYPE parameter_value = REAL;
END_TYPE; -- parameter_value

TYPE person_item = SELECT
  (document,
   site);
END_TYPE; -- person_item

TYPE person_organization_select = SELECT
  (person,
   organization,
   person_and_organization);
END_TYPE; -- person_organization_select

TYPE plane_angle_measure = REAL;
END_TYPE; -- plane_angle_measure

TYPE positive_length_measure = length_measure;
WHERE
  wr1: (SELF > 0);
END_TYPE; -- positive_length_measure

TYPE positive_plane_angle_measure = plane_angle_measure;
WHERE
  wr1: (SELF > 0);
END_TYPE; -- positive_plane_angle_measure

TYPE positive_ratio_measure = ratio_measure;
WHERE
  wr1: (SELF > 0);
END_TYPE; -- positive_ratio_measure

TYPE presentable_text = STRING;
END_TYPE; -- presentable_text

TYPE presentation_representation_select = SELECT
  (presentation_representation,
   presentation_set);
END_TYPE; -- presentation_representation_select

TYPE presentation_size_assignment_select = SELECT
  (presentation_view,
   presentation_area,
   area_in_set);
```

```
  END_TYPE; -- presentation_size_assignment_select

  TYPE presentation_style_select = SELECT
    (point_style,
     curve_style,
     symbol_style,
     fill_area_style,
     text_style);
  END_TYPE; -- presentation_style_select

  TYPE presented_item_select = SELECT
    (action_method);
  END_TYPE; -- presented_item_select

  TYPE property_or_shape_select = SELECT
    (property_definition,
     shape_definition);
  END_TYPE; -- property_or_shape_select

  TYPE ratio_measure = REAL;
  END_TYPE; -- ratio_measure

  TYPE represented_definition = SELECT
    (property_definition,
     property_definition_relationship,
     shape_aspect,
     shape_aspect_relationship);
  END_TYPE; -- represented_definition

  TYPE second_in_minute = REAL;
  WHERE
    wr1: ((0 <= SELF) AND (SELF <= 60));
  END_TYPE; -- second_in_minute

  TYPE set_representation_item = SET [1:?] OF representation_item;
  END_TYPE; -- set_representation_item

  TYPE shape_definition = SELECT
    (product_definition_shape,
     shape_aspect,
     shape_aspect_relationship);
  END_TYPE; -- shape_definition

  TYPE si_prefix = ENUMERATION OF
    (exa,
     peta,
     tera,
     giga,
     mega,
     kilo,
     hecto,
     deca,
     deci,
     centi,
     milli,
     micro,
     nano,
     pico,
     femto,
     atto);
  END_TYPE; -- si_prefix

  TYPE si_unit_name = ENUMERATION OF
    (metre,
```

```
   gram,
   second,
   ampere,
   kelvin,
   mole,
   candela,
   radian,
   steradian,
   hertz,
   newton,
   pascal,
   joule,
   watt,
   coulomb,
   volt,
   farad,
   ohm,
   siemens,
   weber,
   tesla,
   henry,
   degree_celsius,
   lumen,
   lux,
   becquerel,
   gray,
   sievert);
END_TYPE; -- si_unit_name

TYPE size_select = SELECT
  (positive_length_measure,
   measure_with_unit);
END_TYPE; -- size_select

TYPE solid_angle_measure = REAL;
END_TYPE; -- solid_angle_measure

TYPE source_item = SELECT
  (identifier);
END_TYPE; -- source_item

TYPE style_context_select = SELECT
  (representation,
   representation_item,
   presentation_set);
END_TYPE; -- style_context_select

TYPE supported_item = SELECT
  (action,
   action_method);
END_TYPE; -- supported_item

TYPE symbol_style_select = SELECT
  (symbol_colour);
END_TYPE; -- symbol_style_select

TYPE text = STRING;
END_TYPE; -- text

TYPE text_alignment = label;
END_TYPE; -- text_alignment

TYPE text_delineation = label;
END_TYPE; -- text_delineation
```

```
  TYPE text_or_character = SELECT
    (annotation_text,
     text_literal);
  END_TYPE; -- text_or_character

  TYPE text_path = ENUMERATION OF
    (left,
     right,
     up,
     down);
  END_TYPE; -- text_path

  TYPE thermodynamic_temperature_measure = REAL;
  END_TYPE; -- thermodynamic_temperature_measure

  TYPE time_measure = REAL;
  END_TYPE; -- time_measure

  TYPE transformation = SELECT
    (item_defined_transformation);
  END_TYPE; -- transformation

  TYPE transition_code = ENUMERATION OF
    (discontinuous,
     continuous,
     cont_same_gradient,
     cont_same_gradient_same_curvature);
  END_TYPE; -- transition_code

  TYPE trimming_preference = ENUMERATION OF
    (cartesian,
     parameter,
     unspecified);
  END_TYPE; -- trimming_preference

  TYPE trimming_select = SELECT
    (cartesian_point,
     parameter_value);
  END_TYPE; -- trimming_select

  TYPE unit = SELECT
    (named_unit,
     derived_unit);
  END_TYPE; -- unit

  TYPE value_qualifier = SELECT
    (precision_qualifier,
     type_qualifier);
  END_TYPE; -- value_qualifier

  TYPE vector_or_direction = SELECT
    (vector,
     direction);
  END_TYPE; -- vector_or_direction

  TYPE volume_measure = REAL;
  END_TYPE; -- volume_measure

  TYPE year_number = INTEGER;
  END_TYPE; -- year_number

  ENTITY action;
      id             : identifier;
      name           : label;
```

```
    description   : text;
    chosen_method : action_method;
END_ENTITY; -- action

ENTITY action_assignment
  ABSTRACT SUPERTYPE;
    assigned_action : action;
    role            : action_role;
END_ENTITY; -- action_assignment

ENTITY action_method;
    name        : label;
    description : text;
    consequence : text;
    purpose     : text;
END_ENTITY; -- action_method

ENTITY action_method_assignment
  ABSTRACT SUPERTYPE;
    assigned_action_method : action_method;
    role                   : action_method_role;
END_ENTITY; -- action_method_assignment

ENTITY action_method_relationship;
    name            : label;
    description     : text;
    relating_method : action_method;
    related_method  : action_method;
END_ENTITY; -- action_method_relationship

ENTITY action_method_role;
    name        : label;
    description : text;
END_ENTITY; -- action_method_role

ENTITY action_property;
    name        : label;
    description : text;
    definition  : characterized_action_definition;
END_ENTITY; -- action_property

ENTITY action_property_relationship;
    name                     : label;
    description              : text;
    relating_action_property : action_property;
    related_action_property  : action_property;
  WHERE
    wr1: (relating_action_property :<>: related_action_property);
END_ENTITY; -- action_property_relationship

ENTITY action_property_representation;
    name           : label;
    description    : text;
    property       : action_property;
    representation : representation;
END_ENTITY; -- action_property_representation

ENTITY action_relationship;
    name            : label;
    description     : text;
    relating_action : action;
    related_action  : action;
END_ENTITY; -- action_relationship
```

```
  ENTITY action_request_assignment
    ABSTRACT SUPERTYPE;
      assigned_action_request : versioned_action_request;
      role                    : action_request_role;
  END_ENTITY; -- action_request_assignment

  ENTITY action_request_role;
      name        : label;
      description : text;
  END_ENTITY; -- action_request_role

  ENTITY action_request_solution;
      name        : label;
      description : text;
      method      : action_method;
      request     : versioned_action_request;
  END_ENTITY; -- action_request_solution

  ENTITY action_resource;
      name        : label;
      description : text;
      usage       : SET [1:?] OF supported_item;
      kind        : action_resource_type;
  END_ENTITY; -- action_resource

  ENTITY action_resource_relationship;
      name              : label;
      description       : text;
      relating_resource : action_resource;
      related_resource  : action_resource;
  END_ENTITY; -- action_resource_relationship

  ENTITY action_resource_requirement;
      name        : label;
      description : text;
      kind        : resource_requirement_type;
      operations  : SET [1:?] OF characterized_action_definition;
  END_ENTITY; -- action_resource_requirement

  ENTITY action_resource_type;
      name : label;
  END_ENTITY; -- action_resource_type

  ENTITY action_role;
      name        : label;
      description : text;
  END_ENTITY; -- action_role

  ENTITY amount_of_substance_measure_with_unit
    SUBTYPE OF (measure_with_unit);
    WHERE
      wr1: ('CONCEPTUAL_PROCESS_DESIGN.AMOUNT_OF_SUBSTANCE_UNIT' IN
                TYPEOF(SELF\measure_with_unit.unit_component));
  END_ENTITY; -- amount_of_substance_measure_with_unit

  ENTITY amount_of_substance_unit
    SUBTYPE OF (named_unit);
    WHERE
      wr1: ((SELF\named_unit.dimensions.length_exponent = 0) AND (SELF\
                named_unit.dimensions.mass_exponent = 0) AND (SELF\
                named_unit.dimensions.time_exponent = 0) AND (SELF\
                named_unit.dimensions.electric_current_exponent = 0) AND (
                SELF\named_unit.dimensions.
                thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
```

```
            .dimensions.amount_of_substance_exponent = 1) AND (SELF\
            named_unit.dimensions.luminous_intensity_exponent = 0));
END_ENTITY; -- amount_of_substance_unit

ENTITY annotation_curve_occurrence
  SUBTYPE OF (annotation_occurrence);
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.CURVE' IN TYPEOF(SELF\styled_item.
           item));
END_ENTITY; -- annotation_curve_occurrence

ENTITY annotation_fill_area
  SUBTYPE OF (geometric_representation_item);
    boundaries : SET [1:?] OF curve;
END_ENTITY; -- annotation_fill_area

ENTITY annotation_fill_area_occurrence
  SUBTYPE OF (annotation_occurrence);
    fill_style_target : point;
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.ANNOTATION_FILL_AREA' IN TYPEOF(
           SELF.item));
END_ENTITY; -- annotation_fill_area_occurrence

ENTITY annotation_occurrence
  SUPERTYPE OF (ONEOF (annotation_point_occurrence,
      annotation_curve_occurrence,annotation_fill_area_occurrence,
      annotation_text_occurrence,annotation_symbol_occurrence))
  SUBTYPE OF (styled_item);
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.GEOMETRIC_REPRESENTATION_ITEM' IN
           TYPEOF(SELF));
END_ENTITY; -- annotation_occurrence

ENTITY annotation_occurrence_relationship;
    name                          : label;
    description                   : text;
    relating_annotation_occurrence : annotation_occurrence;
    related_annotation_occurrence  : annotation_occurrence;
END_ENTITY; -- annotation_occurrence_relationship

ENTITY annotation_point_occurrence
  SUBTYPE OF (annotation_occurrence);
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.POINT' IN TYPEOF(SELF\styled_item.
           item));
END_ENTITY; -- annotation_point_occurrence

ENTITY annotation_symbol
  SUBTYPE OF (mapped_item);
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.SYMBOL_REPRESENTATION_MAP' IN
           TYPEOF(SELF\mapped_item.mapping_source));
    wr2: ('CONCEPTUAL_PROCESS_DESIGN.SYMBOL_TARGET' IN TYPEOF(SELF\
           mapped_item.mapping_target));
    wr3: ('CONCEPTUAL_PROCESS_DESIGN.GEOMETRIC_REPRESENTATION_ITEM' IN
           TYPEOF(SELF));
END_ENTITY; -- annotation_symbol

ENTITY annotation_symbol_occurrence
  SUBTYPE OF (annotation_occurrence);
  WHERE
    wr1: (SIZEOF(['CONCEPTUAL_PROCESS_DESIGN.ANNOTATION_SYMBOL',
           'CONCEPTUAL_PROCESS_DESIGN.DEFINED_SYMBOL'] * TYPEOF(SELF\
```

```
              styled_item.item)) > 0);
  END_ENTITY; -- annotation_symbol_occurrence

  ENTITY annotation_text
    SUBTYPE OF (mapped_item);
    WHERE
      wr1: ('CONCEPTUAL_PROCESS_DESIGN.AXIS2_PLACEMENT' IN TYPEOF(SELF\
              mapped_item.mapping_target));
      wr2: ('CONCEPTUAL_PROCESS_DESIGN.TEXT_STRING_REPRESENTATION' IN

TYPEOF(SELF\mapped_item.mapping_source.mapped_representation));
      wr3: ('CONCEPTUAL_PROCESS_DESIGN.GEOMETRIC_REPRESENTATION_ITEM' IN
              TYPEOF(SELF));
  END_ENTITY; -- annotation_text

  ENTITY annotation_text_occurrence
    SUBTYPE OF (annotation_occurrence);
    WHERE
      wr1: (SIZEOF(['CONCEPTUAL_PROCESS_DESIGN.TEXT_LITERAL',
              'CONCEPTUAL_PROCESS_DESIGN.ANNOTATION_TEXT',
              'CONCEPTUAL_PROCESS_DESIGN.ANNOTATION_TEXT_CHARACTER',
              'CONCEPTUAL_PROCESS_DESIGN.DEFINED_CHARACTER_GLYPH',
              'CONCEPTUAL_PROCESS_DESIGN.COMPOSITE_TEXT'] * TYPEOF(SELF\
              styled_item.item)) > 0);
  END_ENTITY; -- annotation_text_occurrence

  ENTITY annotation_text_with_extent
    SUBTYPE OF (annotation_text);
      extent : planar_extent;
  END_ENTITY; -- annotation_text_with_extent

  ENTITY application_context;
      name        : label;
      description : text;
    INVERSE
      context_elements : SET [1:?] OF application_context_element FOR
                           frame_of_reference;
  END_ENTITY; -- application_context

  ENTITY application_context_element
    SUPERTYPE OF (ONEOF (product_context,product_definition_context));
      name              : label;
      frame_of_reference : SET [1:?] OF application_context;
  END_ENTITY; -- application_context_element

  ENTITY application_protocol_definition;
      status                                 : label;
      application_interpreted_model_schema_name : label;
      application_protocol_year              : year_number;
      application                            : SET [1:?] OF
                                                   application_context;
  END_ENTITY; -- application_protocol_definition

  ENTITY applied_action_assignment
    SUBTYPE OF (action_assignment);
      items : SET [1:?] OF action_item;
  END_ENTITY; -- applied_action_assignment

  ENTITY applied_action_method_assignment
    SUBTYPE OF (action_method_assignment);
      items : SET [1:?] OF action_method_item;
  END_ENTITY; -- applied_action_method_assignment

  ENTITY applied_approval_assignment
```

```
  SUBTYPE OF (approval_assignment);
    items : SET [1:?] OF approved_item;
END_ENTITY; -- applied_approval_assignment

ENTITY applied_certification_assignment
  SUBTYPE OF (certification_assignment);
    items : SET [1:?] OF certified_item;
END_ENTITY; -- applied_certification_assignment

ENTITY applied_date_assignment
  SUBTYPE OF (date_assignment);
    items : SET [1:?] OF dated_item;
END_ENTITY; -- applied_date_assignment

ENTITY applied_date_time_assignment
  SUBTYPE OF (date_and_time_assignment);
    items : SET [1:?] OF date_time_item;
END_ENTITY; -- applied_date_time_assignment

ENTITY applied_document_reference
  SUBTYPE OF (document_reference);
    items : SET [1:?] OF document_reference_item;
END_ENTITY; -- applied_document_reference

ENTITY applied_group_assignment
  SUBTYPE OF (group_assignment);
    items : SET [1:?] OF grouped_item;
END_ENTITY; -- applied_group_assignment

ENTITY applied_identification_assignment
  SUBTYPE OF (identification_assignment);
    items : SET [1:?] OF identified_item;
END_ENTITY; -- applied_identification_assignment

ENTITY applied_organization_assignment
  SUBTYPE OF (organization_assignment);
    items : SET [1:?] OF organization_item;
END_ENTITY; -- applied_organization_assignment

ENTITY applied_person_assignment
  SUBTYPE OF (person_assignment);
    items : SET [1:?] OF person_item;
END_ENTITY; -- applied_person_assignment

ENTITY approval;
    status : approval_status;
    level  : label;
END_ENTITY; -- approval

ENTITY approval_assignment
  ABSTRACT SUPERTYPE;
    assigned_approval : approval;
    role              : approval_role;
END_ENTITY; -- approval_assignment

ENTITY approval_date_time;
    date_time      : date_time_select;
    dated_approval : approval;
    role           : approval_date_time_role;
END_ENTITY; -- approval_date_time

ENTITY approval_date_time_role;
    name        : label;
    description : text;
```

```
  END_ENTITY; -- approval_date_time_role

  ENTITY approval_person_organization;
      person_organization : person_organization_select;
      authorized_approval : approval;
      role                : approver_role;
  END_ENTITY; -- approval_person_organization

  ENTITY approval_role;
      name        : label;
      description : text;
  END_ENTITY; -- approval_role

  ENTITY approval_status;
      name : label;
  END_ENTITY; -- approval_status

  ENTITY approver_role;
      name        : label;
      description : text;
  END_ENTITY; -- approver_role

  ENTITY area_in_set;
      area   : presentation_area;
      in_set : presentation_set;
  END_ENTITY; -- area_in_set

  ENTITY area_measure_with_unit
    SUBTYPE OF (measure_with_unit);
    WHERE
      wr1: ('CONCEPTUAL_PROCESS_DESIGN.AREA_UNIT' IN TYPEOF(SELF\
              measure_with_unit.unit_component));
  END_ENTITY; -- area_measure_with_unit

  ENTITY area_unit
    SUBTYPE OF (named_unit);
    WHERE
      wr1: ((SELF\named_unit.dimensions.length_exponent = 2) AND (SELF\
                named_unit.dimensions.mass_exponent = 0) AND (SELF\
                named_unit.dimensions.time_exponent = 0) AND (SELF\
                named_unit.dimensions.electric_current_exponent = 0) AND (
                SELF\named_unit.dimensions.
                thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
                .dimensions.amount_of_substance_exponent = 0) AND (SELF\
                named_unit.dimensions.luminous_intensity_exponent = 0));
  END_ENTITY; -- area_unit

  ENTITY assembly_component_usage
    SUPERTYPE OF (next_assembly_usage_occurrence)
    SUBTYPE OF (product_definition_usage);
      reference_designator : OPTIONAL identifier;
  END_ENTITY; -- assembly_component_usage

  ENTITY axis2_placement_2d
    SUBTYPE OF (placement);
      ref_direction : OPTIONAL direction;
    DERIVE
      p : LIST [2:2] OF direction := build_2axes(ref_direction);
    WHERE
      wr1: (SELF\geometric_representation_item.dim = 2);
  END_ENTITY; -- axis2_placement_2d

  ENTITY axis2_placement_3d
    SUBTYPE OF (placement);
```

```
    axis          : OPTIONAL direction;
    ref_direction : OPTIONAL direction;
  DERIVE
    p : LIST [3:3] OF direction := build_axes(axis,ref_direction);
  WHERE
    wr1: (SELF\placement.location.dim = 3);
    wr2: ((NOT EXISTS(axis)) OR (axis.dim = 3));
    wr3: ((NOT EXISTS(ref_direction)) OR (ref_direction.dim = 3));
    wr4: ((NOT EXISTS(axis)) OR (NOT EXISTS(ref_direction)) OR (
            cross_product(axis,ref_direction).magnitude > 0));
END_ENTITY; -- axis2_placement_3d

ENTITY b_spline_curve
  SUPERTYPE OF (ONEOF (uniform_curve,b_spline_curve_with_knots,
     quasi_uniform_curve,bezier_curve) ANDOR rational_b_spline_curve)
  SUBTYPE OF (bounded_curve);
    degree              : INTEGER;
    control_points_list : LIST [2:?] OF cartesian_point;
    curve_form          : b_spline_curve_form;
    closed_curve        : LOGICAL;
    self_intersect      : LOGICAL;
  DERIVE
    upper_index_on_control_points : INTEGER := SIZEOF(
                                       control_points_list) - 1;
    control_points               : ARRAY [0:
                                       upper_index_on_control_points] OF
                                        cartesian_point := list_to_array(
                                       control_points_list,0,
                                       upper_index_on_control_points);
  WHERE
    wr1: (('CONCEPTUAL_PROCESS_DESIGN.UNIFORM_CURVE' IN TYPEOF(SELF)) OR
              ('CONCEPTUAL_PROCESS_DESIGN.QUASI_UNIFORM_CURVE' IN TYPEOF(
            SELF)) OR ('CONCEPTUAL_PROCESS_DESIGN.BEZIER_CURVE' IN
            TYPEOF(SELF)) OR (
            'CONCEPTUAL_PROCESS_DESIGN.B_SPLINE_CURVE_WITH_KNOTS' IN
            TYPEOF(SELF)));
END_ENTITY; -- b_spline_curve

ENTITY b_spline_curve_with_knots
  SUBTYPE OF (b_spline_curve);
    knot_multiplicities : LIST [2:?] OF INTEGER;
    knots               : LIST [2:?] OF parameter_value;
    knot_spec           : knot_type;
  DERIVE
    upper_index_on_knots : INTEGER := SIZEOF(knots);
  WHERE
    wr1: constraints_param_b_spline(degree,upper_index_on_knots,
              upper_index_on_control_points,knot_multiplicities,knots);
    wr2: (SIZEOF(knot_multiplicities) = upper_index_on_knots);
END_ENTITY; -- b_spline_curve_with_knots

ENTITY bezier_curve
  SUBTYPE OF (b_spline_curve);
END_ENTITY; -- bezier_curve

ENTITY bin_section
  SUBTYPE OF (product_definition);
  WHERE
    wr1: (SIZEOF(QUERY ( pdr <* USEDIN(SELF,
             'CONCEPTUAL_PROCESS_DESIGN.' +
             'PRODUCT_DEFINITION_RELATIONSHIP.RELATED_PRODUCT_DEFINITION')
              | ('CONCEPTUAL_PROCESS_DESIGN.SOLIDS_STORAGE_BIN' IN
            TYPEOF(pdr.relating_product_definition)) )) = 1);
    wr2: (SIZEOF(QUERY ( pd <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
```

```
            + 'PROPERTY_DEFINITION.DEFINITION') | (
            'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
            TYPEOF(pd)) )) = 1);
      wr3: (SIZEOF(QUERY ( pds <* QUERY ( pd <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION')
             | ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
            TYPEOF(pd)) ) | (SIZEOF(USEDIN(pds,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION')) = 1) )) =
            1);
      wr4: (SIZEOF(QUERY ( pds <* QUERY ( pd <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION')
             | ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
            TYPEOF(pd)) ) | (SIZEOF(QUERY ( pdr <* USEDIN(pds,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') | (SIZEOF(
            QUERY ( it <* pdr.used_representation.items | (
            'CONCEPTUAL_PROCESS_DESIGN.GEOMETRIC_REPRESENTATION_ITEM' IN
            TYPEOF(it)) )) = 2) )) = 1) )) = 1);
      wr5: (SIZEOF(QUERY ( pds <* QUERY ( pd <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION')
             | ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
            TYPEOF(pd)) ) | (SIZEOF(QUERY ( pdr <* USEDIN(pds,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') | (SIZEOF(
            QUERY ( it <* pdr.used_representation.items | (it.name =
            'upper cross section') )) = 1) )) = 1) )) = 1);
      wr6: (SIZEOF(QUERY ( pds <* QUERY ( pd <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION')
             | ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
            TYPEOF(pd)) ) | (SIZEOF(QUERY ( pdr <* USEDIN(pds,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') | (SIZEOF(
            QUERY ( it <* pdr.used_representation.items | (it.name =
            'lower cross section') )) = 1) )) = 1) )) = 1);
      wr7: (SIZEOF(QUERY ( pds <* QUERY ( pd <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION')
             | ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
            TYPEOF(pd)) ) | (SIZEOF(QUERY ( pdr <* USEDIN(pds,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') | (SIZEOF(
            QUERY ( it <* pdr.used_representation.items | (NOT (SIZEOF(
            TYPEOF(it) * ['CONCEPTUAL_PROCESS_DESIGN.POLYLINE',
            'CONCEPTUAL_PROCESS_DESIGN.CIRCLE',
            'CONCEPTUAL_PROCESS_DESIGN.ELLIPSE',
            'CONCEPTUAL_PROCESS_DESIGN.B_SPLINE_CURVE',
            'CONCEPTUAL_PROCESS_DESIGN.COMPOSITE_CURVE',
            'CONCEPTUAL_PROCESS_DESIGN.TRIMMED_CURVE']) = 1)) )) = 0) ))
            = 1) )) = 1);
      wr8: (SIZEOF(QUERY ( pds <* QUERY ( pd <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION')
             | ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
            TYPEOF(pd)) ) | (SIZEOF(QUERY ( pdr <* USEDIN(pds,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') | (SIZEOF(
            QUERY ( cc <* QUERY ( it <* pdr.used_representation.items |
            ('CONCEPTUAL_PROCESS_DESIGN.COMPOSITE_CURVE' IN TYPEOF(it)) )
             | (NOT (SIZEOF(QUERY ( seg <* cc.segments | (SIZEOF(TYPEOF(
            seg) * ['CONCEPTUAL_PROCESS_DESIGN.POLYLINE',
            'CONCEPTUAL_PROCESS_DESIGN.CIRCLE',
            'CONCEPTUAL_PROCESS_DESIGN.ELLIPSE',
            'CONCEPTUAL_PROCESS_DESIGN.B_SPLINE_CURVE',
            'CONCEPTUAL_PROCESS_DESIGN.TRIMMED_CURVE']) = 1) )) = 0)) ))
            = 1) )) = 1) )) = 1);
```

```
END_ENTITY; -- bin_section

ENTITY boot
  SUBTYPE OF (product_definition);
  WHERE
    wr1: (SELF.frame_of_reference.name = 'functional occurrence');
    wr2: (SIZEOF(QUERY ( ca <* USEDIN(SELF.formation.of_product,
            'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
             | (ca.assigned_group.name = 'process vessel') )) = 1);
    wr3: (SIZEOF(QUERY ( ca <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
             | (ca.assigned_group.name = 'boot') )) = 1);
    wr4: (SIZEOF(QUERY ( ownership <* QUERY ( pdr <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'PRODUCT_DEFINITION_RELATIONSHIP.RELATED_PRODUCT_DEFINITION')
             | (pdr.name = 'boot ownership') ) | (SIZEOF(QUERY ( ca <*
           USEDIN(ownership.relating_product_definition,
            'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
             | class_name_in_hierarchy(ca.assigned_group.name,
            'cylindrical pressure vessel section') )) = 1) )) >= 2);
END_ENTITY; -- boot

ENTITY bounded_curve
  SUPERTYPE OF (ONEOF (polyline,b_spline_curve,trimmed_curve,
      composite_curve))
  SUBTYPE OF (curve);
END_ENTITY; -- bounded_curve

ENTITY calendar_date
  SUBTYPE OF (date);
    day_component   : day_in_month_number;
    month_component : month_in_year_number;
  WHERE
    wr1: valid_calendar_date(SELF);
END_ENTITY; -- calendar_date

ENTITY camera_model
  SUPERTYPE OF (camera_model_d2)
  SUBTYPE OF (geometric_representation_item);
  WHERE
    wr1: ((SIZEOF(USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.' +
             'ITEM_DEFINED_TRANSFORMATION.' + 'TRANSFORM_ITEM_1')) +
            SIZEOF(USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.' +
             'REPRESENTATION_MAP.MAPPING_ORIGIN'))) > 0);
    wr2: (SIZEOF(USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.' +
             'STYLED_ITEM.ITEM')) = 0);
END_ENTITY; -- camera_model

ENTITY camera_model_d2
  SUBTYPE OF (camera_model);
    view_window          : planar_box;
    view_window_clipping : BOOLEAN;
  WHERE
    wr1: (SELF\geometric_representation_item.dim = 2);
END_ENTITY; -- camera_model_d2

ENTITY camera_model_d2_shape_clipping
  SUBTYPE OF (camera_model_d2);
    shape_clipping : curve;
END_ENTITY; -- camera_model_d2_shape_clipping

ENTITY cartesian_point
  SUBTYPE OF (point);
    coordinates : LIST [1:3] OF length_measure;
```

```
  END_ENTITY; -- cartesian_point

  ENTITY certification;
      name    : label;
      purpose : text;
      kind    : certification_type;
  END_ENTITY; -- certification

  ENTITY certification_assignment
    ABSTRACT SUPERTYPE;
      assigned_certification : certification;
      role                   : certification_role;
  END_ENTITY; -- certification_assignment

  ENTITY certification_role;
      name        : label;
      description : text;
  END_ENTITY; -- certification_role

  ENTITY certification_type;
      description : label;
  END_ENTITY; -- certification_type

  ENTITY characterized_object;
      name        : label;
      description : text;
  END_ENTITY; -- characterized_object

  ENTITY characterized_object_relationship;
      name            : label;
      description     : text;
      relating_object : characterized_object;
      related_object  : characterized_object;
  END_ENTITY; -- characterized_object_relationship

  ENTITY circle
    SUBTYPE OF (conic);
      radius : positive_length_measure;
  END_ENTITY; -- circle

  ENTITY classification_assignment
    SUBTYPE OF (group_assignment);
      items : SET [1:?] OF classified_item;
  END_ENTITY; -- classification_assignment

  ENTITY colour;
  END_ENTITY; -- colour

  ENTITY colour_rgb
    SUBTYPE OF (colour_specification);
      red   : REAL;
      green : REAL;
      blue  : REAL;
    WHERE
      wr1: ((0 <= red) AND (red <= 1));
      wr2: ((0 <= green) AND (green <= 1));
      wr3: ((0 <= blue) AND (blue <= 1));
  END_ENTITY; -- colour_rgb

  ENTITY colour_specification
    SUBTYPE OF (colour);
      name : label;
  END_ENTITY; -- colour_specification
```

```
ENTITY composite_curve
  SUBTYPE OF (bounded_curve);
    segments       : LIST [1:?] OF composite_curve_segment;
    self_intersect : LOGICAL;
  DERIVE
    n_segments   : INTEGER := SIZEOF(segments);
    closed_curve : LOGICAL := segments[n_segments].transition <>
                        discontinuous;
  WHERE
    wr1: (((NOT closed_curve) AND (SIZEOF(QUERY ( temp <* segments | (
              temp.transition = discontinuous) )) = 1)) OR (closed_curve
              AND (SIZEOF(QUERY ( temp <* segments | (temp.transition =
              discontinuous) )) = 0)));
END_ENTITY; -- composite_curve

ENTITY composite_curve_segment;
    transition   : transition_code;
    same_sense   : BOOLEAN;
    parent_curve : curve;
  INVERSE
    using_curves : BAG [1:?] OF composite_curve FOR segments;
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.BOUNDED_CURVE' IN TYPEOF(
              parent_curve));
END_ENTITY; -- composite_curve_segment

ENTITY compound_representation_item
  SUBTYPE OF (representation_item);
    item_element : compound_item_definition;
END_ENTITY; -- compound_representation_item

ENTITY conic
  SUPERTYPE OF (ONEOF (circle,ellipse,hyperbola,parabola))
  SUBTYPE OF (curve);
    position : axis2_placement;
END_ENTITY; -- conic

ENTITY connector_end_type_classification
  SUBTYPE OF (group);
END_ENTITY; -- connector_end_type_classification

ENTITY context_dependent_invisibility
  SUBTYPE OF (invisibility);
    presentation_context : invisibility_context;
END_ENTITY; -- context_dependent_invisibility

ENTITY context_dependent_unit
  SUBTYPE OF (named_unit);
    name : label;
END_ENTITY; -- context_dependent_unit

ENTITY control_objective
  SUBTYPE OF (action_request_solution, characterized_object);
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.CONTROL_SCHEME' IN TYPEOF(SELF.
              request));
    wr2: (SIZEOF(QUERY ( ca <* USEDIN(SELF.method,
              'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
               | (ca.assigned_group.name IN ['control loop',
              'control logic']) )) = 1);
    wr3: (SIZEOF(QUERY ( pd <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
              + 'PROPERTY_DEFINITION.DEFINITION') | (pd.name =
              'controlled variables') )) = 1);
END_ENTITY; -- control_objective
```

```
  ENTITY control_scheme
    SUBTYPE OF (versioned_action_request);
    WHERE
      wr1: (SELF.description IN ['continuous','discrete']);
      wr2: (SIZEOF(QUERY ( ars <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
              + 'ACTION_REQUEST_SOLUTION.REQUEST') | (
              'CONCEPTUAL_PROCESS_DESIGN.CONTROL_OBJECTIVE'
              IN TYPEOF(ars)) )) >= 1);
      wr3: ((NOT (SELF.description = 'continuous')) OR (SIZEOF(
              QUERY ( co <* QUERY ( ars <* USEDIN(SELF,
              'CONCEPTUAL_PROCESS_DESIGN.ACTION_REQUEST_SOLUTION.REQUEST')
               | ('CONCEPTUAL_PROCESS_DESIGN.CONTROL_OBJECTIVE' IN TYPEOF(
              ars)) ) | (NOT (SIZEOF(QUERY ( ca <* USEDIN(co.method,
              'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
               | (NOT (ca.assigned_group.name = 'control loop')) ))
              = 0)) )) = 0));
      wr4: ((NOT (SELF.description = 'discrete')) OR (SIZEOF(
              QUERY ( co <* QUERY ( ars <* USEDIN(SELF,
              'CONCEPTUAL_PROCESS_DESIGN.ACTION_REQUEST_SOLUTION.REQUEST')
               | ('CONCEPTUAL_PROCESS_DESIGN.CONTROL_OBJECTIVE' IN TYPEOF(
              ars)) ) | (NOT (SIZEOF(QUERY ( ca <* USEDIN(co.method,
              'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
               | (NOT (ca.assigned_group.name = 'control logic')) ))
              = 0)) )) = 0));
  END_ENTITY; -- control_scheme

  ENTITY conversion_based_unit
    SUBTYPE OF (named_unit);
      name              : label;
      conversion_factor : measure_with_unit;
  END_ENTITY; -- conversion_based_unit

  ENTITY coordinated_universal_time_offset;
      hour_offset   : hour_in_day;
      minute_offset : OPTIONAL minute_in_hour;
      sense         : ahead_or_behind;
  END_ENTITY; -- coordinated_universal_time_offset

  ENTITY curve
    SUPERTYPE OF (ONEOF (line,conic,offset_curve_2d))
    SUBTYPE OF (geometric_representation_item);
  END_ENTITY; -- curve

  ENTITY curve_style;
      name         : label;
      curve_font   : curve_font_or_scaled_curve_font_select;
      curve_width  : size_select;
      curve_colour : colour;
  END_ENTITY; -- curve_style

  ENTITY curve_style_font;
      name         : label;
      pattern_list : LIST [1:?] OF curve_style_font_pattern;
  END_ENTITY; -- curve_style_font

  ENTITY curve_style_font_pattern;
      visible_segment_length   : positive_length_measure;
      invisible_segment_length : positive_length_measure;
  END_ENTITY; -- curve_style_font_pattern

  ENTITY data_curve
    SUBTYPE OF (representation);
  WHERE
    WR1: SIZEOF (QUERY (it <* SELF.items |
```

```
        NOT (SIZEOF (['CONCEPTUAL_PROCESS_DESIGN.' +
        'COMPOUND_REPRESENTATION_ITEM',
        'CONCEPTUAL_PROCESS_DESIGN.MAPPED_ITEM'] *
        TYPEOF (it)) = 1))) = 0;
  WR2: SIZEOF (QUERY (cri <* QUERY (it <* SELF.items |
        'CONCEPTUAL_PROCESS_DESIGN.COMPOUND_REPRESENTATION_ITEM' IN
        TYPEOF (it)) |
        NOT ('CONCEPTUAL_PROCESS_DESIGN.LIST_REPRESENTATION_ITEM' IN
        TYPEOF (cri.item_element)))) = 0;
  WR3: SIZEOF (QUERY (cri <* QUERY (it <* SELF.items |
        'CONCEPTUAL_PROCESS_DESIGN.COMPOUND_REPRESENTATION_ITEM' IN
        TYPEOF (it)) |
        NOT (SIZEOF (QUERY (el <* cri.item_element |
        NOT ('CONCEPTUAL_PROCESS_DESIGN.MEASURE_REPRESENTATION_ITEM' IN
        TYPEOF (el)))) = 0))) = 0;
  WR4: SIZEOF (QUERY (cri <* QUERY (it <* SELF.items |
        'CONCEPTUAL_PROCESS_DESIGN.COMPOUND_REPRESENTATION_ITEM' IN
        TYPEOF (it)) |
        NOT (SIZEOF (QUERY (el <* cri.item_element |
        NOT (SIZEOF (QUERY (vu <* QUERY (aga <* USEDIN (el,
        'CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT.ITEMS') |
        aga.role.name = 'variable usage') |
        vu.assigned_group.name IN
        ['independent', 'dependent', 'fixed'])) = 1))) = 0))) = 0;
  WR5: SIZEOF (QUERY (mi <* QUERY (it <* SELF.items |
        'CONCEPTUAL_PROCESS_DESIGN.MAPPED_ITEM' IN TYPEOF (it)) |
        NOT ('CONCEPTUAL_PROCESS_DESIGN.DATA_CURVE' IN
        TYPEOF (mi.mapping_source.mapped_representation)))) = 0;
END_ENTITY; -- data curve

ENTITY data_environment;
    name        : label;
    description : text;
    elements    : SET [1:?] OF condition_definition;
END_ENTITY; -- data_environment

ENTITY date
  SUPERTYPE OF (calendar_date);
    year_component : year_number;
END_ENTITY; -- date

ENTITY date_and_time;
    date_component : date;
    time_component : local_time;
END_ENTITY; -- date_and_time

ENTITY date_and_time_assignment
  ABSTRACT SUPERTYPE;
    assigned_date_and_time : date_and_time;
    role                   : date_time_role;
END_ENTITY; -- date_and_time_assignment

ENTITY date_assignment
  ABSTRACT SUPERTYPE;
    assigned_date : date;
    role          : date_role;
END_ENTITY; -- date_assignment

ENTITY date_role;
    name        : label;
    description : text;
END_ENTITY; -- date_role

ENTITY date_time_role;
```

```
    name        : label;
    description : text;
END_ENTITY; -- date_time_role

ENTITY defined_symbol
  SUBTYPE OF (geometric_representation_item);
    definition : defined_symbol_select;
    target     : symbol_target;
END_ENTITY; -- defined_symbol

ENTITY derived_unit;
    name     : label;
    elements : SET [1:?] OF derived_unit_element;
  WHERE
    wr1: ((SIZEOF(elements) > 1) OR ((SIZEOF(elements) = 1) AND (
              elements[1].exponent <> 1)));
END_ENTITY; -- derived_unit

ENTITY derived_unit_element;
    unit     : named_unit;
    exponent : REAL;
END_ENTITY; -- derived_unit_element

ENTITY descriptive_representation_item
  SUBTYPE OF (representation_item);
    description : text;
END_ENTITY; -- descriptive_representation_item

ENTITY dimensional_exponents;
    length_exponent                   : REAL;
    mass_exponent                     : REAL;
    time_exponent                     : REAL;
    electric_current_exponent         : REAL;
    thermodynamic_temperature_exponent : REAL;
    amount_of_substance_exponent      : REAL;
    luminous_intensity_exponent       : REAL;
END_ENTITY; -- dimensional_exponents

ENTITY direction
  SUBTYPE OF (geometric_representation_item);
    direction_ratios : LIST [2:3] OF REAL;
  WHERE
    wr1: (SIZEOF(QUERY ( tmp <* direction_ratios | (tmp <> 0) )) > 0);
END_ENTITY; -- direction

ENTITY document;
    id          : identifier;
    name        : label;
    description : text;
    kind        : document_type;
END_ENTITY; -- document

ENTITY document_reference
  ABSTRACT SUPERTYPE;
    assigned_document : document;
    source            : label;
    role              : document_role;
END_ENTITY; -- document_reference

ENTITY document_relationship;
    name              : label;
    description       : text;
    relating_document : document;
    related_document  : document;
```

```
END_ENTITY; -- document_relationship

ENTITY document_role;
    name        : label;
    description : text;
END_ENTITY; -- document_role

ENTITY document_type;
    product_data_type : label;
END_ENTITY; -- document_type

ENTITY document_usage_constraint;
    source                : document;
    subject_element       : label;
    subject_element_value : text;
END_ENTITY; -- document_usage_constraint

ENTITY document_with_properties
  SUBTYPE OF (document, characterized_object);
END_ENTITY; -- document_with_properties

ENTITY drawing_definition;
    drawing_number : identifier;
    drawing_type   : OPTIONAL label;
END_ENTITY; -- drawing_definition

ENTITY drawing_revision
  SUBTYPE OF (presentation_set);
    revision_identifier : identifier;
    drawing_identifier  : drawing_definition;
    intended_scale      : OPTIONAL text;
  UNIQUE
    ur1 : revision_identifier, drawing_identifier;
END_ENTITY; -- drawing_revision

ENTITY drawing_revision_sequence;
    predecessor : drawing_revision;
    successor   : drawing_revision;
  WHERE
    wr1: (predecessor :<>: successor);
END_ENTITY; -- drawing_revision_sequence

ENTITY drawing_sheet_revision
 SUBTYPE OF (presentation_area);
  revision_identifier : identifier;
 WHERE
  wr1: (SIZEOF(QUERY ( item <* SELF\representation.items | ((
       'CONCEPTUAL_PROCESS_DESIGN.MAPPED_ITEM' IN TYPEOF(item)) AND
        ('CONCEPTUAL_PROCESS_DESIGN.DRAWING_SHEET_REVISION' IN
       TYPEOF(item\mapped_item.mapping_source.mapped_representation))) ))
       = 0);
END_ENTITY; -- drawing_sheet_revision

ENTITY drawing_sheet_revision_usage
  SUBTYPE OF (area_in_set);
    sheet_number : identifier;
  UNIQUE
    ur1 : sheet_number, in_set;
  WHERE
    wr1: (('CONCEPTUAL_PROCESS_DESIGN.DRAWING_SHEET_REVISION' IN TYPEOF(
              SELF\area_in_set.area)) AND (
              'CONCEPTUAL_PROCESS_DESIGN.DRAWING_REVISION' IN TYPEOF(SELF\
              area_in_set.in_set)));
END_ENTITY; -- drawing_sheet_revision_usage
```

```
  ENTITY electric_current_measure_with_unit
    SUBTYPE OF (measure_with_unit);
    WHERE
      wr1: ('CONCEPTUAL_PROCESS_DESIGN.ELECTRIC_CURRENT_UNIT' IN TYPEOF(
              SELF\measure_with_unit.unit_component));
  END_ENTITY; -- electric_current_measure_with_unit

  ENTITY electric_current_unit
    SUBTYPE OF (named_unit);
    WHERE
      wr1: ((SELF\named_unit.dimensions.length_exponent = 0) AND (SELF\
              named_unit.dimensions.mass_exponent = 0) AND (SELF\
              named_unit.dimensions.time_exponent = 0) AND (SELF\
              named_unit.dimensions.electric_current_exponent = 1) AND (
              SELF\named_unit.dimensions.
              thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
              .dimensions.amount_of_substance_exponent = 0) AND (SELF\
              named_unit.dimensions.luminous_intensity_exponent = 0));
  END_ENTITY; -- electric_current_unit

  ENTITY ellipse
    SUBTYPE OF (conic);
      semi_axis_1 : positive_length_measure;
      semi_axis_2 : positive_length_measure;
  END_ENTITY; -- ellipse

  ENTITY equipment_port
    SUBTYPE OF (shape_aspect);
    WHERE
      wr1: SELF.product_definitional;
      wr2: ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION' IN TYPEOF(SELF.
              of_shape.definition));
      wr3: ((SIZEOF(QUERY ( sar <* USEDIN(SELF,
              'CONCEPTUAL_PROCESS_DESIGN.' +
              'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') | (sar.
              name = 'equipment port connection') )) + SIZEOF(
              QUERY ( sar <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.' +
              'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') | (sar.
              name = 'equipment port connection') ))) <= 1);
  END_ENTITY; -- equipment_port

  ENTITY event_sequence_with_condition
    SUBTYPE OF (action_method, action_method_relationship);
  WHERE
    wr1: SIZEOF (QUERY (ap <* USEDIN (SELF, 'CONCEPTUAL_PROCESS_DESIGN.' +
              'ACTION_PROPERTY.DEFINITION') |
              ap.description = 'control logic condition')) = 1;
  END_ENTITY;

  ENTITY exchanger_zone
    SUBTYPE OF (shape_aspect);
    WHERE
      wr1: (('CONCEPTUAL_PROCESS_DESIGN.HEAT_TRANSFER_EQUIPMENT' IN
           TYPEOF(SELF.of_shape.definition)) AND (SIZEOF(QUERY ( et <*
           QUERY ( ca <* USEDIN(SELF.of_shape.definition.formation.
           of_product,
           'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
            | (ca.role.name = 'equipment type') ) | (et.assigned_group.
           name = 'shell and tube heat exchanger unit') )) = 1));
      wr2: (SIZEOF(QUERY ( pdr <* USEDIN(SELF.of_shape,
           'CONCEPTUAL_PROCESS_DESIGN.' +
           'PROPERTY_DEFINITION_RELATIONSHIP.RELATED_PROPERTY_DEFINITION')
            | (pdr.name = 'exchanger performance') )) = 1);
  END_ENTITY; -- exchanger_zone
```

```
ENTITY external_identification_assignment
  ABSTRACT SUPERTYPE
  SUBTYPE OF (identification_assignment);
    source : external_source;
END_ENTITY; -- external_identification_assignment

ENTITY external_source;
    source_id   : source_item;
    description : text;
END_ENTITY; -- external_source

ENTITY external_source_relationship;
    name            : label;
    description     : text;
    relating_source : external_source;
    related_source  : external_source;
END_ENTITY; -- external_source_relationship

ENTITY externally_defined_action_method
  SUBTYPE OF (action_method, externally_defined_item);
END_ENTITY; -- externally_defined_action_method

ENTITY externally_defined_action_resource
  SUBTYPE OF (action_resource, externally_defined_item);
END_ENTITY; -- externally_defined_action_resource

ENTITY externally_defined_classification
  SUBTYPE OF (group, externally_defined_item);
END_ENTITY; -- externally_defined_classification

ENTITY externally_defined_curve_font
  SUBTYPE OF (externally_defined_item);
END_ENTITY; -- externally_defined_curve_font

ENTITY externally_defined_group
  SUBTYPE OF (group, externally_defined_item);
END_ENTITY; -- externally_defined_group

ENTITY externally_defined_hatch_style
  SUBTYPE OF (externally_defined_item, geometric_representation_item);
END_ENTITY; -- externally_defined_hatch_style

ENTITY externally_defined_item;
    item_id : source_item;
    source  : external_source;
END_ENTITY; -- externally_defined_item

ENTITY externally_defined_plant_item_definition
  SUBTYPE OF (product_definition, externally_defined_item);
END_ENTITY; -- externally_defined_plant_item_definition

ENTITY externally_defined_plant_system
  SUBTYPE OF (product_definition, externally_defined_item);
END_ENTITY; -- externally_defined_plant_system

ENTITY externally_defined_representation_item
  SUBTYPE OF (representation_item, externally_defined_item);
END_ENTITY; -- externally_defined_representation_item

ENTITY externally_defined_symbol
  SUBTYPE OF (externally_defined_item);
END_ENTITY; -- externally_defined_symbol

ENTITY externally_defined_text_font
```

```
    SUBTYPE OF (externally_defined_item);
  END_ENTITY; -- externally_defined_text_font

  ENTITY externally_defined_tile_style
    SUBTYPE OF (externally_defined_item, geometric_representation_item);
  END_ENTITY; -- externally_defined_tile_style

  ENTITY fill_area_style;
      name        : label;
      fill_styles : SET [1:?] OF fill_style_select;
    WHERE
      wr1: (SIZEOF(QUERY ( fill_style <* SELF.fill_styles | ((
                'CONCEPTUAL_PROCESS_DESIGN.' + 'FILL_AREA_STYLE_COLOUR') IN
                TYPEOF(fill_style)) )) <= 1);
  END_ENTITY; -- fill_area_style

  ENTITY fill_area_style_colour;
      name        : label;
      fill_colour : colour;
  END_ENTITY; -- fill_area_style_colour

  ENTITY fill_area_style_hatching
    SUBTYPE OF (geometric_representation_item);
      hatch_line_appearance         : curve_style;
      start_of_next_hatch_line      : one_direction_repeat_factor;
      point_of_reference_hatch_line : cartesian_point;
      pattern_start                 : cartesian_point;
      hatch_line_angle              : plane_angle_measure;
  END_ENTITY; -- fill_area_style_hatching

  ENTITY fill_area_style_tile_symbol_with_style
    SUBTYPE OF (geometric_representation_item);
      symbol : annotation_symbol_occurrence;
  END_ENTITY; -- fill_area_style_tile_symbol_with_style

  ENTITY fill_area_style_tiles
    SUBTYPE OF (geometric_representation_item);
      tiling_pattern : two_direction_repeat_factor;
      tiles          : SET [1:?] OF fill_area_style_tile_shape_select;
      tiling_scale   : positive_ratio_measure;
  END_ENTITY; -- fill_area_style_tiles

  ENTITY functional_volume_service_case
    SUBTYPE OF (shape_aspect, action_resource);
    WHERE
      wr1: (SIZEOF(QUERY ( sar <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
                + 'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') | (
                SIZEOF(QUERY ( aga <* USEDIN(sar.relating_shape_aspect,
                'CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT.ITEMS')
                 | (NOT (aga.assigned_group.name = 'functional_volume')) ))
                = 0) )) = 1);
      wr2: (SIZEOF(QUERY ( sar <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
                + 'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') | (NOT (
                SELF.of_shape :=: sar.relating_shape_aspect.of_shape)) )) =
                0);
      wr3: (SIZEOF(QUERY ( arr <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
                + 'ACTION_RESOURCE_RELATIONSHIP.RELATED_RESOURCE') | (arr.
                relating_resource.kind.name = 'material amount') )) = 1);
      wr4: (SIZEOF(SELF.usage) = 1);
      wr5: (SIZEOF(QUERY ( si <* SELF.usage | (NOT ((
                'CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF(si)) OR
                (SIZEOF(QUERY ( aga <* USEDIN(si,
                'CONCEPTUAL_PROCESS_DESIGN.' +
                'APPLIED_GROUP_ASSIGNMENT.ITEMS') | (NOT (aga.assigned_group
```

```
            .name = 'process service')) )) = 0))) )) = 0);
END_ENTITY; -- functional_volume_service_case

ENTITY geometric_representation_context
  SUBTYPE OF (representation_context);
    coordinate_space_dimension : dimension_count;
END_ENTITY; -- geometric_representation_context

ENTITY geometric_representation_item
  SUPERTYPE OF (ONEOF (point,direction,vector,placement,curve))
  SUBTYPE OF (representation_item);
  DERIVE
    dim : dimension_count := dimension_of(SELF);
  WHERE
    wr1: (SIZEOF(QUERY ( using_rep <* using_representations(SELF) | (
          NOT ('CONCEPTUAL_PROCESS_DESIGN.' +
          'GEOMETRIC_REPRESENTATION_CONTEXT'
          IN TYPEOF(using_rep.context_of_items))) )) = 0);
END_ENTITY; -- geometric_representation_item

ENTITY global_unit_assigned_context
  SUBTYPE OF (representation_context);
    units : SET [1:?] OF unit;
END_ENTITY; -- global_unit_assigned_context

ENTITY graphical_transformation
  SUBTYPE OF (item_defined_transformation);
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.AXIS2_PLACEMENT_2D' IN TYPEOF(SELF\
            item_defined_transformation.transform_item_1));
    wr2: ('CONCEPTUAL_PROCESS_DESIGN.PRESENTATION_SCALED_PLACEMENT' IN
            TYPEOF(SELF\item_defined_transformation.transform_item_2));
END_ENTITY; -- graphical_transformation

ENTITY group;
    name        : label;
    description : text;
END_ENTITY; -- group

ENTITY group_assignment
  ABSTRACT SUPERTYPE;
    assigned_group : group;
    role           : group_role;
END_ENTITY; -- group_assignment

ENTITY group_relationship;
    name           : label;
    description    : text;
    relating_group : group;
    related_group  : group;
END_ENTITY; -- group_relationship

ENTITY group_role;
    name        : label;
    description : text;
END_ENTITY; -- group_role

ENTITY heat_exchanger_component
  SUBTYPE OF (product_definition);
  WHERE
    wr1 : (SIZEOF(QUERY ( pdr <* USEDIN(SELF,
          'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
          'RELATED_PRODUCT_DEFINITION') | (
          'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
```

```
        TYPEOF(pdr)) )) >= 1);
    wr2 : ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
        'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
         | (ca.role.name = 'equipment component type') ) | (ect.
        assigned_group.name = 'exchanger assembly') )) = 1)) OR (
        SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
        'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
        + 'RELATING_PRODUCT_DEFINITION') | (
        'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
        TYPEOF(pdr)) ) | ((
        'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
        TYPEOF(acu.related_product_definition)) AND (SIZEOF(
        QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
        related_product_definition.formation.of_product,
        'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
         | (ca.role.name = 'equipment component type') ) | (ect.
        assigned_group.name = 'reboiler piping') )) = 1)) )) <= 1));
    wr3 : ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
        'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
         | (ca.role.name = 'equipment component type') ) | (ect.
        assigned_group.name = 'exchanger assembly') )) = 1)) OR (
        SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
        'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
        + 'RELATING_PRODUCT_DEFINITION') | (
        'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
        TYPEOF(pdr)) ) | ((
        'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
        TYPEOF(acu.related_product_definition)) AND (SIZEOF(
        QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
        related_product_definition.formation.of_product,
        'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
         | (ca.role.name = 'equipment component type') ) | (ect.
        assigned_group.name = 'exchanger shell') )) = 1)) )) = 1));
    wr4 : ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
        'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
         | (ca.role.name = 'equipment component type') ) | (ect.
        assigned_group.name = 'exchanger assembly') )) = 1)) OR (
        SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
        'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
        + 'RELATING_PRODUCT_DEFINITION') | (
        'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
        TYPEOF(pdr)) ) | ((
        'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
        TYPEOF(acu.related_product_definition)) AND (SIZEOF(
        QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
        related_product_definition.formation.of_product,
        'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
         | (ca.role.name = 'equipment component type') ) | (ect.
        assigned_group.name = 'exchanger bundle') )) = 1)) )) = 1));
    wr5 : ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
        'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
         | (ca.role.name = 'equipment component type') ) | (ect.
        assigned_group.name = 'exchanger assembly') )) = 1)) OR (
        SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
        'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.' +
        'RELATED_PRODUCT_DEFINITION') | (
        'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
        TYPEOF(pdr)) ) | ((
        'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
        TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
        QUERY ( et <* QUERY ( ca <* USEDIN(acu.
        relating_product_definition.formation.of_product,
        'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
         | (ca.role.name = 'equipment type') ) | (et.assigned_group.
```

```
      name = 'shell and tube heat exchanger unit') )) = 1)) )) = 1));
wr6 : ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger bundle') )) = 1)) OR (
      SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger assembly') )) = 1)) )) = 1));
wr7 : ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger end') )) = 1)) OR (SIZEOF(
      QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger assembly') )) = 1)) )) = 1));
wr8 : ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger nozzle') )) = 1)) OR (
      SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger assembly') )) = 1)) )) = 1));
wr9 : ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger shell') )) = 1)) OR (
      SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
```

```
      assigned_group.name = 'exchanger assembly') )) = 1)) )) = 1));
wr10: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'reboiler piping') )) = 1)) OR (
      SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger assembly') )) = 1)) )) = 1));
wr11: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger bundle') )) = 1)) OR (
      SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATING_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.related_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      related_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'passlane') )) = 1)) )) <= 1));
wr12: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger bundle') )) = 1)) OR (
      SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATING_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.related_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      related_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'u bend support') )) = 1)) )) <= 1));
wr13: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger bundle') )) = 1)) OR (
      SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATING_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.related_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      related_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
```

```
      assigned_group.name = 'detuning plate') )) = 1)) )) <= 1));
wr14: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'cross baffle') )) = 1)) OR (SIZEOF(
      QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger bundle') )) = 1)) )) = 1));
wr15: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'passlane') )) = 1)) OR (SIZEOF(
      QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger bundle') )) = 1)) )) = 1));
wr16: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'u bend support') )) = 1)) OR (
      SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger bundle') )) = 1)) )) = 1));
wr17: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'detuning plate') )) = 1)) OR (
      SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
```

```
      assigned_group.name = 'exchanger bundle') )) = 1)) )) = 1));
wr18: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'longitudinal baffle') )) = 1)) OR (
      SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger bundle') )) = 1)) )) = 1));
wr19: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'tubesheet') )) = 1)) OR (SIZEOF(
      QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger bundle') )) = 1)) )) = 1));
wr20: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'tie rod') )) = 1)) OR (SIZEOF(
      QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'tubesheet') )) = 1)) )) = 1));
wr21: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'tie rod spacer') )) = 1)) OR (
      SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
```

```
      assigned_group.name = 'tie rod') )) = 1)) )) = 1));
wr22: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'tubesheet') )) = 1)) OR (SIZEOF(
      QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(pdr.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(pdr.
      relating_product_definition,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'partition seal rod') )) = 1)) ))
      <= 1));
wr23: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger end') )) = 1)) OR (SIZEOF(
      QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATING_PRODUCT_DEFINITION') | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(pdr.related_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(pdr.
      related_product_definition,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'end partition plate') )) = 1)) ))
      <= 1));
wr24: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger nozzle') )) = 1)) OR (
      SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATING_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.related_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      related_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'impingement protection') )) = 1)) ))
      <= 1));
wr25: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger nozzle') )) = 1)) OR (
      SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATING_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.related_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      related_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'distribution belt') )) = 1)) )) <= 1));
```

```
      wr26: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
             | (ca.role.name = 'equipment component type') ) | (ect.
            assigned_group.name = 'exchanger nozzle') )) = 1)) OR (
            SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
            + 'RELATING_PRODUCT_DEFINITION') | (
            'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
            TYPEOF(pdr)) ) | ((
            'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
            TYPEOF(acu.related_product_definition)) AND (SIZEOF(
            QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
            related_product_definition.formation.of_product,
            'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
             | (ca.role.name = 'equipment component type') ) | (ect.
            assigned_group.name = 'nozzle dome') )) = 1)) )) = 1));
      wr27: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
             | (ca.role.name = 'equipment component type') ) | (ect.
            assigned_group.name = 'nozzle dome') )) = 1)) OR (SIZEOF(
            QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
            + 'RELATING_PRODUCT_DEFINITION') | (
            'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
            TYPEOF(pdr)) ) | ((
            'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
            TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
            QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
            relating_product_definition.formation.of_product,
            'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
             | (ca.role.name = 'equipment component type') ) | (ect.
            assigned_group.name = 'exchanger nozzle') )) = 1)) )) = 1));
      wr28: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
             | (ca.role.name = 'equipment component type') ) | (ect.
            assigned_group.name = 'impingement protection') )) = 1)) OR
             (SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
            + 'RELATED_PRODUCT_DEFINITION') | (
            'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
            TYPEOF(pdr)) ) | ((
            'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
            TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
            QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
            relating_product_definition.formation.of_product,
            'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
             | (ca.role.name = 'equipment component type') ) | (ect.
            assigned_group.name = 'exchanger nozzle') )) = 1)) )) = 1));
      wr29: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
             | (ca.role.name = 'equipment component type') ) | (ect.
            assigned_group.name = 'distribution belt') )) = 1)) OR (
            SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
            + 'RELATED_PRODUCT_DEFINITION') | (
            'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
            TYPEOF(pdr)) ) | ((
            'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
            TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
            QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
            relating_product_definition.formation.of_product,
            'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
             | (ca.role.name = 'equipment component type') ) | (ect.
            assigned_group.name = 'exchanger nozzle') )) = 1)) )) = 1));
```

```
wr30: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'external circuit component') )) = 1))
      OR (SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'reboiler piping') )) = 1)) )) = 1));
wr31: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger shell') )) = 1)) OR (
      SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATING_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'vapour belt') )) = 1)) )) <= 1));
wr32: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger shell') )) = 1)) OR (
      SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATING_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'expansion joint') )) = 1)) )) <= 1));
wr33: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'vapour belt') )) = 1)) OR (SIZEOF(
      QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
      'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
      + 'RELATED_PRODUCT_DEFINITION') | (
      'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr)) ) | ((
      'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
      TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
      QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
      relating_product_definition.formation.of_product,
      'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
       | (ca.role.name = 'equipment component type') ) | (ect.
      assigned_group.name = 'exchanger shell') )) = 1)) )) = 1));
```

```
      wr34: ((NOT (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
             | (ca.role.name = 'equipment component type') ) | (ect.
            assigned_group.name = 'expansion joint') )) = 1)) OR (
            SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
            + 'RELATED_PRODUCT_DEFINITION') | (
            'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
            TYPEOF(pdr)) ) | ((
            'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
            TYPEOF(acu.relating_product_definition)) AND (SIZEOF(
            QUERY ( ect <* QUERY ( ca <* USEDIN(acu.
            relating_product_definition.formation.of_product,
            'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
             | (ca.role.name = 'equipment component type') ) | (ect.
            assigned_group.name = 'exchanger shell') )) = 1)) )) = 1));
  END_ENTITY; -- heat_exchanger_component

  ENTITY heat_exchanger_internal_data
    SUBTYPE OF (representation);
    WHERE
      wr1: (SIZEOF(QUERY ( apr <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
           + 'ACTION_PROPERTY_REPRESENTATION.REPRESENTATION') | ((
           'CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF(apr.
           property.definition)) AND (SIZEOF(QUERY ( ca <* USEDIN(apr.
           property.definition,
           'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
            | (NOT (ca.assigned_group.name = 'uo heat exchanger side')) ))
           = 0)) )) = 1);
      wr2: (SIZEOF(QUERY ( rpr <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
           + 'RESOURCE_PROPERTY_REPRESENTATION.REPRESENTATION') | ((
           'CONCEPTUAL_PROCESS_DESIGN.SPECIFIC_PHASE' IN TYPEOF(rpr.
           property.definition)) AND (rpr.property.definition.kind.name
           = 'heat exchanger internal phase')) )) >= 1);
  END_ENTITY; -- heat_exchanger_internal_data

  ENTITY heat_transfer_equipment
    SUBTYPE OF (product_definition);
    WHERE
      wr1: ((NOT (SIZEOF(QUERY ( et <* QUERY ( ca <* USEDIN(SELF,
           'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
            | (ca.role.name = 'equipment type') ) | (et.assigned_group.
           name = 'shell and tube heat exchanger unit') )) = 1)) OR (
           SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
           'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP.'
           + 'RELATING_PRODUCT_DEFINITION') | (
           'CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
           TYPEOF(pdr)) ) | (SIZEOF(QUERY ( ect <* QUERY ( ca <*
           USEDIN(acu.related_product_definition,
           'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
            | (ca.role.name = 'equipment component type') ) | (ect.
           assigned_group.name = 'exchanger assembly') )) = 1) )) >= 1));
  END_ENTITY; -- heat_transfer_equipment

  ENTITY hyperbola
    SUBTYPE OF (conic);
      semi_axis      : positive_length_measure;
      semi_imag_axis : positive_length_measure;
  END_ENTITY; -- hyperbola

  ENTITY identification_assignment
    ABSTRACT SUPERTYPE;
      assigned_id : identifier;
      role        : identification_role;
```

```
END_ENTITY; -- identification_assignment

ENTITY identification_role;
    name        : label;
    description : text;
END_ENTITY; -- identification_role

ENTITY inspection_and_tests
  SUBTYPE OF (action);
  WHERE
    wr1: (SIZEOF(QUERY ( aaa <* QUERY ( aa <* USEDIN(SELF,
              'CONCEPTUAL_PROCESS_DESIGN.' +
              'ACTION_ASSIGNMENT.ASSIGNED_ACTION')
               | ('CONCEPTUAL_PROCESS_DESIGN.APPLIED_ACTION_ASSIGNMENT' IN
               TYPEOF(aa)) ) | ((SIZEOF(aaa.items) = 1) AND (SIZEOF(
              QUERY ( it <* aaa.items | ((1 <= SIZEOF(TYPEOF(it) * [
              'CONCEPTUAL_PROCESS_DESIGN.' + 'PRODUCT_DEFINITION',
              'CONCEPTUAL_PROCESS_DESIGN.' +
              'EXTERNALLY_DEFINED_PLANT_ITEM_DEFINITION',
              'CONCEPTUAL_PROCESS_DESIGN.' +
              'PROCESS_DESIGN_CASE_RESOURCE'])) AND (SIZEOF(TYPEOF(it) * [
              'CONCEPTUAL_PROCESS_DESIGN.' + 'PRODUCT_DEFINITION',
              'CONCEPTUAL_PROCESS_DESIGN.' +
              'EXTERNALLY_DEFINED_PLANT_ITEM_DEFINITION',
              'CONCEPTUAL_PROCESS_DESIGN.' +
              'PROCESS_DESIGN_CASE_RESOURCE']) <= 3)) )) = 1)) )) = 1);
END_ENTITY; -- inspection_and_tests

ENTITY instrumentation_and_control_system
  SUBTYPE OF (product_definition);
  WHERE
    wr1: (SIZEOF(QUERY ( pdr <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
         + 'PRODUCT_DEFINITION_RELATIONSHIP.RELATED_PRODUCT_DEFINITION')
          | (('CONCEPTUAL_PROCESS_DESIGN.PLANT' IN TYPEOF(pdr.
         relating_product_definition.formation.of_product)) AND (pdr.
         relating_product_definition.frame_of_reference.name =
         'functional occurrence')) )) = 1);
END_ENTITY; -- instrumentation_and_control_system

ENTITY interphase
  SUBTYPE OF (action_resource, action_resource_relationship);
  WHERE
    wr1: (SELF.usage :=: SELF.relating_resource.usage);
    wr2: (SELF.usage :=: SELF.related_resource.usage);
    wr3: ('CONCEPTUAL_PROCESS_DESIGN.SPECIFIC_PHASE' IN TYPEOF(SELF.
              relating_resource));
    wr4: ('CONCEPTUAL_PROCESS_DESIGN.SPECIFIC_PHASE' IN TYPEOF(SELF.
              related_resource));
    wr5: (SIZEOF(QUERY ( rp <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
              + 'RESOURCE_PROPERTY.RESOURCE') | (SIZEOF(QUERY ( rpr <*
              USEDIN(rp,'CONCEPTUAL_PROCESS_DESIGN.' +
              'RESOURCE_PROPERTY_REPRESENTATION.PROPERTY') | (rpr.name =
              'interphase thermophysical properties') )) = 1) )) = 1);
END_ENTITY; -- interphase

ENTITY intersection_description
  SUBTYPE OF (representation);
  WHERE
    wr1: (SELF.name IN ['boot on cylinder section',
         'boot on cylinder head section','nozzle on cylinder section',
         'nozzle on cylinder head section']);
    wr2: (SIZEOF(USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.' +
         'PROPERTY_DEFINITION_REPRESENTATION.USED_REPRESENTATION'))
         = 1);
```

```
      wr3: (SIZEOF(QUERY ( pdr <* USEDIN(SELF,
           'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION_REPRESENTATION.'
           + 'USED_REPRESENTATION') | (NOT (
           'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_RELATIONSHIP'
           IN TYPEOF(pdr.definition.definition))) )) = 0);
      wr4: ((NOT (SELF.name = 'boot on cylinder section')) OR (SIZEOF(
           QUERY ( pdr <* USEDIN(SELF,
           'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION_REPRESENTATION.'
           + 'USED_REPRESENTATION') | ((SIZEOF(QUERY ( ca <* USEDIN(pdr
           .definition.definition.related_product_definition,
           'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
            | (ca.assigned_group.name = 'boot') )) = 1) AND (SIZEOF(
           QUERY ( ca <* USEDIN(pdr.definition.definition.
           related_product_definition,
           'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
            | (ca.assigned_group.name =
           'cylindrical pressure vessel cylinder section') )) = 1)) ))
           = 1));
      wr5: ((NOT (SELF.name = 'boot on cylinder head section')) OR (
           SIZEOF(QUERY ( pdr <* USEDIN(SELF,
           'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION_REPRESENTATION.'
           + 'USED_REPRESENTATION') | ((SIZEOF(QUERY ( ca <* USEDIN(pdr
           .definition.definition.relating_product_definition,
           'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
            | (ca.assigned_group.name = 'boot') )) = 1) AND (SIZEOF(
           QUERY ( ca <* USEDIN(pdr.definition.definition.
           related_product_definition,
           'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
            | (ca.assigned_group.name =
           'cylindrical pressure vessel head section') )) = 1)) )) = 1));
      wr6: ((NOT (SELF.name = 'nozzle on cylinder section')) OR (SIZEOF(
           QUERY ( pdr <* USEDIN(SELF,
           'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION_REPRESENTATION.'
           + 'USED_REPRESENTATION') | ((SIZEOF(QUERY ( ca <* USEDIN(pdr
           .definition.definition.relating_product_definition,
           'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
            | (ca.assigned_group.name = 'nozzle section') )) = 1) AND (
           SIZEOF(QUERY ( ca <* USEDIN(pdr.definition.definition.
           related_product_definition,
           'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
            | (ca.assigned_group.name =
           'cylindrical pressure vessel cylinder section') )) = 1)) ))
           = 1));
      wr7: ((NOT (SELF.name = 'nozzle on cylinder head section')) OR (
           SIZEOF(QUERY ( pdr <* USEDIN(SELF,
           'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION_REPRESENTATION.'
           + 'USED_REPRESENTATION') | ((SIZEOF(QUERY ( ca <* USEDIN(pdr
           .definition.definition.relating_product_definition,
           'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
            | (ca.assigned_group.name = 'nozzle section') )) = 1) AND (
           SIZEOF(QUERY ( ca <* USEDIN(pdr.definition.definition.
           related_product_definition,
           'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
            | (ca.assigned_group.name =
           'cylindrical pressure vessel head section') )) = 1)) )) = 1));
  END_ENTITY; -- intersection_description

  ENTITY invisibility;
      invisible_items : SET [1:?] OF invisible_item;
  END_ENTITY; -- invisibility

  ENTITY item_defined_transformation
    SUBTYPE OF (representation_item_relationship);
    DERIVE
```

```
    transform_item_1 : representation_item := SELF\
                           representation_item_relationship.
                           relating_representation_item;
    transform_item_2 : representation_item := SELF\
                           representation_item_relationship.
                           related_representation_item;
END_ENTITY; -- item_defined_transformation

ENTITY known_source
  SUBTYPE OF (external_source, pre_defined_item);
  WHERE
    wr1: (SELF\pre_defined_item.name IN ['ISO 13584 Dictionary',
              'ISO 13584 Parts Library']);
END_ENTITY; -- known_source

ENTITY length_measure_with_unit
  SUBTYPE OF (measure_with_unit);
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.LENGTH_UNIT' IN TYPEOF(SELF\
              measure_with_unit.unit_component));
END_ENTITY; -- length_measure_with_unit

ENTITY length_unit
  SUBTYPE OF (named_unit);
  WHERE
    wr1: ((SELF\named_unit.dimensions.length_exponent = 1) AND (SELF\
              named_unit.dimensions.mass_exponent = 0) AND (SELF\
              named_unit.dimensions.time_exponent = 0) AND (SELF\
              named_unit.dimensions.electric_current_exponent = 0) AND (
              SELF\named_unit.dimensions.
              thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
              .dimensions.amount_of_substance_exponent = 0) AND (SELF\
              named_unit.dimensions.luminous_intensity_exponent = 0));
END_ENTITY; -- length_unit

ENTITY line
  SUBTYPE OF (curve);
    pnt : cartesian_point;
    dir : vector;
  WHERE
    wr1: (dir.dim = pnt.dim);
END_ENTITY; -- line

ENTITY local_time;
    hour_component   : hour_in_day;
    minute_component : OPTIONAL minute_in_hour;
    second_component : OPTIONAL second_in_minute;
    zone             : coordinated_universal_time_offset;
  WHERE
    wr1: valid_time(SELF);
END_ENTITY; -- local_time

ENTITY  logical_operation
  SUBTYPE OF (action_property, action_property_relationship);
  WHERE
    wr1: (SELF\action_property_relationship.name IN ['AND','OR','XOR']);
    wr2: (SELF\action_property.description = 'control logic condition');
    wr3: ('CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF(SELF.
              definition));
    wr4: (SIZEOF(QUERY ( ca <* USEDIN(SELF.definition,
              'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
               | (NOT (ca.assigned_group.name = 'control logic')) )) = 0);
END_ENTITY; -- logical_operation
```

```
  ENTITY luminous_intensity_measure_with_unit
    SUBTYPE OF (measure_with_unit);
    WHERE
      wr1: ('CONCEPTUAL_PROCESS_DESIGN.LUMINOUS_INTENSITY_UNIT' IN TYPEOF(
                SELF\measure_with_unit.unit_component));
  END_ENTITY; -- luminous_intensity_measure_with_unit

  ENTITY luminous_intensity_unit
    SUBTYPE OF (named_unit);
    WHERE
      wr1: ((SELF\named_unit.dimensions.length_exponent = 0) AND (SELF\
                named_unit.dimensions.mass_exponent = 0) AND (SELF\
                named_unit.dimensions.time_exponent = 0) AND (SELF\
                named_unit.dimensions.electric_current_exponent = 0) AND (
                SELF\named_unit.dimensions.
                thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
                .dimensions.amount_of_substance_exponent = 0) AND (SELF\
                named_unit.dimensions.luminous_intensity_exponent = 1));
  END_ENTITY; -- luminous_intensity_unit

  ENTITY make_from_usage_option
    SUBTYPE OF (product_definition_usage);
      ranking           : INTEGER;
      ranking_rationale : text;
      quantity          : measure_with_unit;
    WHERE
      wr1: (ranking > 0);
  END_ENTITY; -- make_from_usage_option

  ENTITY mapped_item
    SUBTYPE OF (representation_item);
      mapping_source : representation_map;
      mapping_target : representation_item;
    WHERE
      wr1: acyclic_mapped_representation(using_representations(SELF),
           [SELF]);
  END_ENTITY; -- mapped_item

  ENTITY mass_measure_with_unit
    SUBTYPE OF (measure_with_unit);
    WHERE
      wr1: ('CONCEPTUAL_PROCESS_DESIGN.MASS_UNIT' IN TYPEOF(SELF\
                measure_with_unit.unit_component));
  END_ENTITY; -- mass_measure_with_unit

  ENTITY mass_unit
    SUBTYPE OF (named_unit);
    WHERE
      wr1: ((SELF\named_unit.dimensions.length_exponent = 0) AND (SELF\
                named_unit.dimensions.mass_exponent = 1) AND (SELF\
                named_unit.dimensions.time_exponent = 0) AND (SELF\
                named_unit.dimensions.electric_current_exponent = 0) AND (
                SELF\named_unit.dimensions.
                thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
                .dimensions.amount_of_substance_exponent = 0) AND (SELF\
                named_unit.dimensions.luminous_intensity_exponent = 0));
  END_ENTITY; -- mass_unit

  ENTITY material_amount_reference_time
    SUBTYPE OF (resource_property);
    WHERE
      wr1: (SELF.description IN ['absolute','relative']);
      wr2: ('CONCEPTUAL_PROCESS_DESIGN.ACTION_RESOURCE' IN TYPEOF(SELF.
                resource));
```

```
    wr3: (SELF.resource.kind.name = 'material amount');
END_ENTITY; -- material_amount_reference_time

ENTITY material_designation;
    name        : label;
    definitions : SET [1:?] OF characterized_definition;
END_ENTITY; -- material_designation

ENTITY material_designation_characterization;
    name        : label;
    description : text;
    designation : material_designation;
    property    : characterized_material_property;
END_ENTITY; -- material_designation_characterization

ENTITY material_property
  SUBTYPE OF (property_definition);
  UNIQUE
    ur1 : name, definition;
  WHERE
    wr1: (('CONCEPTUAL_PROCESS_DESIGN.CHARACTERIZED_OBJECT' IN TYPEOF(
           SELF\property_definition.definition)) OR (SIZEOF(bag_to_set(
           USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.' +
           'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION')) -
           QUERY ( temp <* bag_to_set(USEDIN(SELF,
           'CONCEPTUAL_PROCESS_DESIGN.' +
           'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION')) | ((
           'CONCEPTUAL_PROCESS_DESIGN.' +
           'MATERIAL_PROPERTY_REPRESENTATION') IN TYPEOF(temp)) )) = 0));
END_ENTITY; -- material_property

ENTITY material_property_representation
  SUBTYPE OF (property_definition_representation);
    dependent_environment : data_environment;
END_ENTITY; -- material_property_representation

ENTITY measure_representation_item
  SUBTYPE OF (representation_item, measure_with_unit);
END_ENTITY; -- measure_representation_item

ENTITY measure_with_unit
  SUPERTYPE OF (ONEOF (length_measure_with_unit,mass_measure_with_unit,
      time_measure_with_unit,electric_current_measure_with_unit,
      thermodynamic_temperature_measure_with_unit,
      amount_of_substance_measure_with_unit,
      luminous_intensity_measure_with_unit,solid_angle_measure_with_unit,
      area_measure_with_unit,volume_measure_with_unit,
      ratio_measure_with_unit));
    value_component : measure_value;
    unit_component  : unit;
  WHERE
    wr1: valid_units(SELF);
END_ENTITY; -- measure_with_unit

ENTITY molecular_structural_group
  SUBTYPE OF (characterized_object);
  WHERE
    wr1: (SIZEOF(QUERY ( pd <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
         + 'PROPERTY_DEFINITION.DEFINITION') | (NOT (SIZEOF(
         QUERY ( pdr <* USEDIN(pd,'CONCEPTUAL_PROCESS_DESIGN.' +
         'PROPERTY_DEFINITION_RELATIONSHIP.RELATED_PROPERTY_DEFINITION')
          | (NOT (SIZEOF(QUERY ( aga <* USEDIN(pdr.definition\
         product_definition.formation.of_product,
         'CONCEPTUAL_PROCESS_DESIGN.' +
```

```
          'APPLIED_GROUP_ASSIGNMENT.ITEMS') | (NOT (aga.assigned_group
          .name = 'chemical specie')) )) = 0)) )) = 0)) )) = 0);
    wr2: ((NOT (SIZEOF(USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.' +
          'PROPERTY_DEFINITION.DEFINITION')) >= 1)) OR (SIZEOF(
          QUERY ( pd <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.' +
          'PROPERTY_DEFINITION.DEFINITION') | (NOT ((pd.name =
          'structural') AND (SIZEOF(QUERY ( pdr <* USEDIN(pd,
          'CONCEPTUAL_PROCESS_DESIGN.' +
          'PROPERTY_DEFINITION_RELATIONSHIP.RELATED_PROPERTY_DEFINITION')
           | (NOT (pdr.relating_property_definition.name =
          'structural')) )) = 0))) )) = 0));
END_ENTITY; -- molecular_structural_group

ENTITY named_unit
  SUPERTYPE OF (ONEOF (si_unit,conversion_based_unit,
      context_dependent_unit) ANDOR ONEOF (length_unit,mass_unit,
      time_unit,electric_current_unit,thermodynamic_temperature_unit,
      amount_of_substance_unit,luminous_intensity_unit,solid_angle_unit,
      area_unit,volume_unit,ratio_unit));
    dimensions : dimensional_exponents;
END_ENTITY; -- named_unit

ENTITY next_assembly_usage_occurrence
  SUBTYPE OF (assembly_component_usage);
END_ENTITY; -- next_assembly_usage_occurrence

ENTITY nozzle
  SUBTYPE OF (product_definition);
  WHERE
    wr1: (SIZEOF(QUERY ( pds <* QUERY ( pd <* USEDIN(SELF,
              'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION')
               | ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
              TYPEOF(pd)) ) | (SIZEOF(QUERY ( sa <* USEDIN(pds,
              'CONCEPTUAL_PROCESS_DESIGN.' + 'SHAPE_ASPECT.OF_SHAPE') | (
              SIZEOF(QUERY ( ca <* USEDIN(sa,'CONCEPTUAL_PROCESS_DESIGN.'
              + 'CLASSIFICATION_ASSIGNMENT.ITEMS') | (ca.assigned_group.
              name = 'material port') )) = 1) )) = 1) )) = 1);
END_ENTITY; -- nozzle

ENTITY offset_curve_2d
  SUBTYPE OF (curve);
    basis_curve    : curve;
    distance       : length_measure;
    self_intersect : LOGICAL;
  WHERE
    wr1: (basis_curve.dim = 2);
END_ENTITY; -- offset_curve_2d

ENTITY one_direction_repeat_factor
  SUBTYPE OF (geometric_representation_item);
    repeat_factor : vector;
END_ENTITY; -- one_direction_repeat_factor

ENTITY organization;
    id          : OPTIONAL identifier;
    name        : label;
    description : text;
END_ENTITY; -- organization

ENTITY organization_assignment
  ABSTRACT SUPERTYPE;
    assigned_organization : organization;
    role                  : organization_role;
END_ENTITY; -- organization_assignment
```

```
ENTITY organization_relationship;
    name                  : label;
    description           : text;
    relating_organization : organization;
    related_organization  : organization;
END_ENTITY; -- organization_relationship

ENTITY organization_role;
    name        : label;
    description : text;
END_ENTITY; -- organization_role

ENTITY organizational_project;
    name                      : label;
    description               : text;
    responsible_organizations : SET [1:?] OF organization;
END_ENTITY; -- organizational_project

ENTITY parabola
  SUBTYPE OF (conic);
    focal_dist : length_measure;
  WHERE
    wr1: (focal_dist <> 0);
END_ENTITY; -- parabola

ENTITY person;
    id            : identifier;
    last_name     : OPTIONAL label;
    first_name    : OPTIONAL label;
    middle_names  : OPTIONAL LIST [1:?] OF label;
    prefix_titles : OPTIONAL LIST [1:?] OF label;
    suffix_titles : OPTIONAL LIST [1:?] OF label;
  WHERE
    wr1: (EXISTS(last_name) OR EXISTS(first_name));
END_ENTITY; -- person

ENTITY person_and_organization;
    name             : label;
    description      : text;
    the_person       : person;
    the_organization : organization;
END_ENTITY; -- person_and_organization

ENTITY person_assignment
  ABSTRACT SUPERTYPE;
    assigned_person : person;
    role            : person_role;
END_ENTITY; -- person_assignment

ENTITY person_role;
    name        : label;
    description : text;
END_ENTITY; -- person_role

ENTITY particle_size_distribution_values
  SUBTYPE OF (representation);
WHERE
  WR1: SIZEOF (QUERY (it <* SELF.items |
       'CONCEPTUAL_PROCESS_DESIGN.COMPOUND_REPRESENTATION_ITEM' IN
       TYPEOF (it))) = 1;
  WR2: SIZEOF (QUERY (it <* SELF.items |
       ('CONCEPTUAL_PROCESS_DESIGN.COMPOUND_REPRESENTATION_ITEM' IN
       TYPEOF (it)) AND
       (NOT ('CONCEPTUAL_PROCESS_DESIGN.LIST_REPRESENTATION_ITEM' IN
```

```
        TYPEOF (it.item_element))))) = 0;
  END_ENTITY; -- particle_size_distribution_values

  ENTITY phase
    SUBTYPE OF (group, characterized_object);
  END_ENTITY; -- phase

  ENTITY phases_in_equilibrium_group_assignment
    SUBTYPE OF (group_assignment);
      items : SET [1:?] OF equilibrium_item;
    WHERE
      wr1: (SELF.assigned_group.name = 'phases in equilibrium');
  END_ENTITY; -- phases_in_equilibrium_group_assignment

  ENTITY piping_connector_classification
    SUBTYPE OF (group);
  END_ENTITY; -- piping_connector_classification

  ENTITY placement
    SUPERTYPE OF (ONEOF (axis2_placement_2d,axis2_placement_3d))
    SUBTYPE OF (geometric_representation_item);
      location : cartesian_point;
  END_ENTITY; -- placement

  ENTITY planar_box
    SUBTYPE OF (planar_extent);
      placement : axis2_placement;
  END_ENTITY; -- planar_box

  ENTITY planar_extent
    SUBTYPE OF (geometric_representation_item);
      size_in_x : length_measure;
      size_in_y : length_measure;
  END_ENTITY; -- planar_extent

  ENTITY plant
    SUBTYPE OF (product);
    WHERE
      wr1: (SIZEOF(QUERY ( pc <* SELF.frame_of_reference | (pc.
                discipline_type = 'process plant') )) = 1);
      wr2: (SIZEOF(QUERY ( pdf <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
                + 'PRODUCT_DEFINITION_FORMATION.OF_PRODUCT') | (NOT (SIZEOF(
                QUERY ( pd <* USEDIN(pdf,
                'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION.FORMATION') |
                (pd.frame_of_reference.name = 'functional occurrence') )) <=
                 1)) )) = 0);
  END_ENTITY; -- plant

  ENTITY plant_item_reference_time
    SUBTYPE OF (property_definition);
    WHERE
      wr1: (SELF.description IN ['absolute','relative']);
      wr2: ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION' IN TYPEOF(SELF.
                definition));
  END_ENTITY; -- plant_item_reference_time

  ENTITY point
    SUPERTYPE OF (ONEOF (cartesian_point,point_on_curve))
    SUBTYPE OF (geometric_representation_item);
  END_ENTITY; -- point

  ENTITY point_on_curve
    SUBTYPE OF (point);
      basis_curve     : curve;
```

```
    point_parameter : parameter_value;
END_ENTITY; -- point_on_curve

ENTITY point_style;
    name          : label;
    marker        : marker_select;
    marker_size   : size_select;
    marker_colour : colour;
END_ENTITY; -- point_style

ENTITY polyline
  SUBTYPE OF (bounded_curve);
    points : LIST [2:?] OF cartesian_point;
END_ENTITY; -- polyline

ENTITY port_service_case
  SUBTYPE OF (property_definition);
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.EQUIPMENT_PORT' IN TYPEOF(SELF.
            definition));
    wr2: ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION' IN TYPEOF(SELF.
            definition.of_shape.definition));
    wr3: (SELF.definition.of_shape.definition.frame_of_reference.
            life_cycle_stage = 'design case study');
    wr4: (SIZEOF(USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.' +
            'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION')) >= 1);
END_ENTITY; -- port_service_case

ENTITY pre_defined_colour
  SUBTYPE OF (pre_defined_item, colour);
END_ENTITY; -- pre_defined_colour

ENTITY pre_defined_curve_font
  SUBTYPE OF (pre_defined_item);
END_ENTITY; -- pre_defined_curve_font

ENTITY pre_defined_item;
    name : label;
END_ENTITY; -- pre_defined_item

ENTITY pre_defined_text_font
  SUBTYPE OF (pre_defined_item);
END_ENTITY; -- pre_defined_text_font

ENTITY precision_qualifier;
    precision_value : INTEGER;
END_ENTITY; -- precision_qualifier

ENTITY presentation_area
  SUBTYPE OF (presentation_representation);
  WHERE
    wr1: ((SIZEOF(QUERY ( ais <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.' + 'AREA_IN_SET.AREA') | (
            SIZEOF(USEDIN(ais,'CONCEPTUAL_PROCESS_DESIGN.' +
            'PRESENTATION_SIZE.UNIT')) = 1) )) > 0) OR (SIZEOF(USEDIN(
            SELF,'CONCEPTUAL_PROCESS_DESIGN.PRESENTATION_SIZE.UNIT'))
            = 1));
END_ENTITY; -- presentation_area

ENTITY presentation_layer_assignment;
    name           : label;
    description    : text;
    assigned_items : SET [1:?] OF layered_item;
END_ENTITY; -- presentation_layer_assignment
```

```
  ENTITY presentation_layer_usage;
      assignment   : presentation_layer_assignment;
      presentation : presentation_representation;
    UNIQUE
      ur1 : assignment, presentation;
  END_ENTITY; -- presentation_layer_usage

  ENTITY presentation_representation
    SUBTYPE OF (representation);
    WHERE
      wr1: (SELF\representation.context_of_items\
                geometric_representation_context.coordinate_space_dimension
                = 2);
      wr2: ('CONCEPTUAL_PROCESS_DESIGN.GEOMETRIC_REPRESENTATION_CONTEXT'
                IN TYPEOF(SELF\representation.context_of_items));
  END_ENTITY; -- presentation_representation

  ENTITY presentation_representation_relationship
    SUBTYPE OF (representation_relationship_with_transformation);
    WHERE
      wr1: ('CONCEPTUAL_PROCESS_DESIGN.PRESENTATION_REPRESENTATION' IN
             TYPEOF(SELF\representation_relationship.rep_1));
      wr2: ('CONCEPTUAL_PROCESS_DESIGN.PRESENTATION_REPRESENTATION' IN
             TYPEOF(SELF\representation_relationship.rep_2));
      wr3: acyclic_presentation_representation_relationship(SELF,[SELF\
             representation_relationship.rep_2]);
      wr4: (NOT (('CONCEPTUAL_PROCESS_DESIGN.PRESENTATION_AREA' IN TYPEOF(
             SELF\representation_relationship.rep_1)) AND (NOT (SIZEOF([
             'CONCEPTUAL_PROCESS_DESIGN.' +
             'PRODUCT_DATA_REPRESENTATION_VIEW',
             'CONCEPTUAL_PROCESS_DESIGN.' +
             'VIEW_DEPENDENT_ANNOTATION_REPRESENTATION'] * TYPEOF(SELF\
             representation_relationship.rep_2)) = 0))));
      wr5: (NOT (('CONCEPTUAL_PROCESS_DESIGN.PRESENTATION_VIEW' IN TYPEOF(
             SELF\representation_relationship.rep_1)) AND (NOT (SIZEOF([
             'CONCEPTUAL_PROCESS_DESIGN.' + 'PRESENTATION_AREA',
             'CONCEPTUAL_PROCESS_DESIGN.' + 'PRESENTATION_VIEW',
             'CONCEPTUAL_PROCESS_DESIGN.' +
             'AREA_DEPENDENT_ANNOTATION_REPRESENTATION'] * TYPEOF(SELF\
             representation_relationship.rep_2)) = 0))));
      wr6: ((NOT ('CONCEPTUAL_PROCESS_DESIGN.PRESENTATION_VIEW' IN TYPEOF(
             SELF\representation_relationship.rep_2))) XOR (
             'CONCEPTUAL_PROCESS_DESIGN.PRESENTATION_AREA' IN TYPEOF(SELF
             \representation_relationship.rep_1)));
      wr7: ((NOT (('CONCEPTUAL_PROCESS_DESIGN.' +
             'PRODUCT_DATA_REPRESENTATION_VIEW') IN (TYPEOF(SELF\
             representation_relationship.rep_1) + TYPEOF(SELF\
             representation_relationship.rep_2)))) XOR ((
             'CONCEPTUAL_PROCESS_DESIGN.PRESENTATION_VIEW' IN TYPEOF(SELF
             \representation_relationship.rep_1)) AND
             ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DATA_REPRESENTATION_VIEW'
             IN TYPEOF(SELF\representation_relationship.rep_2))));
      wr8: ('CONCEPTUAL_PROCESS_DESIGN.GRAPHICAL_TRANSFORMATION' IN
             TYPEOF(SELF\representation_relationship_with_transformation.
             transformation_operator));
  END_ENTITY; -- presentation_representation_relationship

  ENTITY presentation_scaled_placement
    SUBTYPE OF (geometric_representation_item);
      placement : axis2_placement;
      scaling   : positive_ratio_measure;
  END_ENTITY; -- presentation_scaled_placement

  ENTITY presentation_set;
```

```
  INVERSE
    areas : SET [1:?] OF area_in_set FOR in_set;
END_ENTITY; -- presentation_set

ENTITY presentation_size;
    unit : presentation_size_assignment_select;
    size : planar_box;
  WHERE
    wr1: ((('CONCEPTUAL_PROCESS_DESIGN.PRESENTATION_REPRESENTATION' IN
           TYPEOF(SELF.unit)) AND item_in_context(SELF.size,SELF.unit\
           representation.context_of_items)) OR ((
           'CONCEPTUAL_PROCESS_DESIGN.AREA_IN_SET' IN TYPEOF(SELF.unit))
           AND (SIZEOF(QUERY ( ais <* SELF.unit\area_in_set.in_set.
           areas | (NOT item_in_context(SELF.size,ais.area\
           representation.context_of_items)) )) = 0)));
END_ENTITY; -- presentation_size

ENTITY presentation_style_assignment;
    styles : SET [1:?] OF presentation_style_select;
  WHERE
    wr1: (SIZEOF(QUERY ( style1 <* SELF.styles | (NOT (SIZEOF(
              QUERY ( style2 <* (SELF.styles - style1) | (NOT ((TYPEOF(
              style1) <> TYPEOF(style2)) OR (SIZEOF([
              'CONCEPTUAL_PROCESS_DESIGN.' + 'SURFACE_STYLE_USAGE',
              'CONCEPTUAL_PROCESS_DESIGN.' + 'EXTERNALLY_DEFINED_STYLE'] *
               TYPEOF(style1)) = 1))) )) = 0)) )) = 0);
    wr2: (SIZEOF(QUERY ( style1 <* SELF.styles | (
              'CONCEPTUAL_PROCESS_DESIGN.SURFACE_STYLE_USAGE' IN TYPEOF(
              style1)) )) <= 2);
END_ENTITY; -- presentation_style_assignment

ENTITY presentation_style_by_context
  SUBTYPE OF (presentation_style_assignment);
    style_context : style_context_select;
END_ENTITY; -- presentation_style_by_context

ENTITY presentation_view
  SUBTYPE OF (presentation_representation);
END_ENTITY; -- presentation_view

ENTITY presentation_with_association
  SUBTYPE OF (presentation_representation);
  WHERE
    wr1: (SIZEOF(SELF\representation.items) = 1);
    wr2: (SIZEOF(QUERY ( pir <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
              + 'PRESENTED_ITEM_REPRESENTATION.PRESENTATION') | (NOT (
              'CONCEPTUAL_PROCESS_DESIGN.PRESENTED_ITEM_WITH_ASSOCIATION'
              IN TYPEOF(pir.item))) )) = 0);
    wr3: (SIZEOF(QUERY ( it <* SELF.items | (NOT (SIZEOF([
              'CONCEPTUAL_PROCESS_DESIGN.' +
              'ANNOTATION_SYMBOL_OCCURRENCE',
              'CONCEPTUAL_PROCESS_DESIGN.ANNOTATION_TEXT_OCCURRENCE',
              'CONCEPTUAL_PROCESS_DESIGN.ANNOTATION_CURVE_OCCURRENCE',
              'CONCEPTUAL_PROCESS_DESIGN.ANNOTATION_POINT_OCCURRENCE'] *
              TYPEOF(it)) = 1)) )) = 0);
END_ENTITY; -- presentation_with_association

ENTITY presented_item
  ABSTRACT SUPERTYPE;
END_ENTITY; -- presented_item

ENTITY presented_item_association
  SUBTYPE OF (presented_item);
    items : SET [1:?] OF presented_item_select;
```

```
  END_ENTITY; -- presented_item_association

  ENTITY presented_item_representation;
      presentation : presentation_representation_select;
      item         : presented_item;
  END_ENTITY; -- presented_item_representation

  ENTITY presented_item_with_association
    SUBTYPE OF (presented_item);
      items : SET [1:?] OF associated_item;
    WHERE
      wr1: (SIZEOF(QUERY ( pir <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.PRESENTED_ITEM_REPRESENTATION.ITEM')
             | (NOT (
            'CONCEPTUAL_PROCESS_DESIGN.PRESENTATION_WITH_ASSOCIATION' IN
            TYPEOF(pir.presentation))) )) = 0);
  END_ENTITY; -- presented_item_with_association

  ENTITY process_definition_reference_time
    SUBTYPE OF (action_property);
    WHERE
      wr1: (SELF.description IN ['absolute','relative']);
      wr2: ('CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF(SELF.
              definition));
  END_ENTITY; -- process_definition_reference_time

  ENTITY process_design_case
    SUBTYPE OF (property_definition);
    WHERE
      wr1: ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION' IN TYPEOF(SELF.
              definition));
      wr2: (SELF.definition.frame_of_reference.life_cycle_stage =
              'design case study');
      wr3: (SIZEOF(USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.' +
              'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION')) >= 1);
  END_ENTITY; -- process_design_case

  ENTITY process_design_case_resource
    SUBTYPE OF (action_resource, product_definition);
    WHERE
      wr1: (SELF\product_definition.frame_of_reference.life_cycle_stage =
              'design');
      wr2: (SIZEOF(USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.' +
              'REQUIREMENT_FOR_ACTION_RESOURCE.RESOURCES')) >= 1);
  END_ENTITY; -- process_design_case_resource

  ENTITY process_design_property_value
    SUBTYPE OF (representation, externally_defined_item);
  END_ENTITY; -- process_design_property_value

  ENTITY process_material
    SUBTYPE OF (action_resource, product_definition);
    WHERE
      wr1: (SIZEOF(QUERY ( mu <* QUERY ( arr <* USEDIN(SELF,
             'CONCEPTUAL_PROCESS_DESIGN.' +
             'ACTION_RESOURCE_RELATIONSHIP.RELATED_RESOURCE') | (arr.name
             = 'material usage') ) | ((
             'CONCEPTUAL_PROCESS_DESIGN.SPECIFIC_PHASE' IN TYPEOF(mu.
             relating_action_resource)) XOR ((
             'CONCEPTUAL_PROCESS_DESIGN.ACTION_RESOURCE' IN TYPEOF(mu.
             relating_action_resource)) AND (mu.relating_action_resource.
             kind.name IN ['material stream','material amount'])))  )) = 1);
  END_ENTITY; -- process_material
```

```
ENTITY process_material_reference_time
  SUBTYPE OF (resource_property);
  WHERE
    wr1: (SELF.description IN ['absolute','relative']);
    wr2: ('CONCEPTUAL_PROCESS_DESIGN.PROCESS_MATERIAL' IN TYPEOF(SELF.
           resource));
END_ENTITY; -- process_material_reference_time

ENTITY process_port
  SUBTYPE OF (action_resource, characterized_object);
  WHERE
    wr1: (SIZEOF(QUERY ( usg <* SELF.usage | (NOT (
          'CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF(usg))) ))
         = 0);
END_ENTITY; -- process_port

ENTITY process_port_connection
  SUBTYPE OF (action_resource, characterized_object_relationship);
  WHERE
    wr1: (('CONCEPTUAL_PROCESS_DESIGN.PROCESS_PORT' IN TYPEOF(SELF.
           relating_object)) AND (
           'CONCEPTUAL_PROCESS_DESIGN.PROCESS_PORT' IN TYPEOF(SELF.
           related_object)));
END_ENTITY; -- process_port_connection

ENTITY process_product_association;
    name            : label;
    description     : text;
    defined_product : characterized_product_definition;
    process         : product_definition_process;
END_ENTITY; -- process_product_association

ENTITY process_property_association;
    name              : label;
    description       : text;
    process           : property_process;
    property_or_shape : property_or_shape_select;
END_ENTITY; -- process_property_association

ENTITY process_resource_plant_item
  SUBTYPE OF (action_resource, product);
  WHERE
    wr1: (SIZEOF(QUERY ( pc <* SELF\product.frame_of_reference | (pc.
           discipline_type = 'process plant') )) = 1);
END_ENTITY; -- process_resource_plant_item

ENTITY process_simulation
  SUBTYPE OF (action_method);
  WHERE
    wr1: (SIZEOF(QUERY ( amr <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
          + 'ACTION_METHOD_RELATIONSHIP.RELATED_METHOD') | (
          'CONCEPTUAL_PROCESS_DESIGN.SIMULATED_PROCESS_DEFINITION' IN
          TYPEOF(amr)) )) >= 1);
    wr2: (SIZEOF(QUERY ( ap <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
          + 'ACTION_PROPERTY.DEFINITION') | (ap.description =
          'thermophysical property option') )) >= 1);
    wr3: ((NOT (SELF.purpose = 'variable convergence block')) OR (
          SIZEOF(QUERY ( ap <* USEDIN(SELF,
          'CONCEPTUAL_PROCESS_DESIGN.' + 'ACTION_PROPERTY.DEFINITION')
           | (NOT (SIZEOF(QUERY ( apr <* USEDIN(SELF,
          'CONCEPTUAL_PROCESS_DESIGN.' +
          'ACTION_PROPERTY_REPRESENTATION.PROPERTY') | (apr.
          representation.name = 'variable adjustment specification') ))
          >= 1)) )) = 1));
```

```
  END_ENTITY; -- process_simulation

  ENTITY process_simulation_reference_time
    SUBTYPE OF (action_property);
    WHERE
      wr1: (SELF.description IN ['absolute','relative']);
      wr2: ('CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF(SELF.
              definition));
  END_ENTITY; -- process_simulation_reference_time

  ENTITY product;
      id                : identifier;
      name              : label;
      description       : text;
      frame_of_reference : SET [1:?] OF product_context;
  END_ENTITY; -- product

  ENTITY product_category;
      name        : label;
      description : OPTIONAL text;
  END_ENTITY; -- product_category

  ENTITY product_category_relationship;
      name         : label;
      description  : text;
      category     : product_category;
      sub_category : product_category;
    WHERE
      wr1: acyclic_product_category_relationship(SELF,[SELF.sub_category]);
  END_ENTITY; -- product_category_relationship

  ENTITY product_context
    SUBTYPE OF (application_context_element);
      discipline_type : label;
  END_ENTITY; -- product_context

  ENTITY product_data_representation_view
    SUBTYPE OF (presentation_representation);
    WHERE
      wr1: (SIZEOF(QUERY ( item <* SELF\representation.items | (NOT (
                SIZEOF(['CONCEPTUAL_PROCESS_DESIGN.CAMERA_IMAGE',
                'CONCEPTUAL_PROCESS_DESIGN.AXIS2_PLACEMENT'] * TYPEOF(item))
                = 1)) )) = 0);
      wr2: (SIZEOF(QUERY ( item <* SELF\representation.items | (
                'CONCEPTUAL_PROCESS_DESIGN.CAMERA_IMAGE' IN TYPEOF(item)) ))
                >= 1);
  END_ENTITY; -- product_data_representation_view

  ENTITY product_definition;
      id                : identifier;
      name              : label;
      description       : text;
      formation         : product_definition_formation;
      frame_of_reference : product_definition_context;
  END_ENTITY; -- product_definition

  ENTITY product_definition_context
    SUBTYPE OF (application_context_element);
      life_cycle_stage : label;
  END_ENTITY; -- product_definition_context

  ENTITY product_definition_formation;
      id          : identifier;
      description : text;
```

```
    of_product  : product;
  UNIQUE
    ur1 : id, of_product;
END_ENTITY; -- product_definition_formation

ENTITY product_definition_process
  SUBTYPE OF (action);
    identification : identifier;
  INVERSE
    product_definitions : SET [1:?] OF process_product_association FOR
                                  process;
END_ENTITY; -- product_definition_process

ENTITY product_definition_relationship;
    id                           : identifier;
    name                         : label;
    description                  : text;
    relating_product_definition : product_definition;
    related_product_definition  : product_definition;
END_ENTITY; -- product_definition_relationship

ENTITY product_definition_shape
  SUBTYPE OF (property_definition);
  UNIQUE
    ur1 : definition;
  WHERE
    wr1: (NOT ('CONCEPTUAL_PROCESS_DESIGN.SHAPE_DEFINITION' IN TYPEOF(
              SELF\property_definition.definition)));
END_ENTITY; -- product_definition_shape

ENTITY product_definition_usage
  SUPERTYPE OF (ONEOF (make_from_usage_option,assembly_component_usage))
  SUBTYPE OF (product_definition_relationship);
  UNIQUE
    ur1 : id, relating_product_definition, related_product_definition;
  WHERE
    wr1: acyclic_product_definition_relationship(SELF,[SELF\
              product_definition_relationship.related_product_definition],
              'CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_USAGE.' +
              'RELATED_PRODUCT_DEFINITION');
END_ENTITY; -- product_definition_usage

ENTITY product_definition_with_associated_documents
  SUBTYPE OF (product_definition);
    documentation_ids : SET [1:?] OF document;
END_ENTITY; -- product_definition_with_associated_documents

ENTITY product_related_product_category
  SUBTYPE OF (product_category);
    products : SET [1:?] OF product;
END_ENTITY; -- product_related_product_category

ENTITY property_definition;
    name        : label;
    description : text;
    definition  : characterized_definition;
END_ENTITY; -- property_definition

ENTITY property_definition_relationship;
    name                          : label;
    description                   : text;
    relating_property_definition : property_definition;
    related_property_definition  : property_definition;
END_ENTITY; -- property_definition_relationship
```

```
  ENTITY property_definition_representation;
      name                : label;
      description         : text;
      definition          : represented_definition;
      used_representation : representation;
  END_ENTITY; -- property_definition_representation

  ENTITY property_process
    SUBTYPE OF (action);
      identification : identifier;
    INVERSE
      properties : SET [1:?] OF process_property_association FOR process;
  END_ENTITY; -- property_process

  ENTITY qualified_representation_item
    SUBTYPE OF (representation_item);
      qualifiers : SET [1:?] OF value_qualifier;
    WHERE
      wr1: (SIZEOF(QUERY ( temp <* qualifiers | (
                'CONCEPTUAL_PROCESS_DESIGN.PRECISION_QUALIFIER' IN TYPEOF(
                temp)) )) < 2);
  END_ENTITY; -- qualified_representation_item

  ENTITY quantified_assembly_component_usage
    SUBTYPE OF (assembly_component_usage);
      quantity : measure_with_unit;
  END_ENTITY; -- quantified_assembly_component_usage

  ENTITY quasi_uniform_curve
    SUBTYPE OF (b_spline_curve);
  END_ENTITY; -- quasi_uniform_curve

  ENTITY ratio_measure_with_unit
    SUBTYPE OF (measure_with_unit);
    WHERE
      wr1: ('CONCEPTUAL_PROCESS_DESIGN.RATIO_UNIT' IN TYPEOF(SELF\
                measure_with_unit.unit_component));
  END_ENTITY; -- ratio_measure_with_unit

  ENTITY ratio_unit
    SUBTYPE OF (named_unit);
    WHERE
      wr1: ((SELF\named_unit.dimensions.length_exponent = 0) AND (SELF\
                named_unit.dimensions.mass_exponent = 0) AND (SELF\
                named_unit.dimensions.time_exponent = 0) AND (SELF\
                named_unit.dimensions.electric_current_exponent = 0) AND (
                SELF\named_unit.dimensions.
                thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
                .dimensions.amount_of_substance_exponent = 0) AND (SELF\
                named_unit.dimensions.luminous_intensity_exponent = 0));
  END_ENTITY; -- ratio_unit

  ENTITY rational_b_spline_curve
    SUBTYPE OF (b_spline_curve);
      weights_data : LIST [2:?] OF REAL;
    DERIVE
      weights : ARRAY [0:upper_index_on_control_points] OF REAL :=
                    list_to_array(weights_data,0,
                    upper_index_on_control_points);
    WHERE
      wr1: (SIZEOF(weights_data) = SIZEOF(SELF\b_spline_curve.
                control_points_list));
      wr2: curve_weights_positive(SELF);
  END_ENTITY; -- rational_b_spline_curve
```

```
ENTITY reactor_yield
  SUBTYPE OF (representation);
  WHERE
    wr1: (SIZEOF(QUERY ( apr <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
              + 'ACTION_PROPERTY_REPRESENTATION.REPRESENTATION') | ((
              'CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF(apr.
              property.definition)) AND (SIZEOF(QUERY ( ca <* USEDIN(apr.
              property.definition,
              'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
               | (NOT (ca.assigned_group.name =
              'uo specified yield reactor')) )) = 0)) )) = 1);
    wr2: (SIZEOF(QUERY ( pdr <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
              + 'PROPERTY_DEFINITION_REPRESENTATION.USED_REPRESENTATION')
               | (('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION' IN
              TYPEOF(pdr.definition.definition)) AND (SIZEOF(
              QUERY ( prpc <* USEDIN(pdr.definition.definition.formation.
              of_product,'CONCEPTUAL_PROCESS_DESIGN.' +
              'PRODUCT_RELATED_PRODUCT_CATEGORY.PRODUCTS') | (NOT (prpc.
              name = 'substance')) )) = 0)) )) = 1);
    wr3: (SIZEOF(QUERY ( aga <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
              + 'APPLIED_GROUP_ASSIGNMENT.ITEMS') | (
              'CONCEPTUAL_PROCESS_DESIGN.PHASE' IN TYPEOF(aga.
              assigned_group)) )) = 1);
END_ENTITY; -- reactor_yield

ENTITY representation;
    id               : identifier;
    name             : label;
    description      : text;
    items            : SET [1:?] OF representation_item;
    context_of_items : representation_context;
END_ENTITY; -- representation

ENTITY representation_context;
    context_identifier : identifier;
    context_type       : text;
  INVERSE
    representations_in_context : SET [1:?] OF representation FOR
                                     context_of_items;
END_ENTITY; -- representation_context

ENTITY representation_item;
    name : label;
  WHERE
    wr1: (SIZEOF(using_representations(SELF)) > 0);
END_ENTITY; -- representation_item

ENTITY representation_item_relationship;
    name                         : label;
    description                  : text;
    relating_representation_item : representation_item;
    related_representation_item  : representation_item;
END_ENTITY; -- representation_item_relationship

ENTITY representation_map;
    mapping_origin        : representation_item;
    mapped_representation : representation;
  INVERSE
    map_usage : SET [1:?] OF mapped_item FOR mapping_source;
  WHERE
    wr1: item_in_context(SELF.mapping_origin,SELF.mapped_representation.
              context_of_items);
END_ENTITY; -- representation_map
```

```
ENTITY representation_relationship;
    name        : label;
    description : text;
    rep_1       : representation;
    rep_2       : representation;
END_ENTITY; -- representation_relationship

ENTITY representation_relationship_with_transformation
  SUBTYPE OF (representation_relationship);
    transformation_operator : transformation;
  WHERE
    wr1: (SELF\representation_relationship.rep_1.context_of_items :<>:
             SELF\representation_relationship.rep_2.context_of_items);
END_ENTITY; -- representation_relationship_with_transformation

ENTITY requirement_for_action_resource
  SUBTYPE OF (action_resource_requirement);
    resources : SET [1:?] OF action_resource;
END_ENTITY; -- requirement_for_action_resource

ENTITY reference_state
  SUBTYPE OF (compound_representation_item);
WHERE
  WR1: 'CONCEPTUAL_PROCESS_DESIGN.SET_REPRESENTATION_ITEM' IN
       TYPEOF (SELF.item_element);
  WR2: SIZEOF (SELF.item_element) = 2;
  WR3: SIZEOF (QUERY (elem <* SELF.item_element |
       ('CONCEPTUAL_PROCESS_DESIGN.DESCRIPTIVE_REPRESENTATION_ITEM' IN
       TYPEOF (elem)) AND
       (elem.name = 'basis'))) = 1;
  WR4: SIZEOF (QUERY (elem <* SELF.item_element |
       'CONCEPTUAL_PROCESS_DESIGN.MEASURE_REPRESENTATION_ITEM' IN
       TYPEOF (elem))) = 1;
END_ENTITY; -- reference_state

ENTITY reserved_space
  SUBTYPE OF (shape_aspect);
  WHERE
    wr1: (SELF.of_shape.definition.frame_of_reference\
             application_context_element.name = 'physical occurrence');
END_ENTITY; -- reserved_space

ENTITY resource_property;
    name        : label;
    description : text;
    resource    : characterized_resource_definition;
END_ENTITY; -- resource_property

ENTITY resource_property_relationship;
    name                       : label;
    description                : text;
    relating_resource_property : resource_property;
    related_resource_property  : resource_property;
  WHERE
    wr1: (relating_resource_property :<>: related_resource_property);
END_ENTITY; -- resource_property_relationship

ENTITY resource_property_representation;
    name           : label;
    description    : text;
    property       : resource_property;
    representation : representation;
END_ENTITY; -- resource_property_representation
```

```
ENTITY resource_requirement_type;
    name        : label;
    description : text;
END_ENTITY; -- resource_requirement_type

ENTITY separation_tower
  SUBTYPE OF (product_definition);
  WHERE
    wr1: (SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
         'CONCEPTUAL_PROCESS_DESIGN.' +
         'PRODUCT_DEFINITION_RELATIONSHIP.RELATING_PRODUCT_DEFINITION')
          | ('CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
         TYPEOF(pdr)) ) | (SIZEOF(QUERY ( ca <* USEDIN(acu.
         related_product_definition,
         'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
          | (ca.assigned_group.name = 'cylindrical pressure vessel') ))
         = 1) )) >= 1);
END_ENTITY; -- separation_tower

ENTITY separation_tray_component_definition
  SUBTYPE OF (product_definition);
  WHERE
    wr1: (SELF.frame_of_reference.name = 'functional definition');
    wr2: ((NOT (SELF.description IN ['separation tray baffle',
         'blinding strip','downcomer','weir','tray panel'])) OR (
         SIZEOF(QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
         'CONCEPTUAL_PROCESS_DESIGN.' +
         'PRODUCT_DEFINITION_RELATIONSHIP.RELATED_PRODUCT_DEFINITION')
          | ('CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
         TYPEOF(pdr)) ) | (SIZEOF(QUERY ( ca <* USEDIN(acu.
         relating_product_definition,
         'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
          | ((ca.assigned_group.name = 'separation tray') AND (acu.
         relating_product_definition.frame_of_reference.name =
         'functional definition')) )) = 1) )) = 1));
    wr3: ((NOT (SELF.description = 'bubble cap')) OR (SIZEOF(
         QUERY ( acu <* QUERY ( pdr <* USEDIN(SELF,
         'CONCEPTUAL_PROCESS_DESIGN.' +
         'PRODUCT_DEFINITION_RELATIONSHIP.RELATING_PRODUCT_DEFINITION')
          | ('CONCEPTUAL_PROCESS_DESIGN.ASSEMBLY_COMPONENT_USAGE' IN
         TYPEOF(pdr)) ) | (('CONCEPTUAL_PROCESS_DESIGN.' +
         'SEPARATION_TRAY_COMPONENT_DEFINITION' IN
         TYPEOF(acu.related_product_definition)) AND (acu.
         related_product_definition.description = 'riser')) )) = 1));
    wr4: ((NOT (SELF.description = 'bubble cap')) OR (SIZEOF(
         QUERY ( pds <* QUERY ( pd <* USEDIN(SELF,
         'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION')
          | ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
         TYPEOF(pd)) ) | (SIZEOF(QUERY ( sa <* USEDIN(pds,
         'CONCEPTUAL_PROCESS_DESIGN.' + 'SHAPE_ASPECT.OF_SHAPE') | (
         sa.description = 'cap') )) = 1) )) = 1));
    wr5: ((NOT (SELF.description IN ['bubble cap','perforation cover',
         'valve cap'])) OR (SIZEOF(QUERY ( pds <* QUERY ( pd <*
         USEDIN(SELF,
         'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION')
          | ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION_SHAPE' IN
         TYPEOF(pd)) ) | (SIZEOF(QUERY ( sa <* USEDIN(pds,
         'CONCEPTUAL_PROCESS_DESIGN.' + 'SHAPE_ASPECT.OF_SHAPE') | (
         sa.description = 'active area') )) = 1) )) = 1));
END_ENTITY; -- separation_tray_component_definition

ENTITY separation_tray_component_feature
  SUBTYPE OF (shape_aspect);
  WHERE
```

```
      wr1 : ((NOT (SELF.description IN ['downcomer apron',
            'downcomer apron section','downcomer disengaging panel',
            'disengaging panel opening','downcomer liquid flow channel',
            'escape area','pressure equalization channel'])) OR ((
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'SEPARATION_TRAY_COMPONENT_DEFINITION'
            IN TYPEOF(SELF.of_shape.definition)) AND (SELF.of_shape.
            definition.description = 'downcomer')));
      wr2 : ((NOT (SELF.description = 'downcomer apron')) OR (SIZEOF(
            QUERY ( comp <* QUERY ( sar <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') | (sar.
            name = 'composition') ) | (comp.related_shape_aspect.
            description = 'downcomer apron section') )) >= 1));
      wr3 : ((NOT (SELF.description = 'downcomer apron section')) OR (
            SIZEOF(QUERY ( comp <* QUERY ( sar <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') | (sar.
            name = 'composition') ) | (comp.relating_shape_aspect.
            description = 'downcomer apron') )) = 1));
      wr4 : ((NOT (SELF.description = 'downcomer apron section')) OR (
            SIZEOF(QUERY ( comp <* QUERY ( sar <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') | (sar.
            name = 'composition') ) | (comp.related_shape_aspect.
            description = 'downcomer liquid flow channel') )) <= 1));
      wr5 : ((NOT (SELF.description = 'downcomer liquid flow channel')) OR
            (SIZEOF(QUERY ( comp <* QUERY ( sar <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') | (sar.
            name = 'composition') ) | (comp.relating_shape_aspect.
            description = 'downcomer apron section') )) = 1));
      wr6 : ((NOT (SELF.description = 'pressure equalization channel')) OR
            (SIZEOF(QUERY ( comp <* QUERY ( sar <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') | (sar.
            name = 'composition') ) | (comp.relating_shape_aspect.
            description = 'downcomer apron section') )) = 1));
      wr7 : ((NOT (SELF.description IN ['riser','riser and tray panel']))
            OR (('CONCEPTUAL_PROCESS_DESIGN.' +
            'SEPARATION_TRAY_COMPONENT_DEFINITION'
            IN TYPEOF(SELF.of_shape.definition)) AND (SELF.of_shape.
            definition.description = 'bubble cap')));
      wr8 : ((NOT (SELF.description = 'riser')) OR (SIZEOF(
            QUERY ( comp <* QUERY ( sar <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') | (sar.
            name = 'composition') ) | (comp.relating_shape_aspect.
            description = 'riser and tray panel') )) >= 1));
      wr9 : ((NOT (SELF.description = 'riser and tray panel')) OR (SIZEOF(
            QUERY ( comp <* QUERY ( sar <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') | (sar.
            name = 'composition') ) | (comp.related_shape_aspect.
            description = 'riser') )) = 1));
      wr10: ((NOT (SELF.description = 'seal pan recess')) OR ((
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'SEPARATION_TRAY_COMPONENT_DEFINITION'
            IN TYPEOF(SELF.of_shape.definition)) AND (SELF.of_shape.
            definition.description = 'seal pan')));
      wr11: ((NOT (SELF.description = 'tray panel and perforation')) OR ((
           'CONCEPTUAL_PROCESS_DESIGN.' +
            'SEPARATION_TRAY_COMPONENT_DEFINITION'
            IN TYPEOF(SELF.of_shape.definition)) AND (SELF.of_shape.
```

```
        definition.description = 'tray panel')));
    wr12: ((NOT (SELF.description = 'tray panel and perforation')) OR (
        SIZEOF(QUERY ( comp <* QUERY ( sar <* USEDIN(SELF,
        'CONCEPTUAL_PROCESS_DESIGN.' +
        'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') | (sar.
        name = 'composition') ) | (comp.related_shape_aspect.
        description = 'perforation') )) = 1));
    wr13: ((NOT (SELF.description = 'tray panel and slot')) OR ((
        'CONCEPTUAL_PROCESS_DESIGN.' +
        'SEPARATION_TRAY_COMPONENT_DEFINITION'
        IN TYPEOF(SELF.of_shape.definition)) AND (SELF.of_shape.
        definition.description = 'tray panel')));
    wr14: ((NOT (SELF.description = 'tray panel and slot')) OR (SIZEOF(
        QUERY ( comp <* QUERY ( sar <* USEDIN(SELF,
        'CONCEPTUAL_PROCESS_DESIGN.' +
        'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') | (sar.
        name = 'composition') ) | (comp.related_shape_aspect.
        description = 'tray slot') )) = 1));
END_ENTITY; -- separation_tray_component_feature

ENTITY separation_tray_component_feature_definition
  SUBTYPE OF (shape_aspect);
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.CHARACTERIZED_OBJECT' IN TYPEOF(
            SELF.of_shape.definition));
    wr2: (SELF.of_shape.definition.name = 'feature definition');
    wr3: (SELF.description IN ['tray slot','pattern','perforation',
            'perimeter','perimeter segment']);
    wr4: ((NOT (SELF.description = 'perimeter')) OR (SIZEOF(
            QUERY ( comp <* QUERY ( sar <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') | (sar.
            name = 'composition') ) | ((('CONCEPTUAL_PROCESS_DESIGN.' +
            'SEPARATION_TRAY_COMPONENT_FEATURE_DEFINITION') IN TYPEOF(
            comp.related_shape_aspect)) AND (comp.related_shape_aspect.
            description = 'perimeter segment')) )) >= 1));
    wr5: ((NOT (SELF.description = 'perimeter segment')) OR (SIZEOF(
            QUERY ( comp <* QUERY ( sar <* USEDIN(SELF,
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'SHAPE_ASPECT_RELATIONSHIP.RELATED_SHAPE_ASPECT') | (sar.
            name = 'composition') ) | ((('CONCEPTUAL_PROCESS_DESIGN.' +
            'SEPARATION_TRAY_COMPONENT_FEATURE_DEFINITION') IN TYPEOF(
            comp.relating_shape_aspect)) AND (comp.relating_shape_aspect
            .description = 'perimeter')) )) = 1));
    wr6: ((NOT (SELF.description = 'perimeter segment')) OR (SIZEOF(
            QUERY ( pdr <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.' +
            'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') | (SIZEOF(
            QUERY ( it <* pdr.used_representation.items | (
            'CONCEPTUAL_PROCESS_DESIGN.CURVE' IN TYPEOF(it)) )) = 1) ))
            = 1));
    wr7: ((NOT (SELF.description = 'tray slot')) OR (SIZEOF(
            QUERY ( sar <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.' +
            'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') | ((sar.
            name = 'slot opening') AND (('CONCEPTUAL_PROCESS_DESIGN.' +
            'SEPARATION_TRAY_COMPONENT_FEATURE_DEFINITION') IN TYPEOF(
            sar.relating_shape_aspect)) AND (sar.relating_shape_aspect.
            description = 'perimeter')) )) <= 1));
    wr8: ((NOT (SELF.description = 'tray slot')) OR (SIZEOF(
            QUERY ( sar <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.' +
            'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') | ((sar.
            name = 'horizontal projection') AND ((
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'SEPARATION_TRAY_COMPONENT_FEATURE_DEFINITION') IN TYPEOF(
            sar.relating_shape_aspect)) AND (sar.relating_shape_aspect.
```

```
              description = 'perimeter')) )) <= 1));
    wr9: ((NOT (SELF.description = 'pattern')) OR (SIZEOF(
              QUERY ( sar <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.' +
              'SHAPE_ASPECT_RELATIONSHIP.RELATING_SHAPE_ASPECT') | ((sar.
              name = 'composition') AND (('CONCEPTUAL_PROCESS_DESIGN.' +
              'SEPARATION_TRAY_COMPONENT_FEATURE_DEFINITION') IN TYPEOF(
              sar.relating_shape_aspect)) AND (sar.relating_shape_aspect.
              description = 'perforation')) )) >= 1));
END_ENTITY; -- separation_tray_component_feature_definition

ENTITY shape_aspect;
    name                : label;
    description         : text;
    of_shape            : product_definition_shape;
    product_definitional : LOGICAL;
END_ENTITY; -- shape_aspect

ENTITY shape_aspect_relationship;
    name                 : label;
    description          : text;
    relating_shape_aspect : shape_aspect;
    related_shape_aspect  : shape_aspect;
END_ENTITY; -- shape_aspect_relationship

ENTITY shape_representation
  SUBTYPE OF (representation);
END_ENTITY; -- shape_representation

ENTITY si_unit
  SUBTYPE OF (named_unit);
    prefix : OPTIONAL si_prefix;
    name   : si_unit_name;
  DERIVE
    SELF\named_unit.dimensions : dimensional_exponents :=
                                    dimensions_for_si_unit(SELF.name);
END_ENTITY; -- si_unit

ENTITY simulated_process_definition
  SUBTYPE OF (action_method_relationship);
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.PROCESS_SIMULATION' IN TYPEOF(SELF.
              related_method));
END_ENTITY; -- simulated_process_definition

ENTITY site
  SUBTYPE OF (characterized_object, property_definition);
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.PLANT' IN TYPEOF(SELF\
              property_definition.definition\product_definition.formation.
              of_product));
END_ENTITY; -- site

ENTITY site_reference_time
  SUBTYPE OF (property_definition);
  WHERE
    wr1: (SELF.description IN ['absolute','relative']);
    wr2: ('CONCEPTUAL_PROCESS_DESIGN.SITE' IN TYPEOF(SELF.definition));
END_ENTITY; -- site_reference_time

ENTITY site_standard_condition
  SUBTYPE OF (property_definition);
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.SITE' IN TYPEOF(SELF.definition));
END_ENTITY; -- site_standard_condition
```

```
ENTITY sited_plant
  SUBTYPE OF (property_definition);
  UNIQUE
    ur1 : definition;
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION' IN TYPEOF(SELF.
           definition));
    wr2: (SELF.definition.frame_of_reference.name =
           'physical occurrence');
END_ENTITY; -- sited_plant

ENTITY solid_angle_measure_with_unit
  SUBTYPE OF (measure_with_unit);
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.SOLID_ANGLE_UNIT' IN TYPEOF(SELF\
           measure_with_unit.unit_component));
END_ENTITY; -- solid_angle_measure_with_unit

ENTITY solid_angle_unit
  SUBTYPE OF (named_unit);
  WHERE
    wr1: ((SELF\named_unit.dimensions.length_exponent = 0) AND (SELF\
           named_unit.dimensions.mass_exponent = 0) AND (SELF\
           named_unit.dimensions.time_exponent = 0) AND (SELF\
           named_unit.dimensions.electric_current_exponent = 0) AND (
           SELF\named_unit.dimensions.
           thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
           .dimensions.amount_of_substance_exponent = 0) AND (SELF\
           named_unit.dimensions.luminous_intensity_exponent = 0));
END_ENTITY; -- solid_angle_unit

ENTITY solids_storage_bin
  SUBTYPE OF (product_definition);
  WHERE
    wr1: (SIZEOF(QUERY ( pdr <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
         + 'PRODUCT_DEFINITION_RELATIONSHIP.RELATING_PRODUCT_DEFINITION')
          | ('CONCEPTUAL_PROCESS_DESIGN.BIN_SECTION' IN TYPEOF(pdr.
         related_product_definition)) )) >= 1);
END_ENTITY; -- solids_storage_bin

ENTITY specific_equation
  SUBTYPE OF (representation);
WHERE
  WR1: SIZEOF (QUERY (it <* SELF.items |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.COMPOUND_REPRESENTATION_ITEM' IN
       TYPEOF (it)))) = 0;
  WR2: SIZEOF (QUERY (cpr <* QUERY (it <* SELF.items |
       'CONCEPTUAL_PROCESS_DESIGN.COMPOUND_REPRESENTATION_ITEM' IN
       TYPEOF (it)) |
       NOT ('CONCEPTUAL_PROCESS_DESIGN.SET_REPRESENTATION_ITEM' IN
       TYPEOF (cpr.item_element)))) = 0;
  WR3: SIZEOF (QUERY (it <* SELF.items |
       NOT (SIZEOF (QUERY (aga <* USEDIN (it,
       'CONCEPTUAL_PROCESS_DESIGN.' +
       'APPLIED_GROUP_ASSIGNMENT.ITEMS') |
       aga.role.name = 'specific equation parameter type')) = 1))) = 0;
  WR4: SIZEOF (QUERY (it <* SELF.items |
       NOT (SIZEOF (QUERY (spt <* QUERY (aga <* USEDIN (it,
       'CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT.ITEMS') |
       aga.role.name = 'specific equation parameter type') |
       (spt.assigned_group.name IN
       ['coefficient', 'substance property', 'binary parameter']) AND
       (spt.assigned_group.description = 'parameter type'))) = 1))) = 0;
  WR5: SIZEOF (QUERY (it <* SELF.items |
```

```
        NOT ((NOT (SIZEOF (QUERY (spt <* QUERY (aga <* USEDIN (it,
        'CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT.ITEMS') |
        aga.role.name = 'specific equation parameter type') |
        spt.assigned_group.name IN
        ['coefficient', 'substance property'])) = 1)) OR
        (SIZEOF (QUERY (elem <*
        it\compound_representation_item.item_element |
        NOT (SIZEOF (QUERY (pdr <* USEDIN (elem,
        'CONCEPTUAL_PROCESS_DESIGN.' +
        'ITEM_IDENTIFIED_REPRESENTATION_USAGE.IDENTIFIED_ITEM') |
        SIZEOF (QUERY (aga <* USEDIN (pdr.definition.definition\
        product_definition.formation.of_product,
        'CONCEPTUAL_PROCESS_DESIGN.' +
        'APPLIED_GROUP_ASSIGNMENT.ITEMS') |
        aga.assigned_group.name = 'chemical component'))
        = 1)) = 1))) = 0)))) = 0;
  WR6: SIZEOF (QUERY (it <* SELF.items |
        NOT ((NOT (SIZEOF (QUERY (spt <* QUERY (aga <* USEDIN (it,
        'CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT.ITEMS') |
        aga.role.name = 'specific equation parameter type') |
        spt.assigned_group.name = 'binary parameter')) = 1)) OR
        (SIZEOF (QUERY (elem <*
        it\compound_representation_item.item_element |
        NOT (SIZEOF (QUERY (pdr <* USEDIN (elem,
        'CONCEPTUAL_PROCESS_DESIGN.' +
        'ITEM_IDENTIFIED_REPRESENTATION_USAGE.IDENTIFIED_ITEM') |
        SIZEOF (QUERY (aga <* USEDIN (pdr.definition.definition\
        product_definition.formation.of_product,
        'CONCEPTUAL_PROCESS_DESIGN.' +
        'APPLIED_GROUP_ASSIGNMENT.ITEMS') |
        aga.assigned_group.name = 'chemical component'))
        = 1)) = 2))) = 0)))) = 0;
END_ENTITY;

ENTITY specific_phase
  SUBTYPE OF (action_resource);
  WHERE
    wr1: (SELF.kind.name IN ['material stream phase',
         'material amount phase','internal stream phase',
         'distillation stage phase','heat exchanger internal phase']);
    wr2: (SIZEOF(QUERY ( aga <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
         + 'APPLIED_GROUP_ASSIGNMENT.ITEMS') | ((aga.role.name =
         'phase type') AND (aga.assigned_group.name IN ['physical',
         'logical'])) )) = 1);
    wr3: (SIZEOF(QUERY ( aga <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
         + 'APPLIED_GROUP_ASSIGNMENT.ITEMS') | (
         'CONCEPTUAL_PROCESS_DESIGN.PHASE' IN TYPEOF(aga.
         assigned_group)) )) <= 1);
    wr4: ((NOT (SELF.kind.name = 'material amount phase')) OR (SIZEOF(
         QUERY ( pos <* QUERY ( arr <* USEDIN(SELF,
         'CONCEPTUAL_PROCESS_DESIGN.' +
         'ACTION_RESOURCE_RELATIONSHIP.RELATED_RESOURCE') | (arr.name
         = 'specific phase possession') ) | (pos.
         relating_action_resource.kind.name = 'material amount') ))
         = 1));
    wr5: ((NOT (SELF.kind.name = 'material stream phase')) OR (SIZEOF(
         QUERY ( pos <* QUERY ( arr <* USEDIN(SELF,
         'CONCEPTUAL_PROCESS_DESIGN.' +
         'ACTION_RESOURCE_RELATIONSHIP.RELATED_RESOURCE') | (arr.name
         = 'specific phase possession') ) | (pos.
         relating_action_resource.kind.name = 'material stream') ))
         = 1));
    wr6: ((NOT (SELF.kind.name IN ['internal stream phase',
         'distillation stage phase','heat exchanger internal phase']))
```

```
          OR (SIZEOF(QUERY ( pos <* QUERY ( arr <* USEDIN(SELF,
          'CONCEPTUAL_PROCESS_DESIGN.' +
          'ACTION_RESOURCE_RELATIONSHIP.RELATED_RESOURCE') | (arr.name
          = 'specific phase possession') ) | (
          'CONCEPTUAL_PROCESS_DESIGN.STREAM' IN TYPEOF(pos.
          relating_action_resource)) )) = 1));
    wr7: (SIZEOF(QUERY ( rp <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
          + 'RESOURCE_PROPERTY.RESOURCE') | (NOT (SIZEOF(
          QUERY ( rpr <* USEDIN(rp,'CONCEPTUAL_PROCESS_DESIGN.' +
          'RESOURCE_PROPERTY_REPRESENTATION.PROPERTY') | (NOT (SIZEOF(
          QUERY ( pdr <* USEDIN(rpr.representation,
          'CONCEPTUAL_PROCESS_DESIGN.' +
          'PROPERTY_DEFINITION_REPRESENTATION.USED_REPRESENTATION') |
          (NOT (SIZEOF(QUERY ( denv <* USEDIN(pdr,
          'CONCEPTUAL_PROCESS_DESIGN.' + 'DATA_ENVIRONMENT.ELEMENTS')
           | ('CONCEPTUAL_PROCESS_DESIGN.THERMODYNAMIC_CONDITION' IN
          TYPEOF(denv)) )) = 1)) )) = 0)) )) = 0)) )) = 0);
END_ENTITY; -- specific_phase

ENTITY stage_column_section
  SUBTYPE OF (group, characterized_object);
  WHERE
    wr1: (SIZEOF(QUERY ( aga <* QUERY ( ag <* USEDIN(SELF,
              'CONCEPTUAL_PROCESS_DESIGN.GROUP_ASSIGNMENT.ASSIGNED_GROUP')
               | ('CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT' IN
              TYPEOF(ag)) ) | (NOT (SIZEOF(QUERY ( it <* aga.items | ((
              'CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF(it)) AND
               (NOT (SIZEOF(QUERY ( ca <* USEDIN(it,
              'CONCEPTUAL_PROCESS_DESIGN.' +
              'CLASSIFICATION_ASSIGNMENT.ITEMS') | (NOT (ca.assigned_group
              .name IN ['uo distillation stage','uo distillation'])) )) =
              0))) )) = 0)) )) = 0);
    wr2: (SIZEOF(QUERY ( aga <* QUERY ( ag <* USEDIN(SELF,
              'CONCEPTUAL_PROCESS_DESIGN.GROUP_ASSIGNMENT.ASSIGNED_GROUP')
               | ('CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT' IN
              TYPEOF(ag)) ) | (SIZEOF(QUERY ( it <* aga.items | ((
              'CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF(it)) AND
               (SIZEOF(QUERY ( ca <* USEDIN(it,
              'CONCEPTUAL_PROCESS_DESIGN.' +
              'CLASSIFICATION_ASSIGNMENT.ITEMS') | (ca.assigned_group.name
              = 'uo distillation') )) = 1)) )) = 1) )) = 1);
END_ENTITY; -- stage_column_section

ENTITY stream
  SUBTYPE OF (action_resource, characterized_object);
END_ENTITY; -- stream

ENTITY stream_reference_time
  SUBTYPE OF (resource_property);
  WHERE
    wr1: (SELF.description IN ['absolute','relative']);
    wr2: ('CONCEPTUAL_PROCESS_DESIGN.STREAM' IN TYPEOF(SELF.resource));
END_ENTITY; -- stream_reference_time

ENTITY stream_separation_specification
  SUBTYPE OF (representation);
  WHERE
    wr1: (SIZEOF(QUERY ( apr <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
          + 'ACTION_PROPERTY_REPRESENTATION.REPRESENTATION') | ((
          'CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF(apr.
          property.definition)) AND (SIZEOF(QUERY ( ca <* USEDIN(apr.
          property.definition,
          'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
           | (NOT (ca.assigned_group.name = 'uo substance splitter')) ))
```

```
          = 0)) )) = 1);
     wr2: (SIZEOF(QUERY ( pdr <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
          + 'PROPERTY_DEFINITION_REPRESENTATION.USED_REPRESENTATION')
           | (('CONCEPTUAL_PROCESS_DESIGN.PRODUCT_DEFINITION' IN
          TYPEOF(pdr.definition.definition)) AND (SIZEOF(
          QUERY ( prpc <* USEDIN(pdr.definition.definition.formation.
          of_product,'CONCEPTUAL_PROCESS_DESIGN.' +
          'PRODUCT_RELATED_PRODUCT_CATEGORY.PRODUCTS') | (NOT (prpc.
          name = 'substance')) )) = 0)) )) = 1);
  END_ENTITY; -- stream_separation_specification

  ENTITY stream_split_specification
    SUBTYPE OF (representation);
    WHERE
      wr1: (SIZEOF(QUERY ( apr <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
               + 'ACTION_PROPERTY_REPRESENTATION.REPRESENTATION') | ((
               'CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF(apr.
               property.definition)) AND (SIZEOF(QUERY ( ca <* USEDIN(apr.
               property.definition,
               'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
                | (NOT (ca.assigned_group.name = 'uo stream splitter')) ))
               = 0)) )) = 1);
      wr2: (SIZEOF(QUERY ( rpr <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
               + 'RESOURCE_PROPERTY_REPRESENTATION.REPRESENTATION') | ((rpr
               .property.name = 'outlet specification') AND (
               'CONCEPTUAL_PROCESS_DESIGN.ACTION_RESOURCE' IN TYPEOF(rpr.
               property.definition)) AND (rpr.property.definition.kind.name
               = 'material stream')) )) = 1);
  END_ENTITY; -- stream_split_specification

  ENTITY styled_item
    SUBTYPE OF (representation_item);
      styles : SET [1:?] OF presentation_style_assignment;
      item   : representation_item;
    WHERE
      wr1: ((SIZEOF(SELF.styles) = 1) XOR (SIZEOF(QUERY ( pres_style <*
               SELF.styles | (NOT (('CONCEPTUAL_PROCESS_DESIGN.' +
               'PRESENTATION_STYLE_BY_CONTEXT') IN TYPEOF(pres_style))) ))
               = 0));
  END_ENTITY; -- styled_item

  ENTITY symbol_colour;
      colour_of_symbol : colour;
  END_ENTITY; -- symbol_colour

  ENTITY symbol_representation
    SUBTYPE OF (representation);
  END_ENTITY; -- symbol_representation

  ENTITY symbol_representation_map
    SUBTYPE OF (representation_map);
    WHERE
      wr1: ('CONCEPTUAL_PROCESS_DESIGN.SYMBOL_REPRESENTATION' IN TYPEOF(
               SELF\representation_map.mapped_representation));
      wr2: ('CONCEPTUAL_PROCESS_DESIGN.AXIS2_PLACEMENT' IN TYPEOF(SELF\
               representation_map.mapping_origin));
  END_ENTITY; -- symbol_representation_map

  ENTITY symbol_representation_relationship
    SUBTYPE OF (representation_relationship_with_transformation);
    WHERE
      wr1: acyclic_symbol_representation_relationship(SELF,[SELF\
               representation_relationship.rep_2]);
      wr2: ('CONCEPTUAL_PROCESS_DESIGN.SYMBOL_REPRESENTATION' IN TYPEOF(
```

```
            SELF\representation_relationship.rep_1));
    wr3: ('CONCEPTUAL_PROCESS_DESIGN.SYMBOL_REPRESENTATION' IN TYPEOF(
            SELF\representation_relationship.rep_2));
END_ENTITY; -- symbol_representation_relationship

ENTITY symbol_style;
    name            : label;
    style_of_symbol : symbol_style_select;
END_ENTITY; -- symbol_style

ENTITY symbol_target
  SUBTYPE OF (geometric_representation_item);
    placement : axis2_placement;
    x_scale   : positive_ratio_measure;
    y_scale   : positive_ratio_measure;
END_ENTITY; -- symbol_target

ENTITY text_literal
  SUBTYPE OF (geometric_representation_item);
    literal   : presentable_text;
    placement : axis2_placement;
    alignment : text_alignment;
    path      : text_path;
    font      : font_select;
END_ENTITY; -- text_literal

ENTITY text_literal_with_associated_curves
  SUBTYPE OF (text_literal);
    associated_curves : SET [1:?] OF curve;
END_ENTITY; -- text_literal_with_associated_curves

ENTITY text_literal_with_blanking_box
  SUBTYPE OF (text_literal);
    blanking : planar_box;
END_ENTITY; -- text_literal_with_blanking_box

ENTITY text_literal_with_delineation
  SUBTYPE OF (text_literal);
    delineation : text_delineation;
END_ENTITY; -- text_literal_with_delineation

ENTITY text_literal_with_extent
  SUBTYPE OF (text_literal);
    extent : planar_extent;
END_ENTITY; -- text_literal_with_extent

ENTITY text_string_representation
  SUBTYPE OF (representation);
  WHERE
    wr1: (SIZEOF(QUERY ( item <* SELF\representation.items | (SIZEOF([
              'CONCEPTUAL_PROCESS_DESIGN.TEXT_LITERAL',
              'CONCEPTUAL_PROCESS_DESIGN.ANNOTATION_TEXT',
              'CONCEPTUAL_PROCESS_DESIGN.ANNOTATION_TEXT_CHARACTER',
              'CONCEPTUAL_PROCESS_DESIGN.DEFINED_CHARACTER_GLYPH',
              'CONCEPTUAL_PROCESS_DESIGN.COMPOSITE_TEXT',
              'CONCEPTUAL_PROCESS_DESIGN.AXIS2_PLACEMENT'] * TYPEOF(item))
              = 0) )) = 0);
    wr2: (SIZEOF(QUERY ( item <* SELF\representation.items | (NOT (
              SIZEOF(['CONCEPTUAL_PROCESS_DESIGN.TEXT_LITERAL',
              'CONCEPTUAL_PROCESS_DESIGN.ANNOTATION_TEXT',
              'CONCEPTUAL_PROCESS_DESIGN.ANNOTATION_TEXT_CHARACTER',
              'CONCEPTUAL_PROCESS_DESIGN.DEFINED_CHARACTER_GLYPH',
              'CONCEPTUAL_PROCESS_DESIGN.COMPOSITE_TEXT'] * TYPEOF(item))
              = 0)) )) >= 1);
```

```
      wr3: (SIZEOF(QUERY ( a2p <* QUERY ( item <* SELF\representation.
                items | ('CONCEPTUAL_PROCESS_DESIGN.AXIS2_PLACEMENT' IN
                TYPEOF(item)) ) | (NOT ((SIZEOF(QUERY ( at <*
                QUERY ( item <* SELF\representation.items | ((
                'CONCEPTUAL_PROCESS_DESIGN.' + 'ANNOTATION_TEXT') IN TYPEOF(
                item)) ) | (at\mapped_item.mapping_target :=: a2p) )) >= 1)
                OR (SIZEOF(QUERY ( atc <* QUERY ( item <* SELF\
                representation.items | (('CONCEPTUAL_PROCESS_DESIGN.' +
                'ANNOTATION_TEXT_CHARACTER') IN TYPEOF(item)) ) | (atc\
                mapped_item.mapping_target :=: a2p) )) >= 1))) )) = 0);
  END_ENTITY; -- text_string_representation

  ENTITY text_style;
      name                 : label;
      character_appearance : character_style_select;
  END_ENTITY; -- text_style

  ENTITY text_style_for_defined_font;
      text_colour : colour;
  END_ENTITY; -- text_style_for_defined_font

  ENTITY text_style_with_box_characteristics
    SUBTYPE OF (text_style);
      characteristics : SET [1:4] OF box_characteristic_select;
    WHERE
      wr1: (SIZEOF(QUERY ( c1 <* SELF.characteristics | (SIZEOF(
                QUERY ( c2 <* (SELF.characteristics - c1) | (TYPEOF(c1) =
                TYPEOF(c2)) )) > 0) )) = 0);
  END_ENTITY; -- text_style_with_box_characteristics

  ENTITY text_style_with_mirror
    SUBTYPE OF (text_style);
      mirror_placement : axis2_placement;
  END_ENTITY; -- text_style_with_mirror

  ENTITY thermodynamic_condition
    SUBTYPE OF (data_environment);
    WHERE
      wr1: (SIZEOF(SELF.elements) = 1);
  END_ENTITY; -- thermodynamic_condition

  ENTITY thermodynamic_temperature_measure_with_unit
    SUBTYPE OF (measure_with_unit);
    WHERE
      wr1: ('CONCEPTUAL_PROCESS_DESIGN.THERMODYNAMIC_TEMPERATURE_UNIT' IN
                TYPEOF(SELF\measure_with_unit.unit_component));
  END_ENTITY; -- thermodynamic_temperature_measure_with_unit

  ENTITY thermodynamic_temperature_unit
    SUBTYPE OF (named_unit);
    WHERE
      wr1: ((SELF\named_unit.dimensions.length_exponent = 0) AND (SELF\
                named_unit.dimensions.mass_exponent = 0) AND (SELF\
                named_unit.dimensions.time_exponent = 0) AND (SELF\
                named_unit.dimensions.electric_current_exponent = 0) AND (
                SELF\named_unit.dimensions.
                thermodynamic_temperature_exponent = 1) AND (SELF\named_unit
                .dimensions.amount_of_substance_exponent = 0) AND (SELF\
                named_unit.dimensions.luminous_intensity_exponent = 0));
  END_ENTITY; -- thermodynamic_temperature_unit

  ENTITY thermophysical_property_classification
    SUBTYPE OF (group);
    WHERE
```

```
    wr1: (SELF.name IN ['bulk thermodynamic',
         'bulk vapor liquid equilibrium','transport','density',
         'thermodynamic','component in mixture','excess']);
    wr2: (SIZEOF(QUERY ( ga <* USEDIN(SELF,'CONCEPTUAL_PROCESS_DESIGN.'
         + 'GROUP_ASSIGNMENT.ASSIGNED_GROUP') | (NOT (ga.role.name =
         'property class')) )) = 0);
    wr3: (SIZEOF(QUERY ( aga <* QUERY ( ga <* USEDIN(SELF,
         'CONCEPTUAL_PROCESS_DESIGN.GROUP_ASSIGNMENT.ASSIGNED_GROUP')
          | ('CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT' IN
         TYPEOF(ga)) ) | (NOT (SIZEOF(QUERY ( it <* aga.items | (NOT
         ('CONCEPTUAL_PROCESS_DESIGN.REPRESENTATION_ITEM' IN TYPEOF(
         it))) )) = 0)) )) = 0);
    wr4: (SIZEOF(QUERY ( aga <* QUERY ( ga <* USEDIN(SELF,
         'CONCEPTUAL_PROCESS_DESIGN.GROUP_ASSIGNMENT.ASSIGNED_GROUP')
          | ('CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT' IN
         TYPEOF(ga)) ) | (NOT (SIZEOF(QUERY ( ri <* QUERY ( it <* aga
         .items | (NOT (
         'CONCEPTUAL_PROCESS_DESIGN.REPRESENTATION_ITEM'
         IN TYPEOF(it))) )
          | (NOT (SIZEOF(QUERY ( rep <* USEDIN(ri,
         'CONCEPTUAL_PROCESS_DESIGN.REPRESENTATION.ITEMS') | (NOT (
         rep.name IN ['bulk thermophysical properties',
         'single phase thermophysical properties'])) )) = 0)) )) = 0)) ))
         = 0);
END_ENTITY; -- thermophysical_property_classification

ENTITY time_measure_with_unit
  SUBTYPE OF (measure_with_unit);
  WHERE
    wr1: ('CONCEPTUAL_PROCESS_DESIGN.TIME_UNIT' IN TYPEOF(SELF\
            measure_with_unit.unit_component));
END_ENTITY; -- time_measure_with_unit

ENTITY time_unit
  SUBTYPE OF (named_unit);
  WHERE
    wr1: ((SELF\named_unit.dimensions.length_exponent = 0) AND (SELF\
            named_unit.dimensions.mass_exponent = 0) AND (SELF\
            named_unit.dimensions.time_exponent = 1) AND (SELF\
            named_unit.dimensions.electric_current_exponent = 0) AND (
            SELF\named_unit.dimensions.
            thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
            .dimensions.amount_of_substance_exponent = 0) AND (SELF\
            named_unit.dimensions.luminous_intensity_exponent = 0));
END_ENTITY; -- time_unit

ENTITY trigger
  SUBTYPE OF (action_property);
  WHERE
    wr1: (SELF.description = 'control logic condition');
    wr2: ('CONCEPTUAL_PROCESS_DESIGN.ACTION_METHOD' IN TYPEOF(SELF.
            definition));
    wr3: (SIZEOF(QUERY ( ca <* USEDIN(SELF.definition,
            'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
             | (NOT (ca.assigned_group.name = 'control logic')) )) = 0);
END_ENTITY; -- trigger

ENTITY trimmed_curve
  SUBTYPE OF (bounded_curve);
    basis_curve           : curve;
    trim_1                : SET [1:2] OF trimming_select;
    trim_2                : SET [1:2] OF trimming_select;
    sense_agreement       : BOOLEAN;
    master_representation : trimming_preference;
```

```
    WHERE
      wr1: ((HIINDEX(trim_1) = 1) XOR (TYPEOF(trim_1[1]) <> TYPEOF(trim_1[
           2])));
      wr2: ((HIINDEX(trim_2) = 1) XOR (TYPEOF(trim_2[1]) <> TYPEOF(trim_2[
           2])));
  END_ENTITY; -- trimmed_curve

  ENTITY tube_type
    SUBTYPE OF (group, characterized_object);
    WHERE
      wr1: (SIZEOF(QUERY ( ca <* QUERY ( ga <* USEDIN(SELF,
           'CONCEPTUAL_PROCESS_DESIGN.GROUP_ASSIGNMENT.ASSIGNED_GROUP')
            | ('CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT' IN
           TYPEOF(ga)) ) | (SIZEOF(QUERY ( it <* ca.items | (NOT ((
           'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT' IN
           TYPEOF(it)) AND (SIZEOF(QUERY ( ect <* QUERY ( ca <* USEDIN(
           it.of_shape.definition.formation.of_product,
           'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT.ITEMS')
            | (ca.role.name = 'equipment component type') ) | (ect.
           assigned_group.name = 'exchanger bundle') )) = 1))) )) = 0) ))
           >= 1);
      wr2: ((SIZEOF(QUERY ( pd <* USEDIN(SELF,
           'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION')
            | (SIZEOF(QUERY ( pdr <* USEDIN(pd,
           'CONCEPTUAL_PROCESS_DESIGN.' +
           'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') | (pdr.
           used_representation.name = 'tube internal characteristics') ))
           <= 1) )) <= 1) AND (SIZEOF(QUERY ( pd <* USEDIN(SELF,
           'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION')
            | (SIZEOF(QUERY ( pdr <* USEDIN(pd,
           'CONCEPTUAL_PROCESS_DESIGN.' +
           'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') | (pdr.
           used_representation.name = 'tube internal characteristics') ))
           >= 2) )) = 0));
      wr3: ((SIZEOF(QUERY ( pd <* USEDIN(SELF,
           'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION')
            | (SIZEOF(QUERY ( pdr <* USEDIN(pd,
           'CONCEPTUAL_PROCESS_DESIGN.' +
           'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') | (pdr.
           used_representation.name = 'tube external characteristics') ))
           <= 1) )) <= 1) AND (SIZEOF(QUERY ( pd <* USEDIN(SELF,
           'CONCEPTUAL_PROCESS_DESIGN.PROPERTY_DEFINITION.DEFINITION')
            | (SIZEOF(QUERY ( pdr <* USEDIN(pd,
           'CONCEPTUAL_PROCESS_DESIGN.' +
           'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') | (pdr.
           used_representation.name = 'tube external characteristics') ))
           >= 2) )) = 0));
  END_ENTITY; -- tube_type

  ENTITY two_direction_repeat_factor
    SUBTYPE OF (one_direction_repeat_factor);
      second_repeat_factor : vector;
  END_ENTITY; -- two_direction_repeat_factor

  ENTITY type_qualifier;
      name : label;
  END_ENTITY; -- type_qualifier

  ENTITY uniform_curve
    SUBTYPE OF (b_spline_curve);
  END_ENTITY; -- uniform_curve

  ENTITY vector
    SUBTYPE OF (geometric_representation_item);
```

```
      orientation : direction;
      magnitude   : length_measure;
    WHERE
      wr1: (magnitude >= 0);
  END_ENTITY; -- vector

  ENTITY versioned_action_request;
      id          : identifier;
      version     : label;
      purpose     : text;
      description : text;
  END_ENTITY; -- versioned_action_request

  ENTITY volume_measure_with_unit
    SUBTYPE OF (measure_with_unit);
    WHERE
      wr1: ('CONCEPTUAL_PROCESS_DESIGN.VOLUME_UNIT' IN TYPEOF(SELF\
              measure_with_unit.unit_component));
  END_ENTITY; -- volume_measure_with_unit

  ENTITY volume_unit
    SUBTYPE OF (named_unit);
    WHERE
      wr1: ((SELF\named_unit.dimensions.length_exponent = 3) AND (SELF\
              named_unit.dimensions.mass_exponent = 0) AND (SELF\
              named_unit.dimensions.time_exponent = 0) AND (SELF\
              named_unit.dimensions.electric_current_exponent = 0) AND (
              SELF\named_unit.dimensions.
              thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
              .dimensions.amount_of_substance_exponent = 0) AND (SELF\
              named_unit.dimensions.luminous_intensity_exponent = 0));
  END_ENTITY; -- volume_unit

  RULE application_context_requires_ap_definition FOR (application_context,
              application_protocol_definition);

  WHERE
    wr1: (SIZEOF(QUERY ( ac <* application_context | (NOT (SIZEOF(
             QUERY ( apd <* application_protocol_definition | ((ac :=: apd.
             application) AND (apd.
             application_interpreted_model_schema_name =
             'conceptual_process_design')) )) = 1)) )) = 0);

  END_RULE; -- application_context_requires_ap_definition

  RULE compatible_dimension FOR (cartesian_point, direction,
             representation_context, geometric_representation_context);

  WHERE
    wr1: (SIZEOF(QUERY ( x <* cartesian_point | (SIZEOF(QUERY ( y <*
         geometric_representation_context | (item_in_context(x,y) AND (
         HIINDEX(x.coordinates) <> y.coordinate_space_dimension)) )) >
         0) )) = 0);
    wr2: (SIZEOF(QUERY ( x <* direction | (SIZEOF(QUERY ( y <*
         geometric_representation_context | (item_in_context(x,y) AND (
         HIINDEX(x.direction_ratios) <> y.coordinate_space_dimension)) ))
         > 0) )) = 0);

  END_RULE; -- compatible_dimension

  RULE dependent_instantiable_application_context FOR
(application_context);

  WHERE
```

```
    wr1: (SIZEOF(QUERY ( ac <* application_context | (NOT (SIZEOF(USEDIN(
            ac,'')) >= 1)) )) = 0);

  END_RULE; -- dependent_instantiable_application_context

  RULE dependent_instantiable_product_context FOR (product_context);

  WHERE
    wr1: (SIZEOF(QUERY ( pc <* product_context |
         (NOT (SIZEOF(USEDIN(pc,'')) >= 1)) )) = 0);

  END_RULE; -- dependent_instantiable_product_context

  RULE dependent_instantiable_product_definition_context FOR (
            product_definition_context);

  WHERE
    wr1: (SIZEOF(QUERY ( pdc <* product_definition_context | (NOT (SIZEOF(
            USEDIN(pdc,'')) >= 1)) )) = 0);

  END_RULE; -- dependent_instantiable_product_definition_context

  RULE drawing_sheets_not_nested FOR (
            presentation_representation_relationship);

  WHERE
    wr1: (SIZEOF(QUERY ( p_r_r <* presentation_representation_relationship
             | (('CONCEPTUAL_PROCESS_DESIGN.DRAWING_SHEET_REVISION' IN
            TYPEOF(p_r_r.rep_1)) AND (
            'CONCEPTUAL_PROCESS_DESIGN.DRAWING_SHEET_REVISION' IN TYPEOF(
            p_r_r.rep_2))) )) = 0);

  END_RULE; -- drawing_sheets_not_nested

  RULE subtype_exclusive_action_method FOR (action_method);

  WHERE
    wr1: (SIZEOF(QUERY ( am <* action_method | (NOT (SIZEOF([
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'EVENT_SEQUENCE_WITH_CONDITION',
            'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_ACTION_METHOD',
            'CONCEPTUAL_PROCESS_DESIGN.PROCESS_SIMULATION'] * TYPEOF(am))
            <= 1)) )) = 0);

  END_RULE; -- subtype_exclusive_action_method

  RULE subtype_exclusive_action_method_relationship FOR (
            action_method_relationship);

  WHERE
    wr1: (SIZEOF(QUERY ( amr <* action_method_relationship | (NOT (SIZEOF(
            ['CONCEPTUAL_PROCESS_DESIGN.' +
            'SIMULATED_PROCESS_DEFINITION',
            'CONCEPTUAL_PROCESS_DESIGN.EVENT_SEQUENCE_WITH_CONDITION'] *
            TYPEOF(amr)) <= 1)) )) = 0);

  END_RULE; -- subtype_exclusive_action_method_relationship

  RULE subtype_exclusive_action_property FOR (action_property);

  WHERE
    wr1: (SIZEOF(QUERY ( ap <* action_property | (NOT (SIZEOF([
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'PROCESS_DEFINITION_REFERENCE_TIME',
```

```
            'CONCEPTUAL_PROCESS_DESIGN.PROCESS_SIMULATION_REFERENCE_TIME',
            'CONCEPTUAL_PROCESS_DESIGN.TRIGGER'] * TYPEOF(ap)) <= 1)) )) =
             0);

END_RULE; -- subtype_exclusive_action_property

RULE subtype_exclusive_action_resource FOR (action_resource);

WHERE
  wr1: (SIZEOF(QUERY ( ar <* action_resource | (NOT (SIZEOF([
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'FUNCTIONAL_VOLUME_SERVICE_CASE',
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'EXTERNALLY_DEFINED_ACTION_RESOURCE',
            'CONCEPTUAL_PROCESS_DESIGN.INTERPHASE',
            'CONCEPTUAL_PROCESS_DESIGN.PROCESS_DESIGN_CASE_RESOURCE',
            'CONCEPTUAL_PROCESS_DESIGN.PROCESS_MATERIAL',
            'CONCEPTUAL_PROCESS_DESIGN.PROCESS_PORT',
            'CONCEPTUAL_PROCESS_DESIGN.PROCESS_RESOURCE_PLANT_ITEM',
            'CONCEPTUAL_PROCESS_DESIGN.SPECIFIC_PHASE',
            'CONCEPTUAL_PROCESS_DESIGN.STREAM'] * TYPEOF(ar)) <= 1)) ))
           = 0);

END_RULE; -- subtype_exclusive_action_resource

RULE subtype_exclusive_characterized_object FOR (characterized_object);

WHERE
  wr1: (SIZEOF(QUERY ( co <* characterized_object | (NOT (SIZEOF([
            'CONCEPTUAL_PROCESS_DESIGN.CONTROL_OBJECTIVE',
            'CONCEPTUAL_PROCESS_DESIGN.DOCUMENT_WITH_PROPERTIES',
            'CONCEPTUAL_PROCESS_DESIGN.MOLECULAR_STRUCTURAL_GROUP',
            'CONCEPTUAL_PROCESS_DESIGN.PHASE',
            'CONCEPTUAL_PROCESS_DESIGN.PROCESS_PORT',
            'CONCEPTUAL_PROCESS_DESIGN.STAGE_COLUMN_SECTION',
            'CONCEPTUAL_PROCESS_DESIGN.SITE',
            'CONCEPTUAL_PROCESS_DESIGN.STREAM',
            'CONCEPTUAL_PROCESS_DESIGN.TUBE_TYPE'] * TYPEOF(co)) <= 1)) ))
           = 0);

END_RULE; -- subtype_exclusive_characterized_object

RULE subtype_exclusive_externally_defined_item FOR (
           externally_defined_item);

WHERE
  wr1: (SIZEOF(QUERY ( edi <* externally_defined_item | (NOT (SIZEOF([
           'CONCEPTUAL_PROCESS_DESIGN.' +
           'EXTERNALLY_DEFINED_ATION_METHOD',
           'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_ACTION_RESOURCE',
           'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_CLASSIFICATION',
           'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_GROUP',
           'CONCEPTUAL_PROCESS_DESIGN.' +
           'EXTERNALLY_DEFINED_PLANT_ITEM_DEFINITION',
           'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_PLANT_SYSTEM',
           'CONCEPTUAL_PROCESS_DESIGN.' +
           'EXTERNALLY_DEFINED_REPRESENTATION_ITEM',
           'CONCEPTUAL_PROCESS_DESIGN.PROCESS_DESIGN_PROPERTY_VALUE'] *
          TYPEOF(edi)) <= 1)) )) = 0);

END_RULE; -- subtype_exclusive_externally_defined_item

RULE subtype_exclusive_group FOR (group);
```

```
  WHERE
    wr1: (SIZEOF(QUERY ( grp <* group | (NOT (SIZEOF([
           'CONCEPTUAL_PROCESS_DESIGN.' +
           'CONNECTOR_END_TYPE_CLASSIFICATION',
           'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_CLASSIFICATION',
           'CONCEPTUAL_PROCESS_DESIGN.EXTERNALLY_DEFINED_GROUP',
           'CONCEPTUAL_PROCESS_DESIGN.PHASE',
           'CONCEPTUAL_PROCESS_DESIGN.PIPING_CONNECTOR_CLASSIFICATION',
           'CONCEPTUAL_PROCESS_DESIGN.STAGE_COLUMN_SECTION',
           'CONCEPTUAL_PROCESS_DESIGN.' +
           'THERMOPHYSICAL_PROPERTY_CLASSIFICATION',
           'CONCEPTUAL_PROCESS_DESIGN.TUBE_TYPE'] * TYPEOF(grp)) <= 1)) ))
          = 0);

  END_RULE; -- subtype_exclusive_group

  RULE subtype_exclusive_presented_item FOR (presented_item);

  WHERE
    wr1: (SIZEOF(QUERY ( pres_i <* presented_item | (NOT (SIZEOF([
              'CONCEPTUAL_PROCESS_DESIGN.' + 'PRESENTED_ITEM_ASSOCIATION',
              'CONCEPTUAL_PROCESS_DESIGN.PRESENTED_ITEM_WITH_ASSOCIATION'] *
               TYPEOF(pres_i)) <= 1)) )) = 0);

  END_RULE; -- subtype_exclusive_presented_item

  RULE subtype_exclusive_product FOR (product);

  WHERE
    wr1: (SIZEOF(QUERY ( prod <* product | (NOT (SIZEOF([
              'CONCEPTUAL_PROCESS_DESIGN.PLANT',
              'CONCEPTUAL_PROCESS_DESIGN.PROCESS_RESOURCE_PLANT_ITEM'] *
              TYPEOF(prod)) <= 1)) )) = 0);

  END_RULE; -- subtype_exclusive_product

  RULE subtype_exclusive_product_definition FOR (product_definition);

  WHERE
    wr1: (SIZEOF(QUERY ( pd <* product_definition | (NOT (SIZEOF([
           'CONCEPTUAL_PROCESS_DESIGN.BIN_SECTION',
           'CONCEPTUAL_PROCESS_DESIGN.BOOT',
           'CONCEPTUAL_PROCESS_DESIGN.INSTRUMENTATION_AND_CONTROL_SYSTEM',
           'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_COMPONENT',
           'CONCEPTUAL_PROCESS_DESIGN.HEAT_TRANSFER_EQUIPMENT',
           'CONCEPTUAL_PROCESS_DESIGN.NOZZLE',
           'CONCEPTUAL_PROCESS_DESIGN.SEPARATION_TOWER',
           'CONCEPTUAL_PROCESS_DESIGN.SEPARATION_TRAY_COMPONENT_DEFINITION',
           'CONCEPTUAL_PROCESS_DESIGN.SOLIDS_STORAGE_BIN',
           'CONCEPTUAL_PROCESS_DESIGN.PROCESS_MATERIAL'] * TYPEOF(pd)) <=
          1)) )) = 0);

  END_RULE; -- subtype_exclusive_product_definition

  RULE subtype_exclusive_property_definition FOR (property_definition);

  WHERE
    wr1: (SIZEOF(QUERY ( pd <* property_definition | (NOT (SIZEOF([
              'CONCEPTUAL_PROCESS_DESIGN.PLANT_ITEM_REFERENCE_TIME',
              'CONCEPTUAL_PROCESS_DESIGN.PORT_SERVICE_CASE',
              'CONCEPTUAL_PROCESS_DESIGN.PROCESS_DESIGN_CASE',
              'CONCEPTUAL_PROCESS_DESIGN.SITE',
              'CONCEPTUAL_PROCESS_DESIGN.SITE_REFERENCE_TIME',
              'CONCEPTUAL_PROCESS_DESIGN.SITED_PLANT',
```

```
            'CONCEPTUAL_PROCESS_DESIGN.SITE_STANDARD_CONDITION'] * TYPEOF(
            pd)) <= 1)) )) = 0);

END_RULE; -- subtype_exclusive_property_definition

RULE subtype_exclusive_representation FOR (representation);

WHERE
  wr1: (SIZEOF(QUERY ( rep <* representation | (NOT (SIZEOF([
            'CONCEPTUAL_PROCESS_DESIGN.DATA_CURVE',
            'CONCEPTUAL_PROCESS_DESIGN.HEAT_EXCHANGER_INTERNAL_DATA',
            'CONCEPTUAL_PROCESS_DESIGN.INTERSECTION_DESCRIPTION',
            'CONCEPTUAL_PROCESS_DESIGN.PARTICLE_SIZE_DISTRIBUTION_VALUES',
            'CONCEPTUAL_PROCESS_DESIGN.PRESENTATION_REPRESENTATION',
            'CONCEPTUAL_PROCESS_DESIGN.PROCESS_DESIGN_PROPERTY_VALUE',
            'CONCEPTUAL_PROCESS_DESIGN.REACTOR_YIELD',
            'CONCEPTUAL_PROCESS_DESIGN.SPECIFIC_EQUATION',
            'CONCEPTUAL_PROCESS_DESIGN.STREAM_SEPARATION_SPECIFICATION',
            'CONCEPTUAL_PROCESS_DESIGN.STREAM_SPLIT_SPECIFICATION',
            'CONCEPTUAL_PROCESS_DESIGN.SHAPE_REPRESENTATION',
            'CONCEPTUAL_PROCESS_DESIGN.SYMBOL_REPRESENTATION'] * TYPEOF(
            rep)) <= 1)) )) = 0);

END_RULE; -- subtype_exclusive_representation

RULE subtype_exclusive_resource_property FOR (resource_property);

WHERE
  wr1: (SIZEOF(QUERY ( rp <* resource_property | (NOT (SIZEOF([
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'MATERIAL_AMOUNT_REFERENCE_TIME',
            'CONCEPTUAL_PROCESS_DESIGN.PROCESS_MATERIAL_REFERENCE_TIME',
            'CONCEPTUAL_PROCESS_DESIGN.STREAM_REFERENCE_TIME'] *
            TYPEOF(rp)) <= 1)) )) = 0);

END_RULE; -- subtype_exclusive_resource_property

RULE subtype_exclusive_shape_aspect FOR (shape_aspect);

WHERE
  wr1: (SIZEOF(QUERY ( sa <* shape_aspect | (NOT (SIZEOF([
            'CONCEPTUAL_PROCESS_DESIGN.EQUIPMENT_PORT',
            'CONCEPTUAL_PROCESS_DESIGN.EXCHANGER_ZONE',
            'CONCEPTUAL_PROCESS_DESIGN.FUNCTIONAL_VOLUME_SERVICE_CASE',
            'CONCEPTUAL_PROCESS_DESIGN.RESERVED_SPACE',
            'CONCEPTUAL_PROCESS_DESIGN.SEPARATION_TRAY_COMPONENT_FEATURE',
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'SEPARATION_TRAY_COMPONENT_FEATURE_DEFINITION'] * TYPEOF(sa))
            <= 1)) )) = 0);

END_RULE; -- subtype_exclusive_shape_aspect

RULE subtype_mandatory_approval_assignment FOR (approval_assignment);

WHERE
  wr1: (SIZEOF(QUERY ( aa <* approval_assignment | (NOT (
            'CONCEPTUAL_PROCESS_DESIGN.APPLIED_APPROVAL_ASSIGNMENT' IN
            TYPEOF(aa))) )) = 0);

END_RULE; -- subtype_mandatory_approval_assignment

RULE subtype_mandatory_certification_assignment FOR (
            certification_assignment);
```

```
  WHERE
    wr1: (SIZEOF(QUERY ( ca <* certification_assignment | (NOT (
              'CONCEPTUAL_PROCESS_DESIGN.APPLIED_CERTIFICATION_ASSIGNMENT'
              IN TYPEOF(ca))) )) = 0);

  END_RULE; -- subtype_mandatory_certification_assignment

  RULE subtype_mandatory_date_and_time_assignment FOR (
              date_and_time_assignment);

  WHERE
    wr1: (SIZEOF(QUERY ( dta <* date_and_time_assignment | (NOT (
              'CONCEPTUAL_PROCESS_DESIGN.APPLIED_DATE_TIME_ASSIGNMENT' IN
              TYPEOF(dta))) )) = 0);

  END_RULE; -- subtype_mandatory_date_and_time_assignment

  RULE subtype_mandatory_date_assignment FOR (date_assignment);

  WHERE
    wr1: (SIZEOF(QUERY ( da <* date_assignment | (NOT (
              'CONCEPTUAL_PROCESS_DESIGN.APPLIED_DATE_ASSIGNMENT' IN TYPEOF(
              da))) )) = 0);

  END_RULE; -- subtype_mandatory_date_assignment

  RULE subtype_mandatory_document_reference FOR (document_reference);

  WHERE
    wr1: (SIZEOF(QUERY ( dr <* document_reference | (NOT (
              'CONCEPTUAL_PROCESS_DESIGN.APPLIED_DOCUMENT_REFERENCE' IN
              TYPEOF(dr))) )) = 0);

  END_RULE; -- subtype_mandatory_document_reference

  RULE subtype_mandatory_group_assignment FOR (group_assignment);

  WHERE
    wr1: (SIZEOF(QUERY ( ga <* group_assignment | (NOT (SIZEOF([
            'CONCEPTUAL_PROCESS_DESIGN.APPLIED_GROUP_ASSIGNMENT',
            'CONCEPTUAL_PROCESS_DESIGN.CLASSIFICATION_ASSIGNMENT',
            'CONCEPTUAL_PROCESS_DESIGN.' +
            'PHASES_IN_EQUILIBRIUM_GROUP_ASSIGNMENT']
            * TYPEOF(ga)) = 1)) )) = 0);

  END_RULE; -- subtype_mandatory_group_assignment

  RULE subtype_mandatory_identification_assignment FOR (
              identification_assignment);

  WHERE
    wr1: (SIZEOF(QUERY ( ia <* identification_assignment | (NOT (
              'CONCEPTUAL_PROCESS_DESIGN.APPLIED_IDENTIFICATION_ASSIGNMENT'
              IN TYPEOF(ia))) )) = 0);

  END_RULE; -- subtype_mandatory_identification_assignment

  RULE subtype_mandatory_organization_assignment FOR (
              organization_assignment);

  WHERE
    wr1: (SIZEOF(QUERY ( oa <* organization_assignment | (NOT (
              'CONCEPTUAL_PROCESS_DESIGN.APPLIED_ORGANIZATION_ASSIGNMENT' IN
               TYPEOF(oa))) )) = 0);
```

```
END_RULE; -- subtype_mandatory_organization_assignment

RULE subtype_mandatory_person_assignment FOR (person_assignment);

WHERE
  wr1: (SIZEOF(QUERY ( pa <* person_assignment | (NOT (
           'CONCEPTUAL_PROCESS_DESIGN.APPLIED_PERSON_ASSIGNMENT' IN
           TYPEOF(pa))) )) = 0);

END_RULE; -- subtype_mandatory_person_assignment

RULE subtype_mandatory_versioned_action_request FOR (
           versioned_action_request);

WHERE
  wr1: (SIZEOF(QUERY ( ver_ar <* versioned_action_request | (NOT (
         'CONCEPTUAL_PROCESS_DESIGN.CONTROL_SCHEME' IN TYPEOF(ver_ar))) ))
         = 0);

END_RULE; -- subtype_mandatory_versioned_action_request

RULE symbol_representation_rule FOR (
           presentation_representation_relationship);

WHERE
  wr1: (SIZEOF(QUERY ( each_1 <*
           presentation_representation_relationship | ((NOT ((
           'CONCEPTUAL_PROCESS_DESIGN.' +
           'SYMBOL_REPRESENTATION_RELATIONSHIP') IN TYPEOF(each_1))) AND
           (SIZEOF(QUERY ( each_2 <* [each_1\representation_relationship.
           rep_1,each_1\representation_relationship.rep_2] | (
           'CONCEPTUAL_PROCESS_DESIGN.SYMBOL_REPRESENTATION' IN TYPEOF(
           each_2)) )) > 0)) )) = 0);

END_RULE; -- symbol_representation_rule

FUNCTION acyclic_mapped_representation(
             parent_set: SET OF representation;
             children_set: SET OF representation_item
    ): BOOLEAN;

  LOCAL
    i : INTEGER;
    x : SET OF representation_item;
    y : SET OF representation_item;
  END_LOCAL;
  x := QUERY ( z <* children_set | (
      'CONCEPTUAL_PROCESS_DESIGN.MAPPED_ITEM' IN TYPEOF(z)) );
  IF SIZEOF(x) > 0 THEN
    REPEAT i := 1 TO HIINDEX(x) BY 1;
      IF x[i]\mapped_item.mapping_source.mapped_representation IN
          parent_set THEN
        RETURN(FALSE);
      END_IF;
      IF NOT acyclic_mapped_representation(parent_set + x[i]\mapped_item
          .mapping_source.mapped_representation,x[i]\mapped_item.
          mapping_source.mapped_representation.items) THEN
        RETURN(FALSE);
      END_IF;
    END_REPEAT;
  END_IF;
  x := children_set - x;
  IF SIZEOF(x) > 0 THEN
    REPEAT i := 1 TO HIINDEX(x) BY 1;
```

```
        y := QUERY ( z <* bag_to_set(USEDIN(x[i],'')) | (
           'CONCEPTUAL_PROCESS_DESIGN.REPRESENTATION_ITEM' IN TYPEOF(z)) );
        IF NOT acyclic_mapped_representation(parent_set,y) THEN
          RETURN(FALSE);
        END_IF;
      END_REPEAT;
    END_IF;
    RETURN(TRUE);

  END_FUNCTION; -- acyclic_mapped_representation

  FUNCTION acyclic_presentation_representation_relationship(
              relation: presentation_representation_relationship;
              children: SET OF presentation_representation
      ): BOOLEAN;

    LOCAL
      i              : INTEGER;
      x              : SET OF presentation_representation_relationship;
      local_children : SET OF presentation_representation;
    END_LOCAL;
    REPEAT i := 1 TO HIINDEX(children) BY 1;
      IF relation\representation_relationship.rep_1 :=: children[i] THEN
        RETURN(FALSE);
      END_IF;
    END_REPEAT;
    x := USEDIN(relation\representation_relationship.rep_1,
        'CONCEPTUAL_PROCESS_DESIGN.' +
        'REPRESENTATION_RELATIONSHIP.REP_2');
    local_children := children + relation\representation_relationship.
        rep_1;
    IF SIZEOF(x) > 0 THEN
      REPEAT i := 1 TO HIINDEX(x) BY 1;
        IF NOT acyclic_presentation_representation_relationship(x[i],
            local_children) THEN
          RETURN(FALSE);
        END_IF;
      END_REPEAT;
    END_IF;
    RETURN(TRUE);

  END_FUNCTION; -- acyclic_presentation_representation_relationship

  FUNCTION acyclic_product_category_relationship(
              relation: product_category_relationship;
              children: SET OF product_category
      ): LOGICAL;

    LOCAL
      i              : INTEGER;
      x              : SET OF product_category_relationship;
      local_children : SET OF product_category;
    END_LOCAL;
    REPEAT i := 1 TO HIINDEX(children) BY 1;
      IF relation.category :=: children[i] THEN
        RETURN(FALSE);
      END_IF;
    END_REPEAT;
    x := bag_to_set(USEDIN(relation.category,'CONCEPTUAL_PROCESS_DESIGN.'
        + 'PRODUCT_CATEGORY_RELATIONSHIP.SUB_CATEGORY'));
    local_children := children + relation.category;
    IF SIZEOF(x) > 0 THEN
      REPEAT i := 1 TO HIINDEX(x) BY 1;
        IF NOT acyclic_product_category_relationship(x[i],local_children)
```

```
          THEN
        RETURN(FALSE);
      END_IF;
    END_REPEAT;
  END_IF;
  RETURN(TRUE);

END_FUNCTION; -- acyclic_product_category_relationship

FUNCTION acyclic_product_definition_relationship(
             relation: product_definition_relationship;
             relatives: SET OF product_definition;
             specific_relation: STRING
    ): LOGICAL;

  LOCAL
    i              : INTEGER;
    x              : SET OF product_definition_relationship;
    local_relatives : SET OF product_definition;
  END_LOCAL;
  REPEAT i := 1 TO HIINDEX(relatives) BY 1;
    IF relation.relating_product_definition :=: relatives[i] THEN
      RETURN(FALSE);
    END_IF;
  END_REPEAT;
  x := bag_to_set(USEDIN(relation.relating_product_definition,
      specific_relation));
  local_relatives := relatives + relation.relating_product_definition;
  IF SIZEOF(x) > 0 THEN
    REPEAT i := 1 TO HIINDEX(x) BY 1;
      IF NOT acyclic_product_definition_relationship(x[i],
          local_relatives,specific_relation) THEN
        RETURN(FALSE);
      END_IF;
    END_REPEAT;
  END_IF;
  RETURN(TRUE);

END_FUNCTION; -- acyclic_product_definition_relationship

FUNCTION acyclic_symbol_representation_relationship(
             relation: symbol_representation_relationship;
             children: SET OF symbol_representation
    ): BOOLEAN;

  LOCAL
    i              : INTEGER;
    x              : SET OF symbol_representation_relationship;
    local_children : SET OF symbol_representation;
  END_LOCAL;
  REPEAT i := 1 TO HIINDEX(children) BY 1;
    IF relation\representation_relationship.rep_1 :=: children[i] THEN
      RETURN(FALSE);
    END_IF;
  END_REPEAT;
  x := USEDIN(relation\representation_relationship.rep_1,
      'CONCEPTUAL_PROCESS_DESIGN.' + 'REPRESENTATION_RELATIONSHIP.' +
      'REP_2');
  local_children := children + relation\representation_relationship.
      rep_1;
  IF SIZEOF(x) > 0 THEN
    REPEAT i := 1 TO HIINDEX(x) BY 1;
      IF NOT acyclic_symbol_representation_relationship(x[i],
          local_children) THEN
```

```
          RETURN(FALSE);
        END_IF;
      END_REPEAT;
    END_IF;
    RETURN(TRUE);

  END_FUNCTION; -- acyclic_symbol_representation_relationship

  FUNCTION bag_to_set(
              the_bag: BAG OF GENERIC:intype
      ): SET OF GENERIC:intype;

    LOCAL
      i       : INTEGER;
      the_set : SET OF GENERIC:intype := [];
    END_LOCAL;
    IF SIZEOF(the_bag) > 0 THEN
      REPEAT i := 1 TO HIINDEX(the_bag) BY 1;
        the_set := the_set + the_bag[i];
      END_REPEAT;
    END_IF;
    RETURN(the_set);

  END_FUNCTION; -- bag_to_set

  FUNCTION build_2axes(
              ref_direction: direction
      ): LIST [2:2] OF direction;

    LOCAL
      u : LIST [2:2] OF direction;
    END_LOCAL;
    u[1] := NVL(normalise(ref_direction),direction([1,0]));
    u[2] := orthogonal_complement(u[1]);
    RETURN(u);

  END_FUNCTION; -- build_2axes

  FUNCTION build_axes(
              axis, ref_direction: direction
      ): LIST [3:3] OF direction;

    LOCAL
      u : LIST [3:3] OF direction;
    END_LOCAL;
    u[3] := NVL(normalise(axis),direction([0,0,1]));
    u[1] := first_proj_axis(u[3],ref_direction);
    u[2] := normalise(cross_product(u[3],u[1])).orientation;
    RETURN(u);

  END_FUNCTION; -- build_axes

  FUNCTION class_name_in_hierarchy(
              class: group;
              str: STRING
      ): BOOLEAN;
    IF class.name = str THEN
      RETURN(TRUE);
    ELSE
      IF SIZEOF(USEDIN(class,
          'CONCEPTUAL_PROCESS_DESIGN.GROUP_RELATIONSHIP.RELATED_GROUP')) >=
           1 THEN
        RETURN(SIZEOF(QUERY ( grp_rel <* USEDIN(class,
            'CONCEPTUAL_PROCESS_DESIGN.GROUP_RELATIONSHIP.RELATED_GROUP')
```

```
            | class_name_in_hierarchy(grp_rel.relating_group,str) )) = 1);
    END_IF;
  END_IF;
  RETURN(FALSE);

END_FUNCTION; -- class_name_in_hierarchy

FUNCTION constraints_param_b_spline(
             degree, up_knots, up_cp: INTEGER;
             knot_mult: LIST OF INTEGER;
             knots: LIST OF parameter_value
    ): BOOLEAN;

  LOCAL
    k      : INTEGER;
    l      : INTEGER;
    sum    : INTEGER;
    result : BOOLEAN := TRUE;
  END_LOCAL;
  sum := knot_mult[1];
  REPEAT i := 2 TO up_knots BY 1;
    sum := sum + knot_mult[i];
  END_REPEAT;
  IF (degree < 1) OR (up_knots < 2) OR (up_cp < degree) OR (sum <> (
      degree + up_cp + 2)) THEN
    result := FALSE;
    RETURN(result);
  END_IF;
  k := knot_mult[1];
  IF (k < 1) OR (k > (degree + 1)) THEN
    result := FALSE;
    RETURN(result);
  END_IF;
  REPEAT i := 2 TO up_knots BY 1;
    IF (knot_mult[i] < 1) OR (knots[i] <= knots[i - 1]) THEN
      result := FALSE;
      RETURN(result);
    END_IF;
    k := knot_mult[i];
    IF (i < up_knots) AND (k > degree) THEN
      result := FALSE;
      RETURN(result);
    END_IF;
    IF (i = up_knots) AND (k > (degree + 1)) THEN
      result := FALSE;
      RETURN(result);
    END_IF;
  END_REPEAT;
  RETURN(result);

END_FUNCTION; -- constraints_param_b_spline

FUNCTION cross_product(
             arg1, arg2: direction
    ): vector;

  LOCAL
    v2     : LIST [3:3] OF REAL;
    v1     : LIST [3:3] OF REAL;
    mag    : REAL;
    res    : direction;
    result : vector;
  END_LOCAL;
  IF (NOT EXISTS(arg1)) OR (arg1.dim = 2) OR (NOT EXISTS(arg2)) OR (arg2
```

```
        .dim = 2) THEN
      RETURN(?);
    ELSE
      BEGIN
        v1 := normalise(arg1).direction_ratios;
        v2 := normalise(arg2).direction_ratios;
        res.direction_ratios[1] := (v1[2] * v2[3]) - (v1[3] * v2[2]);
        res.direction_ratios[2] := (v1[3] * v2[1]) - (v1[1] * v2[3]);
        res.direction_ratios[3] := (v1[1] * v2[2]) - (v1[2] * v2[1]);
        mag := 0;
        REPEAT i := 1 TO 3 BY 1;
          mag := mag + (res.direction_ratios[i] * res.direction_ratios[i]);
        END_REPEAT;
        IF mag > 0 THEN
          result.orientation := res;
          result.magnitude := SQRT(mag);
        ELSE
          result.orientation := arg1;
          result.magnitude := 0;
        END_IF;
        RETURN(result);
      END;
    END_IF;

  END_FUNCTION; -- cross_product

  FUNCTION curve_weights_positive(
              b: rational_b_spline_curve
      ): BOOLEAN;

    LOCAL
      result : BOOLEAN := TRUE;
    END_LOCAL;
    REPEAT i := 0 TO b.upper_index_on_control_points BY 1;
      IF b.weights[i] <= 0 THEN
        result := FALSE;
        RETURN(result);
      END_IF;
    END_REPEAT;
    RETURN(result);

  END_FUNCTION; -- curve_weights_positive

  FUNCTION derive_dimensional_exponents(
              x: unit
      ): dimensional_exponents;

    LOCAL
      i      : INTEGER;
      result : dimensional_exponents := dimensional_exponents(0,0,0,0,0,0,
               0);
    END_LOCAL;
    IF 'CONCEPTUAL_PROCESS_DESIGN.DERIVED_UNIT' IN TYPEOF(x) THEN
      REPEAT i := LOINDEX(x.elements) TO HIINDEX(x.elements) BY 1;
        result.length_exponent := result.length_exponent + (x.elements[i].
            exponent * x.elements[i].unit.dimensions.length_exponent);
        result.mass_exponent := result.mass_exponent + (x.elements[i].
            exponent * x.elements[i].unit.dimensions.mass_exponent);
        result.time_exponent := result.time_exponent + (x.elements[i].
            exponent * x.elements[i].unit.dimensions.time_exponent);
        result.electric_current_exponent := result.
            electric_current_exponent + (x.elements[i].exponent * x.
            elements[i].unit.dimensions.electric_current_exponent);
        result.thermodynamic_temperature_exponent := result.
```

```
          thermodynamic_temperature_exponent + (x.elements[i].exponent *
          x.elements[i].unit.dimensions.
          thermodynamic_temperature_exponent);
      result.amount_of_substance_exponent := result.
          amount_of_substance_exponent + (x.elements[i].exponent * x.
          elements[i].unit.dimensions.amount_of_substance_exponent);
      result.luminous_intensity_exponent := result.
          luminous_intensity_exponent + (x.elements[i].exponent * x.
          elements[i].unit.dimensions.luminous_intensity_exponent);
    END_REPEAT;
  ELSE
    result := x.dimensions;
  END_IF;
  RETURN(result);

END_FUNCTION; -- derive_dimensional_exponents

FUNCTION dimension_of(
            item: geometric_representation_item
    ): dimension_count;

  LOCAL
    x : SET OF representation;
    y : representation_context;
  END_LOCAL;
  x := using_representations(item);
  y := x[1].context_of_items;
  RETURN(y\geometric_representation_context.coordinate_space_dimension);

END_FUNCTION; -- dimension_of

FUNCTION dimensions_for_si_unit(
            n: si_unit_name
    ): dimensional_exponents;
  CASE n OF
    metre           :    RETURN(dimensional_exponents(1,0,0,0,0,0,0));
    gram            :    RETURN(dimensional_exponents(0,1,0,0,0,0,0));
    second          :    RETURN(dimensional_exponents(0,0,1,0,0,0,0));
    ampere          :    RETURN(dimensional_exponents(0,0,0,1,0,0,0));
    kelvin          :    RETURN(dimensional_exponents(0,0,0,0,1,0,0));
    mole            :    RETURN(dimensional_exponents(0,0,0,0,0,1,0));
    candela         :    RETURN(dimensional_exponents(0,0,0,0,0,0,1));
    radian          :    RETURN(dimensional_exponents(0,0,0,0,0,0,0));
    steradian       :    RETURN(dimensional_exponents(0,0,0,0,0,0,0));
    hertz           :    RETURN(dimensional_exponents(0,0,-1,0,0,0,0));
    newton          :    RETURN(dimensional_exponents(1,1,-2,0,0,0,0));
    pascal          :    RETURN(dimensional_exponents(-1,1,-2,0,0,0,0));
    joule           :    RETURN(dimensional_exponents(2,1,-2,0,0,0,0));
    watt            :    RETURN(dimensional_exponents(2,1,-3,0,0,0,0));
    coulomb         :    RETURN(dimensional_exponents(0,0,1,1,0,0,0));
    volt            :    RETURN(dimensional_exponents(2,1,-3,-1,0,0,0));
    farad           :    RETURN(dimensional_exponents(-2,-1,4,1,0,0,0));
    ohm             :    RETURN(dimensional_exponents(2,1,-3,-2,0,0,0));
    siemens         :    RETURN(dimensional_exponents(-2,-1,3,2,0,0,0));
    weber           :    RETURN(dimensional_exponents(2,1,-2,-1,0,0,0));
    tesla           :    RETURN(dimensional_exponents(0,1,-2,-1,0,0,0));
    henry           :    RETURN(dimensional_exponents(2,1,-2,-2,0,0,0));
    degree_celsius  :    RETURN(dimensional_exponents(0,0,0,0,1,0,0));
    lumen           :    RETURN(dimensional_exponents(0,0,0,0,0,0,1));
    lux             :    RETURN(dimensional_exponents(-2,0,0,0,0,0,1));
    becquerel       :    RETURN(dimensional_exponents(0,0,-1,0,0,0,0));
    gray            :    RETURN(dimensional_exponents(2,0,-2,0,0,0,0));
    sievert         :    RETURN(dimensional_exponents(2,0,-2,0,0,0,0));
```

```
      END_CASE;

  END_FUNCTION; -- dimensions_for_si_unit

  FUNCTION dot_product(
              arg1, arg2: direction
      ): REAL;

    LOCAL
      ndim   : INTEGER;
      scalar : REAL;
      vec1   : direction;
      vec2   : direction;
    END_LOCAL;
    IF (NOT EXISTS(arg1)) OR (NOT EXISTS(arg2)) THEN
      scalar := ?;
    ELSE
      IF arg1.dim <> arg2.dim THEN
        scalar := ?;
      ELSE
        BEGIN
          vec1 := normalise(arg1);
          vec2 := normalise(arg2);
          ndim := arg1.dim;
          scalar := 0;
          REPEAT i := 1 TO ndim BY 1;
            scalar := scalar + (vec1.direction_ratios[i] * vec2.
                direction_ratios[i]);
          END_REPEAT;
        END;
      END_IF;
    END_IF;
    RETURN(scalar);

  END_FUNCTION; -- dot_product

  FUNCTION first_proj_axis(
              z_axis, arg: direction
      ): direction;

    LOCAL
      x_vec  : vector;
      v      : direction;
      z      : direction;
      x_axis : direction;
    END_LOCAL;
    IF (NOT EXISTS(z_axis)) OR (NOT EXISTS(arg)) OR (arg.dim <> 3) THEN
      x_axis := ?;
    ELSE
      z_axis := normalise(z_axis);
      IF NOT EXISTS(arg) THEN
        IF z_axis <> direction([1,0,0]) THEN
          v := direction([1,0,0]);
        ELSE
          v := direction([0,1,0]);
        END_IF;
      ELSE
        IF cross_product(arg,z).magnitude = 0 THEN
          RETURN(?);
        ELSE
          v := normalise(arg);
        END_IF;
      END_IF;
      x_vec := scalar_times_vector(dot_product(v,z),z_axis);
```

```
    x_axis := vector_difference(v,x_vec).orientation;
    x_axis := normalise(x_axis);
  END_IF;
  RETURN(x_axis);

END_FUNCTION; -- first_proj_axis

FUNCTION item_in_context(
             item: representation_item;
             cntxt: representation_context
    ): BOOLEAN;

  LOCAL
    i : INTEGER;
    y : BAG OF representation_item;
  END_LOCAL;
  IF SIZEOF(USEDIN(item,'CONCEPTUAL_PROCESS_DESIGN.REPRESENTATION.ITEMS')
      * cntxt.representations_in_context) > 0 THEN
    RETURN(TRUE);
  ELSE
    y := QUERY ( z <* USEDIN(item,'') | (
       'CONCEPTUAL_PROCESS_DESIGN.REPRESENTATION_ITEM' IN TYPEOF(z)) );
    IF SIZEOF(y) > 0 THEN
      REPEAT i := 1 TO HIINDEX(y) BY 1;
        IF item_in_context(y[i],cntxt) THEN
          RETURN(TRUE);
        END_IF;
      END_REPEAT;
    END_IF;
  END_IF;
  RETURN(FALSE);

END_FUNCTION; -- item_in_context

FUNCTION leap_year(
             year: year_number
    ): BOOLEAN;
  IF (((year MOD 4) = 0) AND ((year MOD 100) <> 0)) OR ((year MOD 400) =
       0) THEN
    RETURN(TRUE);
  ELSE
    RETURN(FALSE);
  END_IF;

END_FUNCTION; -- leap_year

FUNCTION list_to_array(
             lis: LIST [0:?] OF GENERIC:t;
             low, u: INTEGER
    ): ARRAY [low:u] OF GENERIC:t;

  LOCAL
    n   : INTEGER;
    res : ARRAY [low:u] OF GENERIC:t;
  END_LOCAL;
  n := SIZEOF(lis);
  IF n <> ((u - low) + 1) THEN
    RETURN(?);
  ELSE
    REPEAT i := 1 TO n BY 1;
      res[(low + i) - 1] := lis[i];
    END_REPEAT;
    RETURN(res);
  END_IF;
```

```
  END_FUNCTION; -- list_to_array

  FUNCTION normalise(
              arg: vector_or_direction
      ): vector_or_direction;

    LOCAL
      ndim   : INTEGER;
      v      : direction;
      vec    : vector;
      mag    : REAL;
      result : vector_or_direction;
    END_LOCAL;
    IF NOT EXISTS(arg) THEN
      result := ?;
    ELSE
      ndim := arg.dim;
      IF 'CONCEPTUAL_PROCESS_DESIGN.VECTOR' IN TYPEOF(arg) THEN
        BEGIN
          vec := arg;
          v := arg.orientation;
          IF arg.magnitude = 0 THEN
            RETURN(?);
          ELSE
            vec.magnitude := 1;
          END_IF;
        END;
      ELSE
        v := arg;
      END_IF;
      mag := 0;
      REPEAT i := 1 TO ndim BY 1;
        mag := mag + (v.direction_ratios[i] * v.direction_ratios[i]);
      END_REPEAT;
      IF mag > 0 THEN
        mag := SQRT(mag);
        REPEAT i := 1 TO ndim BY 1;
          v.direction_ratios[i] := v.direction_ratios[i] / mag;
        END_REPEAT;
        IF 'CONCEPTUAL_PROCESS_DESIGN.VECTOR' IN TYPEOF(arg) THEN
          vec.orientation := v;
          result := vec;
        ELSE
          result := v;
        END_IF;
      ELSE
        RETURN(?);
      END_IF;
    END_IF;
    RETURN(result);

  END_FUNCTION; -- normalise

  FUNCTION orthogonal_complement(
              vec: direction
      ): direction;

    LOCAL
      result : direction;
    END_LOCAL;
    IF (vec.dim <> 2) OR (NOT EXISTS(vec)) THEN
      RETURN(?);
    ELSE
      result.direction_ratios[1] := -vec.direction_ratios[2];
```

```
    result.direction_ratios[2] := vec.direction_ratios[1];
    RETURN(result);
  END_IF;

END_FUNCTION; -- orthogonal_complement

FUNCTION scalar_times_vector(
             scalar: REAL;
             vec: vector_or_direction
    ): vector;

  LOCAL
    v      : direction;
    mag    : REAL;
    result : vector;
  END_LOCAL;
  IF (NOT EXISTS(scalar)) OR (NOT EXISTS(vec)) THEN
    result := ?;
  ELSE
    IF 'CONCEPTUAL_PROCESS_DESIGN.VECTOR' IN TYPEOF(vec) THEN
      v := vec.orientation;
      mag := scalar * vec.magnitude;
    ELSE
      v := vec;
      mag := scalar;
    END_IF;
    IF mag < 0 THEN
      REPEAT i := 1 TO SIZEOF(v.direction_ratios) BY 1;
        v.direction_ratios[i] := -v.direction_ratios[i];
      END_REPEAT;
      mag := -mag;
    END_IF;
    result.orientation := normalise(v);
    result.magnitude := mag;
  END_IF;
  RETURN(result);

END_FUNCTION; -- scalar_times_vector

FUNCTION using_representations(
             item: representation_item
    ): SET OF representation;

  LOCAL
    results            : SET OF representation;
    i                  : INTEGER;
    intermediate_items : SET OF representation_item;
    result_bag         : BAG OF representation;
  END_LOCAL;
  results := [];
  result_bag := USEDIN(item,
      'CONCEPTUAL_PROCESS_DESIGN.REPRESENTATION.ITEMS');
  IF SIZEOF(result_bag) > 0 THEN
    REPEAT i := 1 TO HIINDEX(result_bag) BY 1;
      results := results + result_bag[i];
    END_REPEAT;
  END_IF;
  intermediate_items := QUERY ( z <* bag_to_set(USEDIN(item,'')) | (
      'CONCEPTUAL_PROCESS_DESIGN.REPRESENTATION_ITEM' IN TYPEOF(z)) );
  IF SIZEOF(intermediate_items) > 0 THEN
    REPEAT i := 1 TO HIINDEX(intermediate_items) BY 1;
      results := results + using_representations(intermediate_items[i]);
    END_REPEAT;
  END_IF;
```

```
    RETURN(results);

  END_FUNCTION; -- using_representations

  FUNCTION valid_calendar_date(
              date: calendar_date
    ): LOGICAL;
    IF NOT ((1 <= date.day_component) AND (date.day_component <= 31))
        THEN
      RETURN(FALSE);
    END_IF;
    CASE date.month_component OF
      4        :      RETURN((1 <= date.day_component) AND (date.
            day_component <= 30));
      6        :      RETURN((1 <= date.day_component) AND (date.
            day_component <= 30));
      9        :      RETURN((1 <= date.day_component) AND (date.
            day_component <= 30));
      11       :      RETURN((1 <= date.day_component) AND (date.
            day_component <= 30));
      2        :      BEGIN
        IF leap_year(date.year_component) THEN
          RETURN((1 <= date.day_component) AND (date.day_component <= 29));
          ELSE
          RETURN((1 <= date.day_component) AND (date.day_component <= 28));
          END_IF;
        END;
      OTHERWISE  :         RETURN(TRUE);
      END_CASE;

  END_FUNCTION; -- valid_calendar_date

  FUNCTION valid_time(
              time: local_time
    ): BOOLEAN;
    IF EXISTS(time.second_component) THEN
      RETURN(EXISTS(time.minute_component));
    ELSE
      RETURN(TRUE);
    END_IF;

  END_FUNCTION; -- valid_time

  FUNCTION valid_units(
              m: measure_with_unit
    ): BOOLEAN;
    IF 'CONCEPTUAL_PROCESS_DESIGN.LENGTH_MEASURE' IN TYPEOF(m.
        value_component) THEN
      IF derive_dimensional_exponents(m.unit_component) <>
          dimensional_exponents(1,0,0,0,0,0,0) THEN
        RETURN(FALSE);
      END_IF;
    END_IF;
    IF 'CONCEPTUAL_PROCESS_DESIGN.MASS_MEASURE' IN TYPEOF(m.
        value_component) THEN
      IF derive_dimensional_exponents(m.unit_component) <>
          dimensional_exponents(0,1,0,0,0,0,0) THEN
        RETURN(FALSE);
      END_IF;
    END_IF;
    IF 'CONCEPTUAL_PROCESS_DESIGN.TIME_MEASURE' IN TYPEOF(m.
        value_component) THEN
      IF derive_dimensional_exponents(m.unit_component) <>
          dimensional_exponents(0,0,1,0,0,0,0) THEN
```

```
    RETURN(FALSE);
  END_IF;
END_IF;
IF 'CONCEPTUAL_PROCESS_DESIGN.ELECTRIC_CURRENT_MEASURE' IN TYPEOF(m.
    value_component) THEN
  IF derive_dimensional_exponents(m.unit_component) <>
      dimensional_exponents(0,0,0,1,0,0,0) THEN
    RETURN(FALSE);
  END_IF;
END_IF;
IF 'CONCEPTUAL_PROCESS_DESIGN.THERMODYNAMIC_TEMPERATURE_MEASURE' IN
    TYPEOF(m.value_component) THEN
  IF derive_dimensional_exponents(m.unit_component) <>
      dimensional_exponents(0,0,0,0,1,0,0) THEN
    RETURN(FALSE);
  END_IF;
END_IF;
IF 'CONCEPTUAL_PROCESS_DESIGN.AMOUNT_OF_SUBSTANCE_MEASURE' IN TYPEOF(m
    .value_component) THEN
  IF derive_dimensional_exponents(m.unit_component) <>
      dimensional_exponents(0,0,0,0,0,1,0) THEN
    RETURN(FALSE);
  END_IF;
END_IF;
IF 'CONCEPTUAL_PROCESS_DESIGN.LUMINOUS_INTENSITY_MEASURE' IN TYPEOF(m.
    value_component) THEN
  IF derive_dimensional_exponents(m.unit_component) <>
      dimensional_exponents(0,0,0,0,0,0,1) THEN
    RETURN(FALSE);
  END_IF;
END_IF;
IF 'CONCEPTUAL_PROCESS_DESIGN.PLANE_ANGLE_MEASURE' IN TYPEOF(m.
    value_component) THEN
  IF derive_dimensional_exponents(m.unit_component) <>
      dimensional_exponents(0,0,0,0,0,0,0) THEN
    RETURN(FALSE);
  END_IF;
END_IF;
IF 'CONCEPTUAL_PROCESS_DESIGN.SOLID_ANGLE_MEASURE' IN TYPEOF(m.
    value_component) THEN
  IF derive_dimensional_exponents(m.unit_component) <>
      dimensional_exponents(0,0,0,0,0,0,0) THEN
    RETURN(FALSE);
  END_IF;
END_IF;
IF 'CONCEPTUAL_PROCESS_DESIGN.AREA_MEASURE' IN TYPEOF(m.
    value_component) THEN
  IF derive_dimensional_exponents(m.unit_component) <>
      dimensional_exponents(2,0,0,0,0,0,0) THEN
    RETURN(FALSE);
  END_IF;
END_IF;
IF 'CONCEPTUAL_PROCESS_DESIGN.VOLUME_MEASURE' IN TYPEOF(m.
    value_component) THEN
  IF derive_dimensional_exponents(m.unit_component) <>
      dimensional_exponents(3,0,0,0,0,0,0) THEN
    RETURN(FALSE);
  END_IF;
END_IF;
IF 'CONCEPTUAL_PROCESS_DESIGN.RATIO_MEASURE' IN TYPEOF(m.
    value_component) THEN
  IF derive_dimensional_exponents(m.unit_component) <>
      dimensional_exponents(0,0,0,0,0,0,0) THEN
    RETURN(FALSE);
```

```
      END_IF;
    END_IF;
    IF 'CONCEPTUAL_PROCESS_DESIGN.POSITIVE_LENGTH_MEASURE' IN TYPEOF(m.
        value_component) THEN
      IF derive_dimensional_exponents(m.unit_component) <>
          dimensional_exponents(1,0,0,0,0,0,0) THEN
        RETURN(FALSE);
      END_IF;
    END_IF;
    IF 'CONCEPTUAL_PROCESS_DESIGN.POSITIVE_PLANE_ANGLE_MEASURE' IN TYPEOF(
        m.value_component) THEN
      IF derive_dimensional_exponents(m.unit_component) <>
          dimensional_exponents(0,0,0,0,0,0,0) THEN
        RETURN(FALSE);
      END_IF;
    END_IF;
    RETURN(TRUE);

  END_FUNCTION; -- valid_units

  FUNCTION vector_difference(
              arg1, arg2: vector_or_direction
      ): vector;

    LOCAL
      ndim   : INTEGER;
      mag2   : REAL;
      mag1   : REAL;
      mag    : REAL;
      res    : direction;
      vec1   : direction;
      vec2   : direction;
      result : vector;
    END_LOCAL;
    IF (NOT EXISTS(arg1)) OR (NOT EXISTS(arg2)) OR (arg1.dim <> arg2.dim)
        THEN
      result := ?;
    ELSE
      BEGIN
        IF 'CONCEPTUAL_PROCESS_DESIGN.VECTOR' IN TYPEOF(arg1) THEN
          mag1 := arg1.magnitude;
          vec1 := arg1.orientation;
        ELSE
          mag1 := 1;
          vec1 := arg1;
        END_IF;
        IF 'CONCEPTUAL_PROCESS_DESIGN.VECTOR' IN TYPEOF(arg2) THEN
          mag2 := arg2.magnitude;
          vec2 := arg2.orientation;
        ELSE
          mag2 := 1;
          vec2 := arg2;
        END_IF;
        vec1 := normalise(vec1);
        vec2 := normalise(vec2);
        ndim := SIZEOF(vec1.direction_ratios);
        mag := 0;
        REPEAT i := 1 TO ndim BY 1;
          res.direction_ratios[i] := (mag1 * vec1.direction_ratios[i]) - (
              mag2 * vec2.direction_ratios[i]);
          mag := mag + (res.direction_ratios[i] * res.direction_ratios[i]);
        END_REPEAT;
        IF mag > 0 THEN
          result.magnitude := SQRT(mag);
```

```
          result.orientation := res;
        ELSE
          result.magnitude := 0;
          result.orientation := vec1;
        END_IF;
      END;
    END_IF;
    RETURN(result);

  END_FUNCTION; -- vector_difference

END_SCHEMA; -- conceptual_process_design
```

Annex B
(normative)

AIM short names

Table B.1 provides the short names of entities specified in the AIM of this part of ISO 10303. Requirements on the use of the short names are found in the implementation methods included in ISO 10303.

Table B.1 - Short names of entities

Entity names	Short names
ACTION	ACTION
ACTION_ASSIGNMENT	ACTASS
ACTION_METHOD	ACTMTH
ACTION_METHOD_ASSIGNMENT	ACMTAS
ACTION_METHOD_RELATIONSHIP	ACMTRL
ACTION_METHOD_ROLE	ACM0
ACTION_PROPERTY	ACTPRP
ACTION_PROPERTY_RELATIONSHIP	ACPRRL
ACTION_PROPERTY_REPRESENTATION	ACPRRP
ACTION_RELATIONSHIP	ACTRLT
ACTION_REQUEST_ASSIGNMENT	ACRQAS
ACTION_REQUEST_ROLE	ACRQRL
ACTION_REQUEST_SOLUTION	ACRQSL
ACTION_RESOURCE	ACTRSR
ACTION_RESOURCE_RELATIONSHIP	ACRSRL
ACTION_RESOURCE_REQUIREMENT	ACRSRQ
ACTION_RESOURCE_TYPE	ACRSTY
ACTION_ROLE	ACTRL
AMOUNT_OF_SUBSTANCE_MEASURE_WITH_UNIT	AOSMWU
AMOUNT_OF_SUBSTANCE_UNIT	AOSU
ANNOTATION_CURVE_OCCURRENCE	ANCROC
ANNOTATION_FILL_AREA	ANFLAR

Table B.1 - Short names of entities (continued)

Entity names	Short names
ANNOTATION_FILL_AREA_OCCURRENCE	AFAO
ANNOTATION_OCCURRENCE	ANNOCC
ANNOTATION_OCCURRENCE_RELATIONSHIP	ANOCRL
ANNOTATION_POINT_OCCURRENCE	ANPNOC
ANNOTATION_SYMBOL	ANNSYM
ANNOTATION_SYMBOL_OCCURRENCE	ANSYOC
ANNOTATION_TEXT	ANNTXT
ANNOTATION_TEXT_OCCURRENCE	ANTXOC
ANNOTATION_TEXT_WITH_EXTENT	ATWE
APPLICATION_CONTEXT	APPCNT
APPLICATION_CONTEXT_ELEMENT	APCNEL
APPLICATION_PROTOCOL_DEFINITION	APPRDF
APPLIED_ACTION_ASSIGNMENT	APACAS
APPLIED_ACTION_METHOD_ASSIGNMENT	AAMA
APPLIED_APPROVAL_ASSIGNMENT	APAPAS
APPLIED_CERTIFICATION_ASSIGNMENT	APCRAS
APPLIED_DATE_ASSIGNMENT	APDTAS
APPLIED_DATE_TIME_ASSIGNMENT	ADTA
APPLIED_DOCUMENT_REFERENCE	APDCRF
APPLIED_GROUP_ASSIGNMENT	APGRAS
APPLIED_IDENTIFICATION_ASSIGNMENT	APIDAS
APPLIED_ORGANIZATION_ASSIGNMENT	APORAS
APPLIED_PERSON_ASSIGNMENT	APPRAS
APPROVAL	APPRVL
APPROVAL_ASSIGNMENT	APPASS
APPROVAL_DATE_TIME	APDTTM
APPROVAL_DATE_TIME_ROLE	ADTR
APPROVAL_PERSON_ORGANIZATION	APPROR

Table B.1 - Short names of entities (continued)

Entity names	Short names
APPROVAL_ROLE	APPRL
APPROVAL_STATUS	APPSTT
APPROVER_ROLE	APP0
AREA_IN_SET	ARINST
AREA_MEASURE_WITH_UNIT	AMWU
AREA_UNIT	ARUNT
ASSEMBLY_COMPONENT_USAGE	ASCMUS
AXIS2_PLACEMENT_2D	A2PL2D
AXIS2_PLACEMENT_3D	A2PL3D
BEZIER_CURVE	BZRCRV
BIN_SECTION	BNSCT
BOOT	BOOT
BOUNDED_CURVE	BNDCRV
B_SPLINE_CURVE	BSPCR
B_SPLINE_CURVE_WITH_KNOTS	BSCWK
CALENDAR_DATE	CLNDT
CAMERA_MODEL	CMRMDL
CAMERA_MODEL_D2	CMMDD2
CAMERA_MODEL_D2_SHAPE_CLIPPING	CMDSC
CARTESIAN_POINT	CRTPNT
CERTIFICATION	CRTFCT
CERTIFICATION_ASSIGNMENT	CRTASS
CERTIFICATION_ROLE	CRTRL
CERTIFICATION_TYPE	CRTTYP
CHARACTERIZED_OBJECT	CHROBJ
CHARACTERIZED_OBJECT_RELATIONSHIP	CHOBRL
CIRCLE	CIRCLE
CLASSIFICATION_ASSIGNMENT	CLSASS

Table B.1 - Short names of entities (continued)

Entity names	Short names
COLOUR	COLOUR
COLOUR_RGB	CLRRGB
COLOUR_SPECIFICATION	CLRSPC
COMPOSITE_CURVE	CMPCRV
COMPOSITE_CURVE_SEGMENT	CMCRSG
COMPOUND_REPRESENTATION_ITEM	CMRPIT
CONIC	CONIC
CONNECTOR_END_TYPE_CLASSIFICATION	CETC
CONTEXT_DEPENDENT_INVISIBILITY	CNDPIN
CONTEXT_DEPENDENT_UNIT	CNDPUN
CONTROL_OBJECTIVE	CNTOBJ
CONTROL_SCHEME	CNTSCH
CONVERSION_BASED_UNIT	CNBSUN
COORDINATED_UNIVERSAL_TIME_OFFSET	CUTO
CURVE	CURVE
CURVE_STYLE	CRVSTY
CURVE_STYLE_FONT	CRSTFN
CURVE_STYLE_FONT_PATTERN	CSFP
DATA_CURVE	DTCRV
DATA_ENVIRONMENT	DTENV
DATE	DATE
DATE_AND_TIME	DTANTM
DATE_AND_TIME_ASSIGNMENT	DATA
DATE_ASSIGNMENT	DTASS
DATE_ROLE	DTRL
DATE_TIME_ROLE	DTTMRL
DEFINED_SYMBOL	DFNSYM
DERIVED_UNIT	DRVUNT

Table B.1 - Short names of entities (continued)

Entity names	Short names
DERIVED_UNIT_ELEMENT	DRUNEL
DESCRIPTIVE_REPRESENTATION_ITEM	DSRPIT
DIMENSIONAL_EXPONENTS	DMNEXP
DIRECTION	DRCTN
DOCUMENT	DCMNT
DOCUMENT_REFERENCE	DCMRFR
DOCUMENT_RELATIONSHIP	DCMRLT
DOCUMENT_ROLE	DCMRL
DOCUMENT_TYPE	DCMTYP
DOCUMENT_USAGE_CONSTRAINT	DCUSCN
DOCUMENT_WITH_PROPERTIES	DCWTPR
DRAWING_DEFINITION	DRWDFN
DRAWING_REVISION	DRWRVS
DRAWING_REVISION_SEQUENCE	DRRVSQ
DRAWING_SHEET_REVISION	DRSHRV
DRAWING_SHEET_REVISION_USAGE	DSRU
ELECTRIC_CURRENT_MEASURE_WITH_UNIT	ECMWU
ELECTRIC_CURRENT_UNIT	ELCRUN
ELLIPSE	ELLPS
EQUIPMENT_PORT	EQPPRT
EVENT_SEQUENCE_WITH_CONDITION	ESWC
EXCHANGER_ZONE	EXCZN
EXTERNALLY_DEFINED_ACTION_METHOD	EDAM
EXTERNALLY_DEFINED_ACTION_RESOURCE	EDAR
EXTERNALLY_DEFINED_CLASSIFICATION	EXDFCL
EXTERNALLY_DEFINED_CURVE_FONT	EDCF
EXTERNALLY_DEFINED_GROUP	EXDFGR
EXTERNALLY_DEFINED_HATCH_STYLE	EDHS

Table B.1 - Short names of entities (continued)

Entity names	Short names
EXTERNALLY_DEFINED_ITEM	EXDFIT
EXTERNALLY_DEFINED_PLANT_ITEM_DEFINITION	EDPID
EXTERNALLY_DEFINED_PLANT_SYSTEM	EDPS
EXTERNALLY_DEFINED_REPRESENTATION_ITEM	EDRI
EXTERNALLY_DEFINED_SYMBOL	EXDFSY
EXTERNALLY_DEFINED_TEXT_FONT	EDTF
EXTERNALLY_DEFINED_TILE_STYLE	EDTS
EXTERNAL_IDENTIFICATION_ASSIGNMENT	EXIDAS
EXTERNAL_SOURCE	EXTSRC
EXTERNAL_SOURCE_RELATIONSHIP	EXSRRL
FILL_AREA_STYLE	FLARST
FILL_AREA_STYLE_COLOUR	FASC
FILL_AREA_STYLE_HATCHING	FASH
FILL_AREA_STYLE_TILES	FAST
FILL_AREA_STYLE_TILE_SYMBOL_WITH_STYLE	FASTSW
FUNCTIONAL_VOLUME_SERVICE_CASE	FVSC
GEOMETRIC_REPRESENTATION_CONTEXT	GMRPCN
GEOMETRIC_REPRESENTATION_ITEM	GMRPIT
GLOBAL_UNIT_ASSIGNED_CONTEXT	GUAC
GRAPHICAL_TRANSFORMATION	GRPTRN
GROUP	GROUP
GROUP_ASSIGNMENT	GRPASS
GROUP_RELATIONSHIP	GRPRLT
GROUP_ROLE	GRPRL
HEAT_EXCHANGER_COMPONENT	HTEXCM
HEAT_EXCHANGER_INTERNAL_DATA	HEID
HEAT_TRANSFER_EQUIPMENT	HTTREQ
HYPERBOLA	HYPRBL

Table B.1 - Short names of entities (continued)

Entity names	Short names
IDENTIFICATION_ASSIGNMENT	IDNASS
IDENTIFICATION_ROLE	IDNRL
INSPECTION_AND_TESTS	INANTS
INSTRUMENTATION_AND_CONTROL_SYSTEM	IACS
INTERPHASE	INTRPH
INTERSECTION_DESCRIPTION	INTDSC
INVISIBILITY	INVSBL
ITEM_DEFINED_TRANSFORMATION	ITDFTR
KNOWN_SOURCE	KNWSRC
LENGTH_MEASURE_WITH_UNIT	LMWU
LENGTH_UNIT	LNGUNT
LINE	LINE
LOCAL_TIME	LCLTM
LOGICAL_OPERATION	LGCOPR
LUMINOUS_INTENSITY_MEASURE_WITH_UNIT	LIMWU
LUMINOUS_INTENSITY_UNIT	LMINUN
MAKE_FROM_USAGE_OPTION	MFUO
MAPPED_ITEM	MPPITM
MASS_MEASURE_WITH_UNIT	MMWU
MASS_UNIT	MSSUNT
MATERIAL_AMOUNT_REFERENCE_TIME	MART
MATERIAL_DESIGNATION	MTRDSG
MATERIAL_DESIGNATION_CHARACTERIZATION	MTDSCH
MATERIAL_PROPERTY	MTRPRP
MATERIAL_PROPERTY_REPRESENTATION	MTPRRP
MEASURE_REPRESENTATION_ITEM	MSRPIT
MEASURE_WITH_UNIT	MSWTUN
MOLECULAR_STRUCTURAL_GROUP	MLSTGR

Table B.1 - Short names of entities (continued)

Entity names	Short names
NAMED_UNIT	NMDUNT
NEXT_ASSEMBLY_USAGE_OCCURRENCE	NAUO
NOZZLE	NOZZLE
OFFSET_CURVE_2D	OFCR2D
ONE_DIRECTION_REPEAT_FACTOR	ODRF
ORGANIZATION	ORGNZT
ORGANIZATIONAL_PROJECT	ORGPRJ
ORGANIZATION_ASSIGNMENT	ORGASS
ORGANIZATION_RELATIONSHIP	ORGRLT
ORGANIZATION_ROLE	ORGRL
PARABOLA	PRBL
PARTICLE_SIZE_DISTRIBUTION_VALUES	PSDV
PERSON	PERSON
PERSON_AND_ORGANIZATION	PRANOR
PERSON_ASSIGNMENT	PRSASS
PERSON_ROLE	PRSRL
PHASE	PHASE
PHASES_IN_EQUILIBRIUM_GROUP_ASSIGNMENT	PIEGA
PIPING_CONNECTOR_CLASSIFICATION	PPCNCL
PLACEMENT	PLCMNT
PLANAR_BOX	PLNBX
PLANAR_EXTENT	PLNEXT
PLANT	PLANT
PLANT_ITEM_REFERENCE_TIME	PIRT
POINT	POINT
POINT_ON_CURVE	PNONCR
POINT_STYLE	PNTSTY
POLYLINE	PLYLN

Table B.1 - Short names of entities (continued)

Entity names	Short names
PORT_SERVICE_CASE	PRSRCS
PRECISION_QUALIFIER	PRCQLF
PRESENTATION_AREA	PRSAR
PRESENTATION_LAYER_ASSIGNMENT	PRLYAS
PRESENTATION_LAYER_USAGE	PRLYUS
PRESENTATION_REPRESENTATION	PRSRPR
PRESENTATION_REPRESENTATION_RELATIONSHIP	PRRPRL
PRESENTATION_SCALED_PLACEMENT	PRSCPL
PRESENTATION_SET	PRSST
PRESENTATION_SIZE	PRSSZ
PRESENTATION_STYLE_ASSIGNMENT	PRSTAS
PRESENTATION_STYLE_BY_CONTEXT	PSBC
PRESENTATION_VIEW	PRSVW
PRESENTATION_WITH_ASSOCIATION	PRWTAS
PRESENTED_ITEM	PRSITM
PRESENTED_ITEM_ASSOCIATION	PRITAS
PRESENTED_ITEM_REPRESENTATION	PRITRP
PRESENTED_ITEM_WITH_ASSOCIATION	PIWA
PRE_DEFINED_COLOUR	PRDFCL
PRE_DEFINED_CURVE_FONT	PDCF
PRE_DEFINED_ITEM	PRDFIT
PRE_DEFINED_TEXT_FONT	PDTF
PROCESS_DEFINITION_REFERENCE_TIME	PDRT
PROCESS_DESIGN_CASE	PRDSCS
PROCESS_DESIGN_CASE_RESOURCE	PDC0
PROCESS_DESIGN_PROPERTY_VALUE	PDPV
PROCESS_MATERIAL	PRCMTR
PROCESS_MATERIAL_REFERENCE_TIME	PMRT

Table B.1 - Short names of entities (continued)

Entity names	Short names
PROCESS_PORT	PRCPRT
PROCESS_PORT_CONNECTION	PRPRCN
PROCESS_PRODUCT_ASSOCIATION	PRPRAS
PROCESS_PROPERTY_ASSOCIATION	PRPRS
PROCESS_RESOURCE_PLANT_ITEM	PRPI
PROCESS_SIMULATION	PRCSML
PROCESS_SIMULATION_REFERENCE_TIME	PSRT
PRODUCT	PRDCT
PRODUCT_CATEGORY	PRDCTG
PRODUCT_CATEGORY_RELATIONSHIP	PRCTRL
PRODUCT_CONTEXT	PRDCNT
PRODUCT_DATA_REPRESENTATION_VIEW	PDRV
PRODUCT_DEFINITION	PRDDFN
PRODUCT_DEFINITION_CONTEXT	PRDFCN
PRODUCT_DEFINITION_FORMATION	PRDFFR
PRODUCT_DEFINITION_PROCESS	PRDFPR
PRODUCT_DEFINITION_RELATIONSHIP	PRDFRL
PRODUCT_DEFINITION_SHAPE	PRDFSH
PRODUCT_DEFINITION_USAGE	PRDFUS
PRODUCT_DEFINITION_WITH_ASSOCIATED_DOCUMENTS	PDWAD
PRODUCT_RELATED_PRODUCT_CATEGORY	PRPC
PROPERTY_DEFINITION	PRPDFN
PROPERTY_DEFINITION_RELATIONSHIP	PRDFR
PROPERTY_DEFINITION_REPRESENTATION	PRDFRP
PROPERTY_PROCESS	PRPPRC
QUALIFIED_REPRESENTATION_ITEM	QLRPIT
QUANTIFIED_ASSEMBLY_COMPONENT_USAGE	QACU
QUASI_UNIFORM_CURVE	QSUNCR

Table B.1 - Short names of entities (continued)

Entity names	Short names
RATIONAL_B_SPLINE_CURVE	RBSC
RATIO_MEASURE_WITH_UNIT	RMWU
RATIO_UNIT	RTUNT
REACTOR_YIELD	RCTYLD
REFERENCE_STATE	RFRSTT
REPRESENTATION	RPRSNT
REPRESENTATION_CONTEXT	RPRCNT
REPRESENTATION_ITEM	RPRITM
REPRESENTATION_ITEM_RELATIONSHIP	RPITRL
REPRESENTATION_MAP	RPRMP
REPRESENTATION_RELATIONSHIP	RPRRLT
REPRESENTATION_RELATIONSHIP_WITH_TRANSFORMATION	RRWT
REQUIREMENT_FOR_ACTION_RESOURCE	RFAR
RESERVED_SPACE	RSRSPC
RESOURCE_PROPERTY	RSRPRP
RESOURCE_PROPERTY_RELATIONSHIP	RSPRRL
RESOURCE_PROPERTY_REPRESENTATION	RSPRRP
RESOURCE_REQUIREMENT_TYPE	RSRQTY
SEPARATION_TOWER	SPRTWR
SEPARATION_TRAY_COMPONENT_DEFINITION	STCD
SEPARATION_TRAY_COMPONENT_FEATURE	STCF
SEPARATION_TRAY_COMPONENT_FEATURE_DEFINITION	STCFD
SHAPE_ASPECT	SHPASP
SHAPE_ASPECT_RELATIONSHIP	SHASRL
SHAPE_REPRESENTATION	SHPRPR
SIMULATED_PROCESS_DEFINITION	SMPRDF
SITE	SITE
SITED_PLANT	STDPLN

Table B.1 - Short names of entities (continued)

Entity names	Short names
SITE_REFERENCE_TIME	STR0
SITE_STANDARD_CONDITION	STSTCN
SI_UNIT	SUNT
SOLIDS_STORAGE_BIN	SLSTBN
SOLID_ANGLE_MEASURE_WITH_UNIT	SAMWU
SOLID_ANGLE_UNIT	SLANUN
SPECIFIC_EQUATION	SPCEQT
SPECIFIC_PHASE	SPCPHS
STAGE_COLUMN_SECTION	STCLSC
STREAM	STREAM
STREAM_REFERENCE_TIME	STRFTM
STREAM_SEPARATION_SPECIFICATION	STS0
STREAM_SPLIT_SPECIFICATION	STSPSP
STYLED_ITEM	STYITM
SYMBOL_COLOUR	SYMCLR
SYMBOL_REPRESENTATION	SYMRPR
SYMBOL_REPRESENTATION_MAP	SYRPMP
SYMBOL_REPRESENTATION_RELATIONSHIP	SYRPRL
SYMBOL_STYLE	SYMSTY
SYMBOL_TARGET	SYMTRG
TEXT_LITERAL	TXTLTR
TEXT_LITERAL_WITH_ASSOCIATED_CURVES	TLWAC
TEXT_LITERAL_WITH_BLANKING_BOX	TLWBB
TEXT_LITERAL_WITH_DELINEATION	TLWD
TEXT_LITERAL_WITH_EXTENT	TLWE
TEXT_STRING_REPRESENTATION	TXSTRP
TEXT_STYLE	TXTSTY
TEXT_STYLE_FOR_DEFINED_FONT	TSFDF

Table B.1 - Short names of entities (concluded)

Entity names	Short names
TEXT_STYLE_WITH_BOX_CHARACTERISTICS	TSWBC
TEXT_STYLE_WITH_MIRROR	TSWM
THERMODYNAMIC_CONDITION	THRCND
THERMODYNAMIC_TEMPERATURE_MEASURE_WITH_UNIT	TTMWU
THERMODYNAMIC_TEMPERATURE_UNIT	THTMUN
THERMOPHYSICAL_PROPERTY_CLASSIFICATION	THPRCL
TIME_MEASURE_WITH_UNIT	TMWU
TIME_UNIT	TMUNT
TRIGGER	TRGGR
TRIMMED_CURVE	TRMCRV
TUBE_TYPE	TBTYP
TWO_DIRECTION_REPEAT_FACTOR	TDRF
TYPE_QUALIFIER	TYPQLF
UNIFORM_CURVE	UNFCRV
VECTOR	VECTOR
VERSIONED_ACTION_REQUEST	VRACRQ
VOLUME_MEASURE_WITH_UNIT	VMWU
VOLUME_UNIT	VLMUNT

Annex C
(normative)

Implementation method specific requirements

The implementation method defines what types of exchange behaviour are required with respect to this part of ISO 10303. Conformance to this part of ISO 10303 shall be realized in an exchange structure. The file format shall be encoded according to the syntax and EXPRESS language mapping defined in ISO 10303-21 and the AIM defined in annex A of this part of ISO 10303. The header of the exchange structure shall identify the use of this part of ISO 10303 by the schema name 'conceptual_process_-design'.

Annex D
(normative)

Protocol Information Conformance Statement (PICS) proforma

This clause lists the optional elements of this part of ISO 10303. An implementation may chose to support any combination of this optional elements. However, certain combinations of options are likely to be implemented together. These combinations are called conformance classes and are described in the subclauses of this annex.

This annex is in the form of a questionnaire. This questionnaire is intended to be filled out by the implementor and may be used in preparation for conformance testing by a testing laboratory. The completed PICS proforma is referred to as a PICS.

Eight conformance classes are identified in this part of ISO 10303. A conforming implementation shall support at least one conformance class. Each class specifies a subset of ISO 10303-231 AIM constructs. These classes are detailed in clause 6 of ISO 10303-231.

Questions:

1. Please provide an identifier for the product or system for which conformance is claimed:

    Product name and current version number:_____

2. Please indicate the implementation method chosen:

    — ISO 10303-21 Exchange Structure -- preprocessor
    Preprocessor name and current version number:_____

    — ISO 10303-21 Exchange Structure -- postprocessor
    Postprocessor name and current version number:_____

3. Please indicate the classes for which conformance is claimed:

    — Class 1:_____

    — Class 2:_____

    — Class 3:_____

    — Class 4:_____

    — Class 5:_____

    — Class 6:_____

    — Class 7:_____

    — Class 8:_____

— Class 9:_____

— Class 10:_____

— Class 11:_____

— Class 12:_____

— Class 13:_____

— Class 14:_____

— Class 15:_____

— Class 16:_____

— Class 17:_____

— Class 18:_____

— Class 19:_____

— Class 20:_____

— Class 21:_____

— Class 22:_____

— Class 23:_____

Annex E
(normative)

Information object registration

E.1 Document identification

In order to provide for unambiguous identification of an information object in an open system, the object identifier

{ iso standard 10303 part(231) version(-1) }

is assigned to this part of ISO 10303. The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO 10303-1.

E.2 Schema identification

To provide for unambiguous identification of the schema specifications given in this application protocol **conceptual_process_design** schema in an open information system, object identifiers are assigned as follows:

{ iso standard 10303 part(231) version(-1) object(1) conceptual-process-design-schema }

is assigned to the **conceptual_process_design** expanded schema (see annex A).

The meaning of these values is defined in ISO/IEC 8824-1, and is described in ISO 10303-1.

Annex F
(informative)

Application activity model

The application activity model (AAM) is provided as an aid to understanding the scope and information requirements defined in this application protocol. The model is presented as a set of activity figures that contain the activity diagrams and a set of definitions of the activities and their data. The application activity model is given in figures F.4 through F.14. Activities and data flows that are out of scope are marked with an asterisk.

The viewpoint of the AAM is the users of process engineering information, including process engineers and process engineering management.

F.1 Application activity model

F.1.1 Application activity model definitions and abbreviations

The following terms are used in the application activity model. Terms marked with an asterisk are outside the scope of this application protocol.

The definitions given in this annex do not supersede the definitions given in the main body of the text.

F.1.1.1 As-built Information: Site plans, detailed equipment descriptions, electrical instrumentation diagrams, and P&IDs that record the actual condition at a Plant at a specific point in time.

> NOTE - These documents aid in meeting government documentation and safety requirements. Frequently, they are simply corrections or modifications to existing design documents delivered to construction.

F.1.1.2 Chemical Kinetic Data and Models: Data or models describing the rate of chemical reactions within a process.

F.1.1.3 Chemical Reaction Information: All chemical information associated with a chemical reaction including stoichiometry, operating conditions (temperature, pressure, catalyst, concentration), conversion, kinetic data, or reaction model.

F.1.1.4 Chemical Reactor Design and Rating Directives*: A set of instructions that constrain the activities associated with the design and rating of chemical reactors.

F.1.1.5 Chemical Species Information: All information associated with a chemical compound or mixtures of chemical compounds including physical and transport property data or models, materials compatibility, and environmental impact information, such as material safety datasheets.

F.1.1.6 Cleared Site*: A site that has been prepared for the installation of a new process plant.

F.1.1.7 Commissioning Lifecycle Information*: All information, documents, and drawings that are the result of process plant commissioning activities.

F.1.1.8 Conceptual Design and Engineering Management Resources*: Human resources and tools used to manage conceptual design and engineering activities.

F.1.1.9 Conceptual Design and Engineering Resource Directives*: A set of instructions that constrain the activities associated with providing design and engineering resources.

F.1.1.10 Construct and Pre-Commission Process Plant* (AAM A4): The process of building or modifying a physical plant, resolving any differences between the detailed design and the as-built plant, performing all testing required by regulatory agencies and the client, resolving any problems that were discovered during testing, and obtaining regulatory permission to start-up the plant for functional testing

F.1.1.11 Construction Documents*: All documentation related to the construction of the process plant including as-built reports, equipment certification, nameplate information of installed equipment, operating manuals, testing procedures, field changes, and photographs of as-built units, modules, and plant.

F.1.1.12 Construction Lifecycle Information*: All information, documents, and drawings that are the result of process plant construction activities.

F.1.1.13 Construction Sold Materials*: Material by-products or remains generated during process plant erection activities that are sold for reuse.

F.1.1.14 Construction Waste Materials*: Unwanted or unusable material by-products or remains generated during process plant erection activities.

F.1.1.15 Control Concept: A document describing the conceptual control strategies to be implemented for process control, unit supervision, and safety protection.

F.1.1.16 Control Concept Development Directives*: A set of instructions that constrain the activities associated with preparation of a document describing the conceptual control strategies to be implemented for process control, unit supervision, and safety protection.

F.1.1.17 Control Logic: Textual/diagrammatic explanation of mechanisms/systems that monitor and control a process.

F.1.1.18 Create Process Flow Diagram (AAM A22337): The activities associated with collecting the technical information displayed on the PFD and creating the PFD.

F.1.1.19 Data Requirements: A selection of the types of data required to complete the material and energy balances for a process alternative.

F.1.1.20 Data Requirements Decision Directives*: A set of instructions that constrain the activities associated with selecting the types of data required to complete the material and energy balances for a process alternative.

F.1.1.21 Decide on Data Requirements (AAM A223322): Activities that select the data or models needed to complete a material and energy balance for the process as defined in the quantities flowsheet and by the process design specifications.

F.1.1.22 Decommission and Dispose of Process Plant* (AAM A5): Decommissioning and disassembling of the process plant, and preparation of the site for a new plant or return of the site to a state specified by the regulatory agencies. Records of the disposal of toxic and hazardous waste together with the location of any holes and the methodology used to plug them are produced and stored in accordance with approved procedures and guidelines.

F.1.1.23 Define Engineering Design Strategy (AAM A224): Determining the boundaries of the strategy that will be used in the engineering design of the plant.

F.1.1.24 Define Processes (AAM A223): Activities that specify the basic parameters of the plant flow scheme. Parameters include the relationship of operations necessary to transform feed stock into a product.

F.1.1.25 Define Requirements (AAM A222): Definition of the process plant requirements for: 1) the process technology, 2) the process operation and control systems and procedures, and 3) the physical three-dimensional facility structure and layout. The result is an appropriation request that is expected to be within 30% of the actual cost of the project.

F.1.1.26 Design Analysis and Cost Optimization Performance Directives*: A set of instructions that constrain the activities associated with creating additional process alternatives by making modifications to existing process alternatives.

F.1.1.27 Design Analysis and Cost Optimization Performance Provision Directives*: A set of instructions that constrain the activities associated with providing the resources needed to create additional process alternatives by making modifications to existing process alternatives.

F.1.1.28 Design Analysis and Cost Optimization Performance Provision Resources*: Human resources and tools provided to create additional process alternatives by making modifications to existing process alternatives.

F.1.1.29 Design Analysis and Cost Optimization Performance Resources*: Human resources and tools used to create additional process alternatives by making modifications to existing process alternatives.

F.1.1.30 Design and Engineer Process Plant (AAM A2): Extending a concept into a detailed plant definition in order to support component purchase and plant construction.

F.1.1.31 Design and Engineer Process Plant in Concept (AAM A22): The conversion of a basis of design into functional requirements up to the equipment detail. Conceptual process design produces the preliminary design that will be the basis for conceptual engineering design and detailed process design. It will also prepare a feasibility and financial case for management.

F.1.1.32 Design and Engineer Process Plant in Detail* (AAM A23): The conversion of functional requirements into technical implementation. The output is sufficient to procure materials to construct a process plant. Detailed engineering design produces all specifications, drawings, construction and commissioning plans, 3D models, materials takeoff and spares lists, etc.

F.1.1.33 Design and Engineering Lifecycle Information: All information, documents, and drawings that are the result of the design and engineering activities of a process plant.

F.1.1.34 Design and Engineering Resources*: Human resources and tools used to perform activities associated with the designing and engineering the process plant.

F.1.1.35 Design and Engineering Technical Directives*: A set of instructions that constrain the technical activities associated with the detailed design and engineering of the process plant.

F.1.1.36 Design and Rate Chemical Reactors (AAM A2233435): All activities associated with the design and rating of chemical reactors. These devices include stirred-tank, tubular-flow, gas-liquid, fixed bed, fluidized bed. and kiln reactors.

F.1.1.37 Design and Rate Fluid Transport Equipment (AAM A2233432): All activities associated with the design and rating of fluid transport equipment. Such devices include equipment for the point-to-point transfer of liquids, such as pumps, or of gases, such as fans, blowers, compressors, expanders, and vacuum equipment, within a chemical process or within a piping network. These activities include selecting appropriate transport equipment, determining design details to meet the design specifications, and specifying primary control elements.

F.1.1.38 Design and Rate Heat Transfer Equipment (AAM A2233433): All activities associated with the design and rating of heat transfer equipment. Such devices include equipment for the exchange of energy between two fluid streams without allowing interchange of the two fluids, such as shell-and-tube exchangers, reboilers and condensers, evaporators, and fired heaters. These activities include selecting appropriate equipment items, determining design details including the specification of internal components to meet the design specifications, and specifying primary control elements.

F.1.1.39 Design and Rate Major Processing Equipment (AAM A223343): All activities associated with the design or rating of fluid transport equipment, heat transfer equipment, stills, extractors and absorbers, reactors, mixers and agitators, and process vessels. The result of these activities is a specific equipment datasheet for each equipment item that is included in the process design specifications package. In-house testing and sizing is generally performed on these equipment items prior to specification and vendor selection.

F.1.1.40 Design and Rate Mixers and Agitators (AAM A2233436): All activities associated with the design and rating of mixers and agitators.

F.1.1.41 Design and Rate Process Equipment (AAM A22334): All activities associated with selecting, designing, or rating of equipment items specified on the PFD.

F.1.1.42 Design and Rate Process Vessels (AAM A2233437): All activities associated with the design and rating of process vessels and tanks.

F.1.1.43 Design and Rate Stills, Extractors, and Absorbers (AAM A2233434): All activities associated with the design and rating of stills, absorbers, and extractors. These devices include multi-component distillation columns for petroleum fractionation and for extractive and azeotropic distillation, gas absorption and gas stripping devices, and equipment for the transfer of components between two liquid phases. Such equipment may utilize various types of tray or packing materials for interphase contacting.

F.1.1.44 Design Changes: Changes to the design of the plant arising from errors, omissions, new requirements, or other reasons during plant design, construction, or operation.

F.1.1.45 Design Models and Performance Data: The mathematical models and correlations, performance data, or heuristic rules selected as the design methodologies for use in the process design.

F.1.1.46 Design Strategy: The "how-to" for the design. It encompasses building technology, mechanical technology, utility technology, automation technology, schedules, scope, standards and regulations, process definition, control philosophies, costs, benefits and timings, and project approach (AE, CM, internal).

F.1.1.47 Design Strategy Directives*: A set of instructions that constrain the activities associated with defining an engineering design strategy.

F.1.1.48 Design Task Estimate Results*: Documentation assessing the feasibility or estimating the requirements of the various tasks in the final plant design. Included is a preliminary layout, civil engineering, electrical, and utilities requirements, evaluations of materials of construction, fabrication feasibility, safety, environmental impact, operability, reliability, and controllability, and an estimated schedule and budget.

F.1.1.49 Design, Model, and Process Design Changes: Changes to the process topology, models, or equipment in a process alternative.

F.1.1.50 Designate Vendor-Proprietary Equipment (AAM A223344): All activities associated with the design or rating of equipment whose performance is guaranteed by the vendor. These may include gas-solid separators, solids washers, solid-liquid separators, crushers, screens, critical pipe segments, and other specialized items. The result of these activities is a specific equipment datasheet included in the process design specifications package. The majority of the equipment items in this classification are designed by first selecting a vendor who performs testing and sizing of the item, frequently on a proprietary basis.

F.1.1.51 Detailed Design Task Estimating Directives*: A set of instructions that constrain the activities associated with assessing the feasibility or estimating the requirements of the various tasks in the final plant design.

F.1.1.52 Detailed Plant Design and Engineering Directives*: A set of instructions that constrain the activities associated with the detailed design and engineering of the process plant.

F.1.1.53 Detailed Plant Design and Engineering Resources*: Human resources and tools used to perform detailed design and engineering of a process plant.

F.1.1.54 Develop Control Concept (AAM A22336): The activity of generating the document describing the conceptual control strategies to be implemented for process control, unit supervision, and safety protection.

F.1.1.55 Develop Material and Energy Balances (AAM A22333): The calculation of material and energy flows for all streams and unit operations in the quantities flowsheet.

F.1.1.56 Disposal Documents*: All information related to the disposal of the process plant including acceptance and approval procedures used in disposing all hazardous materials, residues, insulation, wiring, piping, vessels, rotating equipment, site cleanup and restoration reports, and photographs.

F.1.1.57 Documentation: The collection of all project management, design, contractual, regulatory, and disposal documents produced during the life cycle of a process plant. This includes all documentation retained past the end of the plant life cycle.

NOTE - This is a "catch-all" ICOM designed to capture any documentation not specifically identified in the AAM.

F.1.1.58 Engineering Design Specifications: A document stating the final process topology, material and energy balance information, the type and size of equipment, equipment datasheets and specifications, utilities requirements, the top level C&IS architecture, sizes of major piping components, materials of construction, hazards and operability analysis, start-up procedures, initial site selection information, general pre-commissioning guidelines, equipment testing procedures, and acceptance methods. This document is the established basis from which the final plant design is produced.

F.1.1.59 Engineering Design Strategy Definition Resources*: Human resources and tools used in defining the engineering design strategy.

F.1.1.60 Engineering, Procurement, and Construction Performance Information: Information that details how well Engineering, Procurement, and Construction execute or fulfill a task or function.

F.1.1.61 Equipment Data: All of the equipment data on a process flow diagram should be obtained from the equipment datasheets.

F.1.1.62 Equipment Datasheets: A collection of documents for each equipment item in the process flow diagram that contains sufficient information to submit to an engineering design and construction (E&C) firm. Typically, this would include an equipment list and a set of equipment datasheets for submission with the engineering design specifications.

F.1.1.63 Estimate Detailed Design Tasks (AAM A223354): An assessment of the feasibility or estimating the requirements of the various tasks in the final plant design. Included is a preliminary layout, civil engineering, electrical, and utilities requirements, evaluations of materials of construction, fabrication feasibility, safety, environmental impact, operability, reliability, and controllability, and an estimated schedule and budget.

F.1.1.64 Fluid Transport Equipment Design and Rating Directives*: A set of instructions that constrain the activities associated with the design and rating of fluid transport equipment.

F.1.1.65 Generate a Study Cost Estimate* (AAM A223353): For each remaining process alternative, the PFD, utilities summary, and equipment specifications are used to generate a factored estimate (or study cost estimate as defined by the American Association of Cost Engineers (AACE)) of the capital and manufacturing costs. The cost estimate is typically within 30% of the actual cost and is generally used to compare the remaining alternatives to eliminate all but one from further consideration.

F.1.1.66 Generate Additional and Compare All Process Alternatives* (AAM A223352): Activities associated with the analysis of the set of existing process alternatives to determine new alternatives with the potential for improved technical or economical performance. These new alternatives feedback as "changes," perhaps as far as the process synthesis activity. All process alternatives are compared with each other and with the project design requirements. All infeasible or inferior process alternatives are discarded.

F.1.1.67 Generate Specifications and Documentation* (AAM A223355): The equipment specifications, utilities summary, and PFD are combined with statements of general design performance criteria to form a set of process design specifications.

F.1.1.68 Hardware Duty Specifications: Duty Specification for Equipment that are considered to form the major part of the final investment or the functionality criteria to support the intended production.

F.1.1.69 Heat Transfer Equipment Design and Rating Directives*: A set of instructions that constrain the activities associated with the design and rating of heat transfer equipment.

F.1.1.70 Information: Facts, concepts, or instructions.

NOTE - This is a "catch-all" ICOM designed to capture any information not specifically identified in the AAM.

F.1.1.71 Kinetic Data and Models Acquisition Directives*: A set of instructions that constrain the activities associated with determining appropriate kinetic data and models for all chemical reactions occurring in a process.

F.1.1.72 Layout Directives*: A set of instructions that constrain the activities associated with producing a preliminary layout of the process plant.

F.1.1.73 Licensed Technology: Patented or proprietary processes or design information purchased or licensed from an outside source, such as a process processor, vendor, or fabricator. Such technology may range from laboratory synthesis data through unit operation process data to complete, detailed plant designs or equipment items and modules.

F.1.1.74 Lifecycle Information: The collection of all project management, design, contractual, regulatory, and disposal information produced during the life cycle of a process plant. This includes all information retained past the end of the plant life cycle.

F.1.1.75 Maintenance Instructions*: A set of directions that prescribe actions to be taken to maintain the plant and its components in good repair.

F.1.1.76 Major Processing Equipment Design and Rating Directives*: A set of instructions that constrain the activities associated with the design or rating of fluid transport equipment, heat transfer equipment, stills, extractors and absorbers, reactors, mixers and agitators, and process vessels.

F.1.1.77 Major Processing Equipment Design and Rating Provision Directives*: A set of instructions that constrain the activities associated with providing resources used to design or rate fluid transport equipment, heat transfer equipment, stills, extractors and absorbers, reactors, mixers and agitators, and process vessels.

F.1.1.78 Major Processing Equipment Design and Rating Provision Resources*: Human resources and tools provided to design or rate fluid transport equipment, heat transfer equipment, stills, extractors and absorbers, reactors, mixers and agitators, and process vessels.

F.1.1.79 Major Processing Equipment Design and Rating Resources*: Human resources and tools used to design or rate fluid transport equipment, heat transfer equipment, stills, extractors and absorbers, reactors, mixers and agitators, and process vessels.

F.1.1.80 Manage Acquisition of Physical Property Data and Models* (AAM A2233231): Provide sufficient resources to execute the activities associated with development of the thermodynamic and transport property information for the chemical substances within a chemical process and checking that the execution is done in accordance with the plan for these activities and any required regulations.

F.1.1.81 Manage Definition of Processes* (AAM A2231): Provide sufficient resources to execute the activities associated with specifying the basic parameters of the plant flow scheme and checking that the execution is done in accordance with the plan for these activities and any required regulations.

F.1.1.82 Manage Design and Engineer in Concept* (AAM A221): Provide sufficient resources to execute the conceptual design and engineering activities and check that the execution is done in accordance with the plan for these activities and any required regulations.

F.1.1.83 Manage Design and Rating of Process Equipment* (AAM A223341): Provide sufficient resources to execute the activities associated with selecting, designing, or rating of equipment items specified on the PFD and checking that the execution is done in accordance with the plan for these activities and any required regulations.

F.1.1.84 Manage Major Processing Equipment Design and Rating* (AAM A2233431): Provide sufficient resources to execute the activities associated with the design or rating of fluid transport equipment, heat transfer equipment, stills, extractors and absorbers, reactors, mixers and agitators, and process vessels and checking that the execution is done in accordance with the plan for these activities and any required regulations.

F.1.1.85 Manage Model Selection and Performance Data Acquisition* (AAM A223321): Provide sufficient resources to execute the activities associated with the process of collecting the required physical property and kinetics data and developing the necessary correlations for use in the process design and checking that the execution is done in accordance with the plan for these activities and any required regulations.

F.1.1.86 Manage Performance of Design Analysis and Cost Optimization* (AAM A223351): Provide sufficient resources to execute the activities associated with creating additional process alternatives and checking that the execution is done in accordance with the plan for these activities and any required regulations.

F.1.1.87 Manage Process Design* (AAM A22331): Provide sufficient resources to execute the activities associated with the development of a finalized PFD and checking that the execution is done in accordance with the plan for these activities and any required regulations.

F.1.1.88 Manage Process Plant Design and Engineering* (AAM A21): Provide sufficient resources to execute process plant design and engineering activities and check that the execution is done in accordance with the plan for these activities and any required regulations.

F.1.1.89 Manage Process Plant Provision* (AAM A1): Provide sufficient resources to execute the design and engineering, procurement, construction, and commissioning activities for the process plant and check that the execution is done in accordance with the plan for these activities and any required regulations.

F.1.1.90 Management Lifecycle Information*: All information and documents that are the result of process plant management activities.

F.1.1.91 Material and Energy Balance Development Directives*: A set of instructions that constrain the activities associated with calculating material and energy flows for all streams and unit operations in the quantities flowsheet.

F.1.1.92 Materials to Site*: Equipment and materials that have been shipped to the site.

F.1.1.93 Mixer and Agitator Design and Rating Directives*: A set of instructions that constrain the activities associated with the design and rating of mixers and agitators.

F.1.1.94 Mixture Data and Models: Data or models describing the thermodynamic condition and transport properties of mixtures of pure components within a chemical process.

F.1.1.95 Mixture Information Acquisition Directives*: A set of instructions that constrain the activities associated with the development of thermodynamic and transport property information for mixtures of pure components within a chemical process.

F.1.1.96 Model Changes: Requests for updated design or physical property models or performance data.

F.1.1.97 Model Selection and Performance Data Acquisition Directives*: A set of instructions that constrain the activities associated with the process of collecting the required physical property and kinetics data and developing the necessary correlations for use in the process design.

F.1.1.98 Model Selection and Performance Data Acquisition Provision Resources*: Human resources and tools provided to collect the required physical property and kinetics data and develop the necessary correlations for use in the process design.

F.1.1.99 Model Selection and Performance Data Acquisition Resource Provision Directives*: A set of instructions that constrain the activities associated with providing resources to collect the required physical property and kinetics data and develop the necessary correlations for use in the process design.

F.1.1.100 Model Selection and Performance Data Acquisition Resources*: Human resources and tools used to collect the required physical property and kinetics data and develop the necessary correlations for use in the process design.

F.1.1.101 Obtain Kinetic Data and Models (AAM A223324): All activities associated with determining appropriate kinetic data and models for all chemical reactions occurring in a process.

F.1.1.102 Obtain Mixture Information (AAM A2233233): All activities associated with the development of thermodynamic and transport property information for mixtures of pure components within a chemical process.

F.1.1.103 Obtain Physical Property Data and Models (AAM A223323): All activities associated with development of the thermodynamic and transport property information for the chemical substances within a chemical process. These substances include pure components, mixtures of pure components, and pseudo-components.

F.1.1.104 Obtain Pseudo-component and Assay Information (AAM A2233234): All activities associated with the description of complex substances as a mixture of pseudo-components with specified thermodynamic and transport properties.

F.1.1.105 Obtain Pure Component Information (AAM A2233232): All activities associated with the development of thermodynamic and transport property information for pure components within a chemical process.

F.1.1.106 Obtain Transport Rate Data and Models (AAM A223325): All activities associated with determining transport rates within unit operations of a chemical process. Such data may include correlations for mass and heat transfer coefficients, tray efficiencies, bubble dynamics, radiative transport, and drying rates.

F.1.1.107 Obtain Unit Performance Data (AAM A223326): Unit performance data are a quantitative description of the quantity and quality of a product produced by the plant usually stated as "units of product/unit time". Certain unit operations, such as crystallization, fiber drawing, and injection molding, are not easily described by models or correlations derived from fundamental principles. Performance data for these types of operations must be supplied by direct laboratory measurements or from vendors.

F.1.1.108 Obtain Vendor/Fabricator Equipment Data (AAM A223342): All activities associated with contacting vendors or fabricators of certain types of equipment and obtaining information necessary for the design of the equipment.

F.1.1.109 Operations Documents*: Documentation necessary to run the plant safely during the many different phases and aspects of plant operation.

F.1.1.110 P&ID, Approved for Design*: A schematic diagram that shows engineering details of the equipment, instruments, pipes, valves, and their connectivity and sequence. At the approved for design stage, the process definition is firm and instrumentation needs to be added.

F.1.1.111 Payment Requests*: A request for compensation in the form of money, services, or goods to compensate for the delivery of services, goods, or good will.

F.1.1.112 Perform Design Analysis and Cost Optimization (AAM A22335): Additional process alternatives are created by making modifications to existing process alternatives that may reduce costs, increase profitability, or improve operability, maintainability, controllability, or constructability. The new process alternatives may require additional or more accurate design models or performance data. If a new process alternative is radically different from any existing alternative, it will feedback through the design activities, perhaps as far as the process synthesis activities. Inferior alternatives are identified and discarded.

F.1.1.113 Perform Process Design (AAM A2233): All activities associated with the development of a finalized PFD. These activities include refining the required physical property and kinetic data or models, collecting the required equipment performance data, calculating detailed material and energy balances, sizing or rating equipment items, compiling utility requirements, estimating capital and operating costs and producing the PFD. Some optimization of the design is performed to satisfy profitability criteria.

F.1.1.114 Perform Process Engineering Analysis* (AAM A2234): All activities involved in converting the PFD, equipment specification, material and energy balances, and utility requirements into an engineering design specification. These activities include site selection, hazards analysis, environmental impact assessment, definition of major control functions, generation of start-up and acceptance procedures, preliminary estimation of profitability, optimization studies, design validation, and report generation (including the appropriation request and the engineering design specifications).

F.1.1.115 Perform Process Synthesis* (AAM A2232): Process alternatives, that differ in production rate, raw materials, process topology, or process equipment/technologies, are generated, their technical and economical feasibility is verified, and socio-economical comparisons are made to determine a small set for which to perform preliminary designs. Unit operations are selected for modelling the major equipment/technologies, basic chemical and reaction information is determined, and preliminary material and energy balances are performed for each alternative.

F.1.1.116 Performance Requirements: Plant Performance Requirements are a quantitative description of the quantity and quality of a product to be produced by the Plant in a yearly time period. Usually stated as "units of product/unit time". Additional qualifications are made regarding the quality of the Plant.

> EXAMPLE 96 - Time between major shutdowns for continuous processes, percent uptime required, and expected yield.

F.1.1.117 PFD Creation Directives*: A set of instructions that constrain the activities associated with collecting the technical information displayed on the PFD and creating the PFD.

F.1.1.118 PFDs: Graphical documents representing unit operations and connections in the form of streams with their associated stream data. A PFD describes the equipment units and their interconnections, major process control functions, and major stream characteristics including physical and transport properties, material flows, and energy flows.

F.1.1.119 Physical Property Data and Models: Data and models describing the thermodynamic condition and transport properties of substances within a chemical process.

F.1.1.120 Physical Property Data and Models Acquisition Directives*: A set of instructions that constrain the activities associated with development of the thermodynamic and transport property information for the chemical substances within a chemical process.

F.1.1.121 Physical Property Data and Models Acquisition Provision Directives*: A set of instructions that constrain the activities associated with providing resources for the development of the thermodynamic and transport property information for the chemical substances within a chemical process.

F.1.1.122 Physical Property Data and Models Acquisition Provision Resources*: Human resources and tools provided to develop the thermodynamic and transport property information for the chemical substances within a chemical process.

F.1.1.123 Physical Property Data and Models Acquisition Resources*: Human resources and tools used to develop the thermodynamic and transport property information for the chemical substances within a chemical process.

F.1.1.124 Plant 3D Model*: A three-dimensional representation of the plant.

F.1.1.125 Plant Construction and Commissioning Resources*: Human resources and tools used in process plant construction and pre-commissioning activities.

F.1.1.126 Plant Decommissioning and Disposal Resources*: Human resources and tools used to perform the activities associated with decommissioning and disposing of the process plant.

F.1.1.127 Plant Design and Engineering Management Resources*: Human resources and tools used in the management of conceptual and detailed design and engineering of a process plant.

F.1.1.128 Plant Design and Engineering Provision Directives*: A set of instructions that constrain the activities associated with providing resources for plant design and engineering.

F.1.1.129 Plant Provision Management Resources*: Human resources and tools used in the management of activities associated with providing a process plant.

F.1.1.130 Preliminary Cost Estimate*: A factored (study cost estimate as defined by the AACE) estimate of the capital and operating costs of the plant. The estimate is expected to be within 30% of the actual costs of the plant.

F.1.1.131 Preliminary Layout Production Resources*: Human resources and tools used to produce the preliminary layout of a process plant.

F.1.1.132 Preliminary Plant Design and Engineering Directives*: A set of instructions that constrain the activities associated with the conceptual design and engineering of a process plant.

F.1.1.133 Preliminary Plant Design and Engineering Resources*: Human resources and tools used to perform conceptual design and engineering activities for a process plant.

F.1.1.134 Preliminary Plant Layout*: A graphical document describing the spatial arrangement of the major equipment or process units.

F.1.1.135 Preliminary Process Design Specifications: A document containing a list of specifications that the preliminary design must meet or exceed, recommended correlations and their parameter values, site-specific information that will impact the design, and other associated information to be used in the course of the preliminary design.

F.1.1.136 Preliminary System Layout*: The definitions/representation of the system sufficient for construction. This definition results from the use of the system design basis, P&IDs, specifications, and other documentation/information to specify the physical components/items and spatial configuration of the process plant.

NOTE - The definition of "system" is broader than common usage, e.g., it encompasses structural systems. System layout/designs can be viewed or categorized according to three different breakdowns:

1. Evolutionary Phase
   - Initial
   - Design
   - Final

2. System Type
   - Piping
   - HVAC
   - Electrical
   - I&C
   - Structural/Civil

- Architecture
- Safety

3. Functional Views
   - Conceptual arrangement
   - Spatial information
   - Schematic diagram
   - P&ID (includes piping connectivity/sequencing)

EXAMPLE 97 - The final HVAC spatial information system design/layout will specify the definition, physical dimensions, location coordinates, and characteristics for all HVAC components which occupy space in the Plant. Only those physical dimensions, location coordinates, and characteristics required to specify the spatial instance of each component are included in this definition.

F.1.1.137 Process Alternative Generation and Comparison Directives*: A set of instructions that constrain the activities associated with the analysis of the set of existing process alternatives to determine new alternatives with the potential for improved technical or economical performance.

F.1.1.138 Process Definition Directives*: A set of instructions that constrain the activities associated with defining the basic parameters of the plant flow scheme.

F.1.1.139 Process Definition Management Resources*: Human resources and tools used to provide sufficient resources to execute the activities associated with specifying the basic parameters of the plant flow scheme and check that the execution is done in accordance with the plan for these activities and any required regulations.

F.1.1.140 Process Definition Resource Provision Directives*: A set of instructions that constrain the activities associated with providing resources to specify the basic parameters of the plant flow scheme.

F.1.1.141 Process Definition Resources*: Human resources and tools used to define the basic parameters of the plant flow scheme.

F.1.1.142 Process Design Changes: Requests for change to the quantities flowsheet or the chemical species or chemical reaction information.

F.1.1.143 Process Design Directives*: A set of instructions that constrain the activities associated with the development of a finalized PFD.

F.1.1.144 Process Design Documentation: All documents pertaining to the methodologies used in the process design activities.

F.1.1.145 Process Design Management Resources*: Human resources and tools used to provide sufficient resources to execute the activities associated with the development of a finalized PFD and check that the execution is done in accordance with the plan for these activities and any required regulations.

F.1.1.146 Process Design Provision Directives*: A set of instructions that constrain the activities associated with providing resources to develop a finalized PFD.

F.1.1.147 Process Design Provision Resources*: Human resources and tools provided to develop a finalized PFD.

F.1.1.148 Process Design Resources*: Human resources and tools used to develop a finalized PFD.

F.1.1.149 Process Design Specifications: A document containing a list of specifications that the process design must meet or exceed, equipment datasheets and specifications, utility load summaries, stream definitions, and the models, correlations, and performance data used in the process design.

F.1.1.150 Process Engineering Analysis Directives*: A set of instructions that constrain the activities associated with converting the PFD, equipment specification, material and energy balances, and utility requirements into an engineering design specification.

F.1.1.151 Process Engineering Analysis Information*: All information pertaining to the methodologies used in the process engineering analysis activity.

F.1.1.152 Process Engineering Analysis Resources*: Human resources and tools used to convert the PFD, equipment specification, material and energy balances, and utility requirements into an engineering design specification.

F.1.1.153 Process Engineering Changes: Requests for change to the process flow diagram or process design specifications.

F.1.1.154 Process Equipment Design and Rating Directives*: A set of instructions that constrain the activities associated with selecting, designing, or rating equipment items specified on the PFD.

F.1.1.155 Process Equipment Design and Rating Provision Directives*: A set of instructions that constrain the activities associated with providing resources to perform selection, design, or rating of equipment items specified on the PFD.

F.1.1.156 Process Equipment Design and Rating Provision Resources*: Human resources and tools provided to select, design, or rate equipment items specified on the PFD.

F.1.1.157 Process Equipment Design and Rating Resources*: Human resources and tools used to select, design, or rate equipment items specified on the PFD.

F.1.1.158 Process Overview Flowsheet: A diagram that depicts the overview of a process, it's major process activities, and the major flows between the process activities. It typically uses labelled rectangular blocks to show major process activities and labelled arrowed lines that depict major process material flows between the process activities. It is typically used as a precursor to process selection or as a way to organize major sections of a plant, each of which may have it's own PFD.

F.1.1.159 Process Plant Construction and Pre-commissioning Directives*: A set of instructions that constrain the activities associated with constructing and pre-commissioning a process plant.

F.1.1.160 Process Plant Decommissioning and Disposal Directives*: A set of instructions that constrain the activities associated with decommissioning and disposing of a process plant.

F.1.1.161 Process Plant Design and Engineering Directives*: A set of instructions that constrain the activities associated with design and engineering a process plant.

F.1.1.162 Process Plant Procurement Directives*: A set of instructions that constrain the activities associated with procuring goods and services for a process plant.

F.1.1.163 Process Plant Provision Directives*: A set of instructions that constrain the activities associated with providing process plants.

F.1.1.164 Process Plant Provision Support Directives*: A set of instructions that constrain the activities associated with providing resources to support management, design and engineering, procurement, and construction and pre-commissioning of a process plant.

F.1.1.165 Process Plants: Produces chemicals, pharmaceutical, electrical power, petroleum, and similar products (i.e., "stuff" rather than "things").

F.1.1.166 Process Requirements: Conditions imposed on a process.

F.1.1.167 Process Synthesis Directives*: A set of instructions that constrain the activities associated with generating process alternatives, that differ in production rate, raw materials, process topology, or process equipment/technologies, verifying their technical and economical feasibility, and making socio-economical comparisons to determine a small set for which to perform preliminary designs.

F.1.1.168 Process Synthesis Resources*: Human resources and tools used to generate process alternatives, that differ in production rate, raw materials, process topology, or process equipment/technologies, verify their technical and economical feasibility, and make socio-economical comparisons to determine a small set for which to perform preliminary designs.

F.1.1.169 Process Vessel Design and Rating Directives*: A set of instructions that constrain the activities associated with the design and rating of process vessels and tanks.

F.1.1.170 Process Vessel Design and Rating Resources*: Human resources and tools used to design and rate process vessels and tanks.

F.1.1.171 Procure Goods and Services* (AAM A3): The process by which needed parts, equipment, and services are purchased or acquired.

F.1.1.172 Procured Materials and Services: Item that has been obtained from a vendor or supplier or assistance or advice provided by a vendor or supplier.

F.1.1.173 Procurement Lifecycle Information*: All information, documents, and drawings that are the result of process plant procurement activities.

F.1.1.174 Procurement Resources*: Human resources and tools used in the procurement of goods and services for a process plant.

F.1.1.175 Produce Preliminary Layout* (AAM A225): From the early process definitions, plant list and volume estimates, prepare initial plant layout proposals.

F.1.1.176 Provide Design Analysis and Cost Optimization Resources* (AAM A223356): Supplying or furnishing human resources and tools used to perform optimization of a process by evaluating additional process alternatives created by making modifications to existing process alternatives.

F.1.1.177 Provide Design and Engineering Resources* (AAM A226): Supplying or furnishing human resources and tools used to perform conceptual design and engineering activities for a process plant.

F.1.1.178 Provide Major Processing Equipment Design and Rating Resources* (AAM A2233438): Supplying or furnishing human resources and tools used to perform design or rating of fluid transport equipment, heat transfer equipment, stills, extractors and absorbers, reactors, mixers and agitators, and process vessels.

F.1.1.179 Provide Model Selection and Performance Data Acquisition Resources* (AAM A223327): Supplying or furnishing human resources and tools used to perform the process of collecting the required physical property and kinetics data and developing the necessary correlations for use in the process design.

F.1.1.180 Provide Physical Property Data and Models Acquisition Resources* (AAM A2233235): Supplying or furnishing human resources and tools used to perform development of the thermodynamic and transport property information for the chemical substances within a chemical process.

F.1.1.181 Provide Process Definition Resources* (AAM A2235): Supplying or furnishing human resources and tools used to perform specification of the basic parameters of the plant flow scheme.

F.1.1.182 Provide Process Design Resources* (AAM A22338): Supplying or furnishing human resources and tools used to perform the development of a finalized PFD.

F.1.1.183 Provide Process Equipment Design and Rating Resources* (AAM A223345): Supplying or furnishing human resources and tools used to perform selection, design, or rating of equipment items specified on the PFD.

F.1.1.184 Provide Process Plant Design and Engineering Resources* (AAM A24): Supplying or furnishing human resources and tools used to perform conceptual and detailed design and engineering activities for a process plant.

F.1.1.185 Provide Process Plant Provision Support* (AAM A6): Supplying or furnishing human resources and tools used to perform support of activities necessary to provide a process plant.

F.1.1.186 Provide Process Plants (AAM A0): Supplying or furnishing the process plants necessary to create the core business product(s).

F.1.1.187 Pseudo-component and Assay Information Acquisition Directives*: A set of instructions that constrain the activities associated with obtaining information describing complex substances as a mixture of pseudo-components with specified thermodynamic and transport properties.

F.1.1.188 Pseudo-component Data and Models: Data or models describing the thermodynamic condition and transport properties of pseudo-components within a chemical process.

F.1.1.189 Purchase Orders and Contracts for Tools*: Purchase order or contract between two parties to provide tools for designated payment.

F.1.1.190 Pure Component Data and Models: Data or models describing the thermodynamic condition and transport properties of pure components within a chemical process.

F.1.1.191 Pure Component Information Acquisition Directives*: A set of instructions that constrain the activities associated with obtaining information on the development of thermodynamic and transport property information for pure components within a chemical process.

F.1.1.192 Quantities Flowsheets: A document indicating the unit operations and their topology and a preliminary estimate of the material and energy flows for the major process streams in a process alternative.

F.1.1.193 Reconditioned Site*: A site that has been restored to meet environmental requirements or prepared for the installation of a new process plant.

F.1.1.194 Reporting*: Narrating or describing, usually in writing, the status, results, costs, profits, conformance to requirements, etc. of some activity or task.

F.1.1.195 Required at Site Date*: The calendar date when procured goods or services are required to be at the site.

F.1.1.196 Requirements Definition Directives*: A set of instructions that constrain the activities associated with defining the performance requirements for the process plant.

F.1.1.197 Requirements Definition Resources*: Human resources and tools used to perform activities necessary to define the requirements to be met by the process plant. These activities are performed during conceptual design and engineering of the plant.

F.1.1.198 Requisitions*: A written document requesting permission to purchase goods or services.

F.1.1.199 Resource Market Information*: Information regarding the availability, costs, etc. of resources.

F.1.1.200 Retained Process Alternatives: Those process alternatives that are technically, economically, or commercially superior when compared to the set of process alternatives.

F.1.1.201 Reviewed Supplier Information: Technical documentation received from a vendor concerning procured items, usually in the form of drawings, manuals, or calculations, which provides information concerning design details or performance of the procured items, and which has been reviewed by the receiving organization.

F.1.1.202 Select Models and Obtain Performance Data (AAM A22332): The process of collecting the required physical property and kinetics data and developing the necessary correlations for use in the process design. The appropriate design methodology is chosen for each unit operation in the preliminary design specification and the quantities flowsheet. Such methodologies may include a heuristic, model, or performance data. These items may be generated in-house or may be licensed or purchased from vendors and other outside sources.

F.1.1.203 Specification and Documentation Generation Directives*: A set of instructions that constrain the activities associated with generating a set of process design specifications from the combination of the equipment specifications, utilities summary, PFD, and statements of general design performance criteria.

F.1.1.204 Still, Extractor, and Absorber Design and Rating Directives*: A set of instructions that constrain the activities associated with the design and rating of stills, absorbers, and extractors.

F.1.1.205 Stream and Substance Data and Models: Data and models describing the thermodynamic condition and transport properties of substances, the rate of chemical reactions, transport rates within the unit operations, and the operation and performance of unit operations, within a chemical process.

F.1.1.206 Stream Data: Chemical composition, physical state, and mass quantities of process flows. Part of a PFD.

F.1.1.207 Study Cost Estimate Generation Directives*: A set of instructions that constrain the activities associated with generation of a factored estimate of the capital and manufacturing costs for each remaining process alternative.

F.1.1.208 Supplier Information: Documentation received from a vendor concerning procured items, usually in the form of drawings, manuals, or calculations, which provides information concerning design details or performance of the procured items.

Kinds of vendor documentation include:

— Preliminary: in-process design information;

— Certified: information from the supplier of equipment or other components which is warranted to correctly describe the as-delivered functional or physical data;

— Released for fabrication/construction.

F.1.1.209 Supplier Information Delivery Notice*: A notification to a supplier that the supplier technical information for an item has been reviewed and accepted.

F.1.1.210 Tool Improvement Recommendation*: Information generated by research and development activities that is used to enhance the capabilities of tools provided to produce the core business product(s).

F.1.1.211 Tool Performance Data: Data about how well a tool is carrying out or fulfilling its function.

EXAMPLE 98 - Data retrieved from an existing plant to optimize the new process plant design.

F.1.1.212 Tool Provision Resource Requirements: A set of needs or wants defined during tool provision activities.

F.1.1.213 Transport Rate Data and Models: Data or models describing transport rates within the unit operations of a chemical process.

F.1.1.214 Transport Rate Data and Models Acquisition Directives*: A set of instructions that constrain the activities associated with determining transport rates within unit operations of a chemical process.

F.1.1.215 Unit Performance Data: Data or models describing the operation and performance of unit operations in a chemical process.

F.1.1.216 Unit Performance Data Acquisition Directives*: A set of instructions that constrain the activities associated with obtaining unit performance data.

F.1.1.217 Utilities Summary: A compilation of the total annual consumption and peak rates of consumption for each utility in the preliminary design.

F.1.1.218 Vendor Documentation: Documentation received from a vendor concerning procured items, usually in the form of drawings, manuals, or calculations, which provides information concerning design details or performance of the procured items.

Kinds of vendor documentation include:

— Preliminary: in process design information;

— Certified: information from the supplier of equipment or other components which is warranted to correctly describe the as-delivered functional or physical data;

— Released for fabrication/construction.

F.1.1.219 Vendor-Proprietary Equipment Designation Directives*: A set of instructions that constrain the activities associated with the design or rating of equipment whose performance is guaranteed by the vendor.

F.1.1.220 Vendor/Fabricator Equipment Data Acquisition Directives*: A set of instructions that constrain the activities associated with contacting vendors or fabricators of certain types of equipment and obtaining information necessary for the design of the equipment.

F.1.2 Application activity model diagrams

The application activity model diagrams are given in figures F.4 through F.14. The graphical form of the application activity model is presented in the IDEF0 activity modelling format. Activities and data flows that are out of scope are marked with asterisks.

Figure F.1 describes the basic notation used in IDEF0 modelling. Each activity may be decomposed to provide more detail. If an activity has been decomposed, a separate diagram is included.

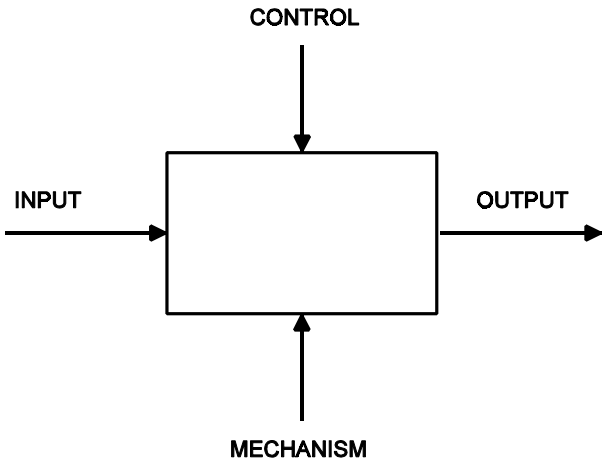


Figure F.1 - IDEF0 basic notation

The application activity model uses a template approach across all principal activities. This template consists of 3 steps, (1) manage, (2) do and (3) provide resources, as shown on figure F.2. The layout and look of the activity model is affected by use of this template.

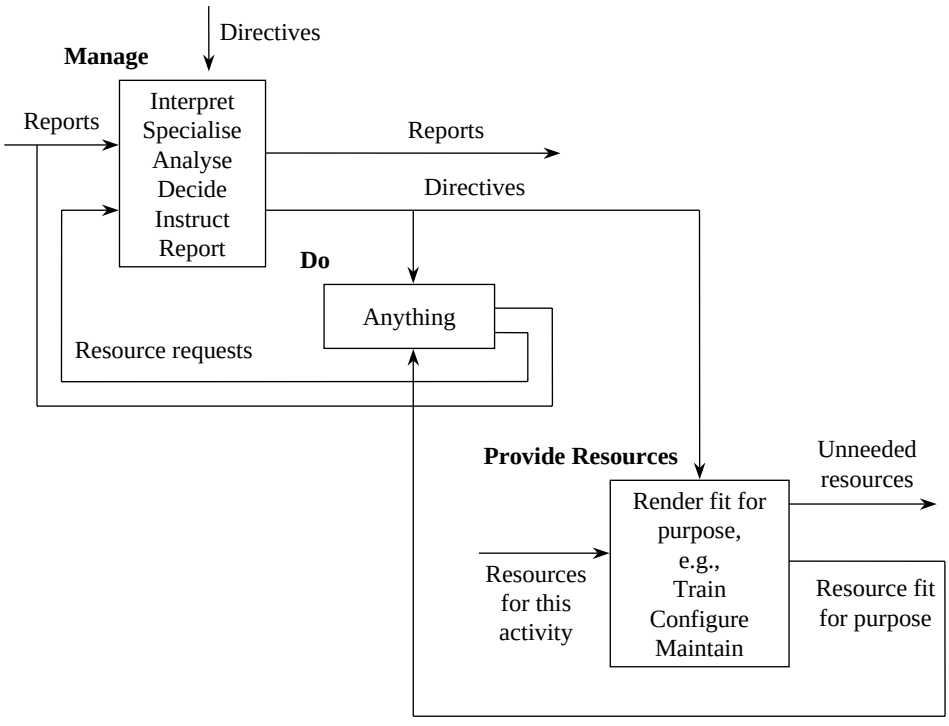


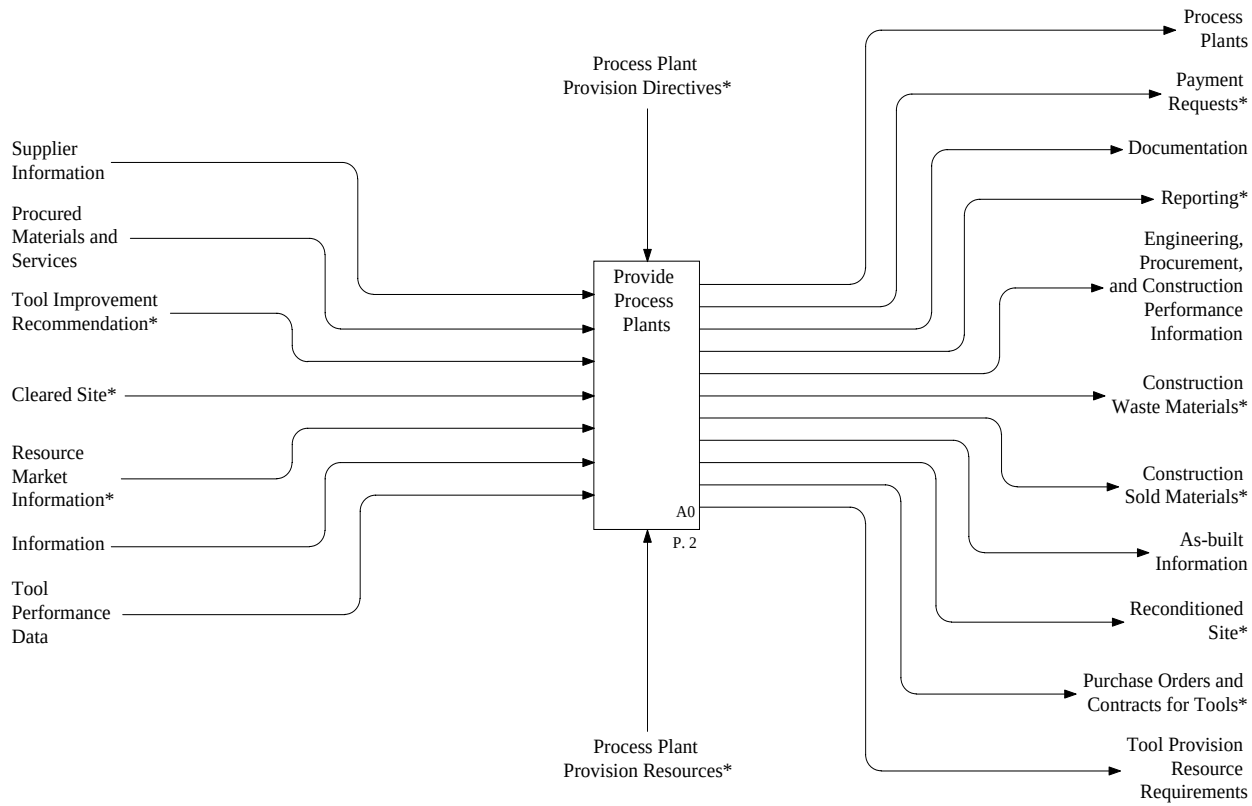
Figure F.2 - Manage, do, provide resources template

Figure F.3 is an indented node listing of the activities shown on figures F.4 through F.14 that provides a hierarchical view of the activity relationships.

[A0] Provide Process Plants
- [A1] Manage Process Plant Provision*
- [A2] Design and Engineer Process Plant
  - [A21] Manage Process Plant Design and Engineering*
  - [A22] Design and Engineer Process Plant in Concept
    - [A221] Manage Design and Engineer in Concept*
    - [A222] Define Requirements
    - [A223] Define Processes
      - [A2231] Manage Definition of Processes*
      - [A2232] Perform Process Synthesis*
      - [A2233] Perform Process Design
        - [A22331] Manage Process Design*
        - [A22332] Select Models and Obtain Performance Data
          - [A223321] Manage Model Selection and Performance Data Acquisition*
          - [A223322] Decide on Data Requirements
          - [A223323] Obtain Physical Property Data and Models
            - [A2233231] Manage Acquisition of Physical Property Data and Models*
            - [A2233232] Obtain Pure Component Information
            - [A2233233] Obtain Mixture Information
            - [A2233234] Obtain Pseudo-component and Assay Information
            - [A2233235] Provide Physical Property Data and Models Acquisition Resources
          - [A223324] Obtain Kinetic Data and Models
          - [A223325] Obtain Transport Rate Data and Models
          - [A223326] Obtain Unit Performance Data
          - [A223327] Provide Model Selection and Performance Data Acquisition Resources
        - [A22333] Develop Material and Engergy Balances
        - [A22334] Design and Rate Process Equipment
          - [A223341] Manage Design and Rating of Process Equipment*
          - [A223342] Obtain Vendor/Fabricator Equipment Data
          - [A223343] Design and Rate Major Processing Equipment
            - [A2233431] Manage Major Processing Equipment Design and Rating*
            - [A2233432] Design and Rate Fluid Transport Equipment
            - [A2233433] Design and Rate Heat Transfer Equipment
            - [A2233434] Design and Rate Stills, Extractors, and Absorbers
            - [A2233435] Design and Rate Chemical Reactors
            - [A2233436] Design and Rate Mixers and Agitators
            - [A2233437] Design and Rate Process Vessels
            - [A2233438] Provide Major Processing Equipment Design and Rating Resources*
          - [A223344] Designate Vendor-Proprietary Equipment
          - [A223345] Provide Process Equipment Design and Rating Resources*
        - [A22335] Perform Design Analysis and Cost Optimization
          - [A223351] Manage Performance of Design Analysis and Cost Optimization*
          - [A223352] Generate Additional and Compare All Process Alternatives*
          - [A223353] Generate a Study Cost Estimate*
          - [A223354] Estimate Detailed Design Tasks
          - [A223355] Generate Specifications and Documentation*
          - [A223356] Provide Design Analysis and Cost Optimization Resources*
        - [A22336] Develop Control Concept
        - [A22337] Create Process Flow Diagram
        - [A22338] Provide Process Design Resources*
      - [A2234] Perform Process Engineering Analysis*
      - [A2235] Provide Process Definition Resources*
    - [A224] Define Engineering Design Strategy
    - [A225] Produce Preliminary Layout*
    - [A226] Provide Design and Engineering Resources*
  - [A23] Design and Engineer Process Plant in Detail*
  - [A24] Provide Process Plant Design and Engineering Resources*
- [A3] Procure Goods and Services*
- [A4] Construct and Pre- Commission Process Plant*
- [A5] Decommission and Dispose of Process Plant*
- [A6] Provide Process Plant Provision Support*

Figure F.3 - AAM indented node list

AUTHOR: AP 231 Project
PROJECT: AP 231 AAM
DATE: 1998-05-11
REV: 0.5
NOTES: 1 2 3 4 5 6 7 8 9 10
CONTEXT: Top



Purpose: Identify the activities in the life cycle of a process plant that generate process engineering data.
Viewpoint: A process engineer or a member of process engineering management.

Notes: 1. An * after an Activity or ICOM (Input, Control, Output, Mechanism) name is an indication that it is not within the scope of this part of ISO 10303.

NODE: A-0	TITLE: Provide Physical Assets	NUMBER: P. 1

Figure F.4 - A-0: Provide physical assets

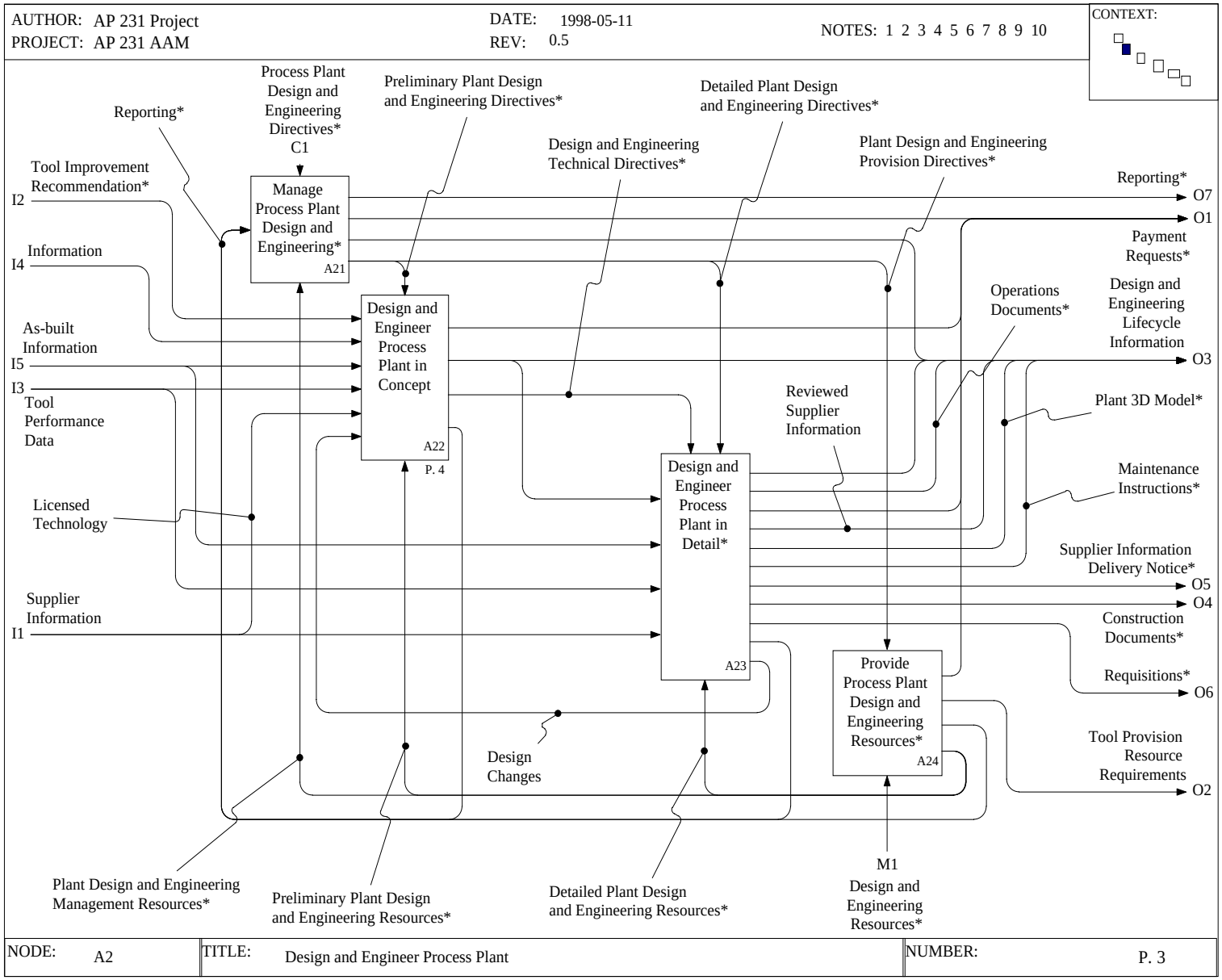


Figure F.5 - A2: Design and engineer process plant

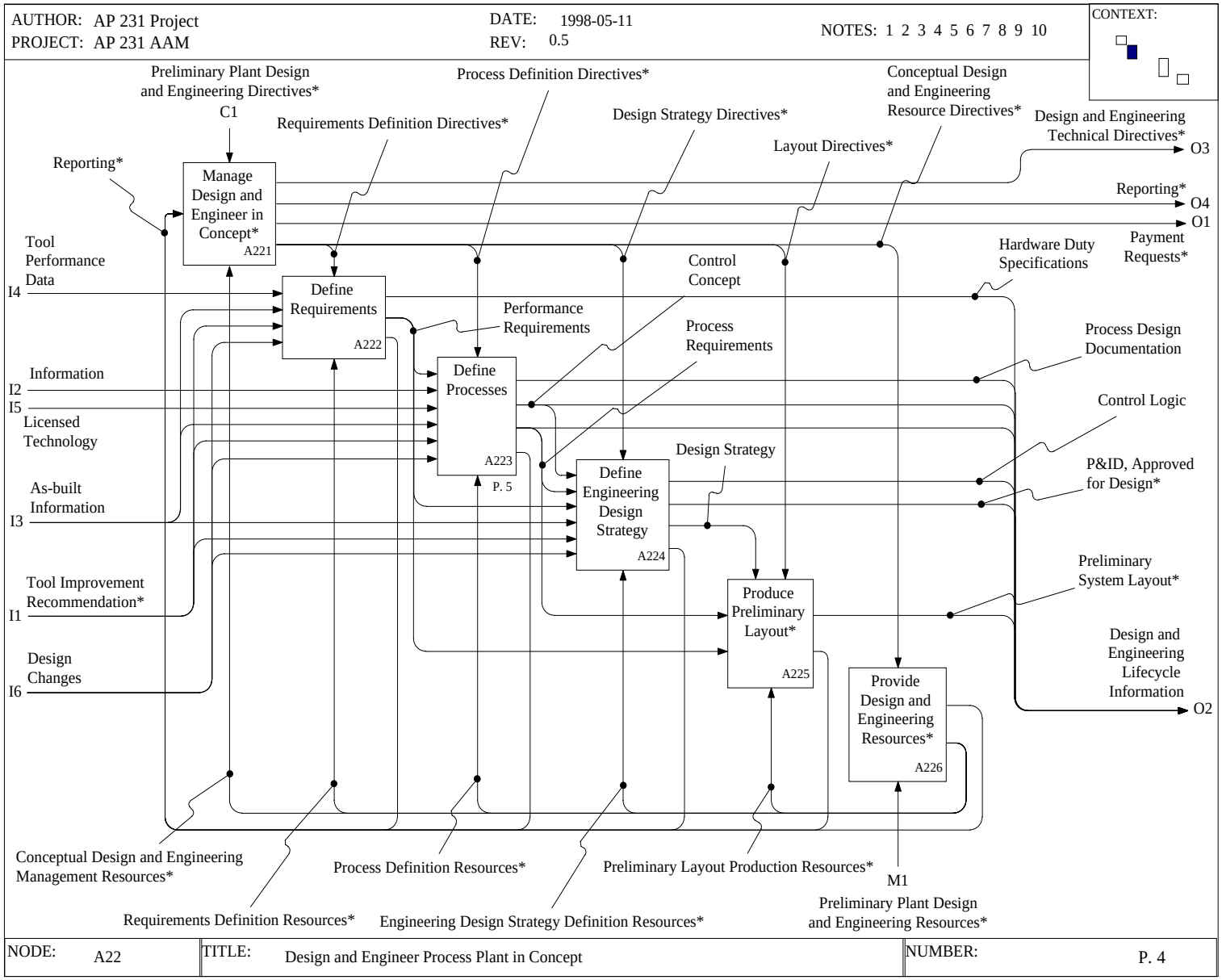


Figure F.6 - A22: Design and engineer process plant in concept

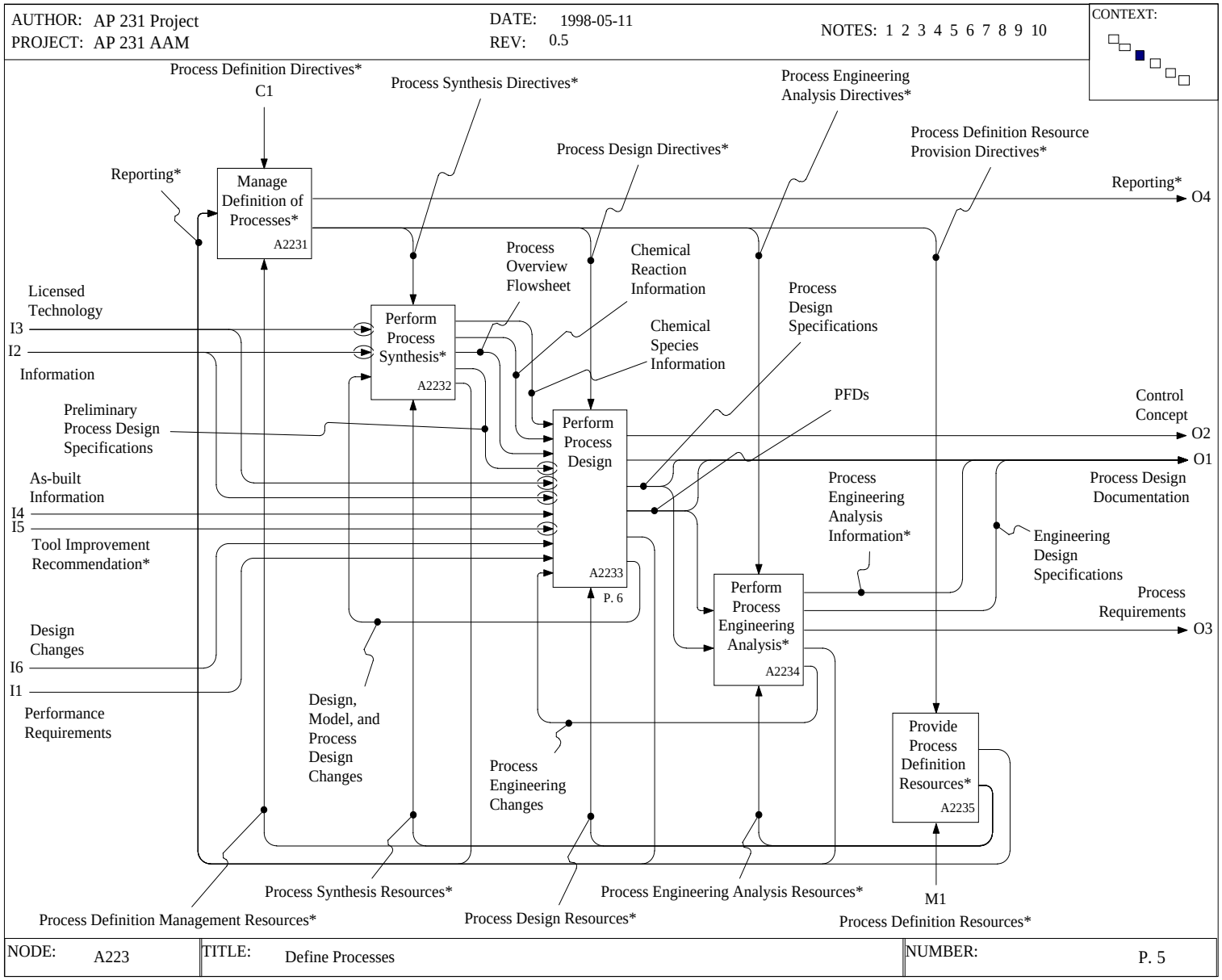


Figure F.7 - A223: Define processes

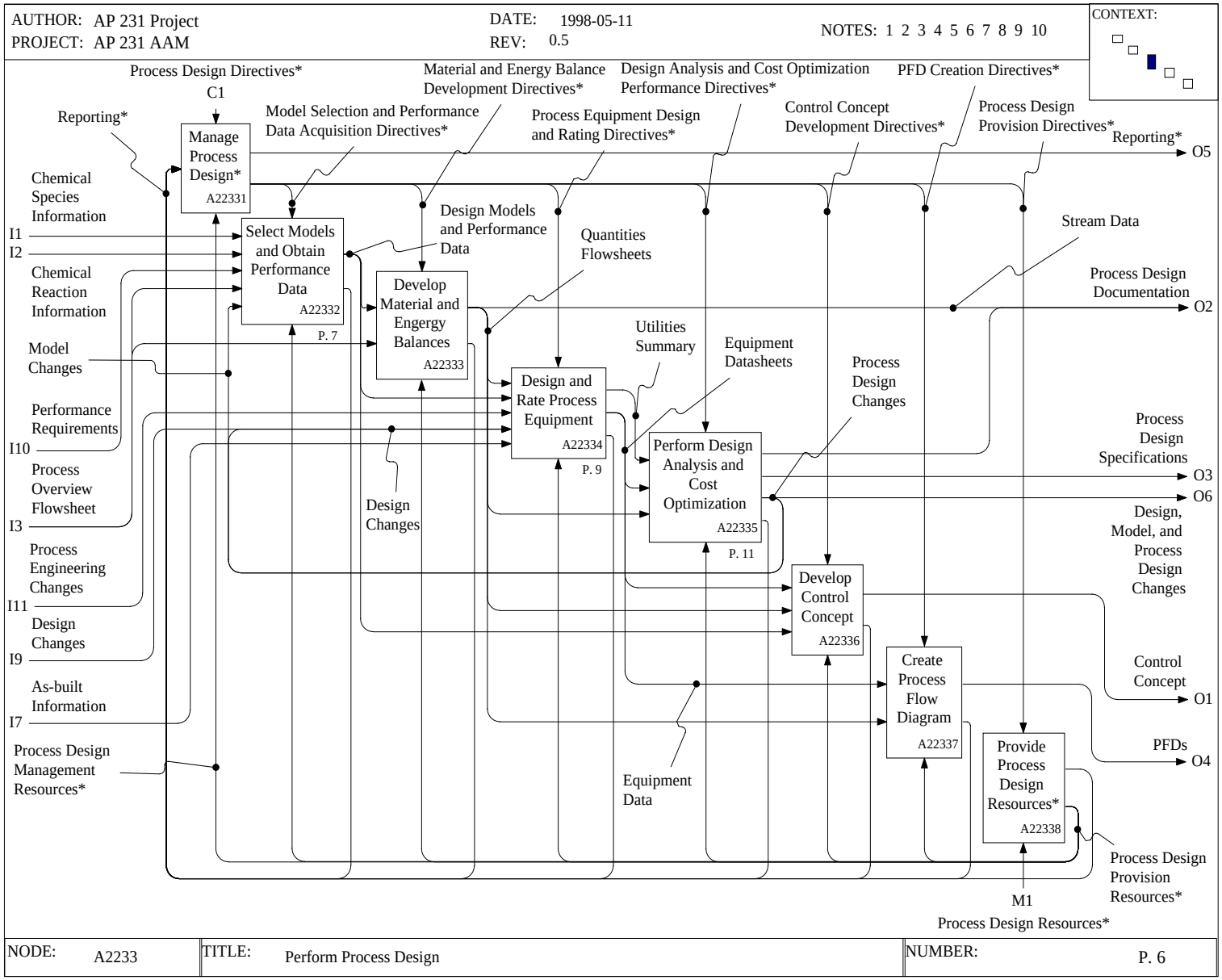


Figure F.8 - A2233: Perform process design

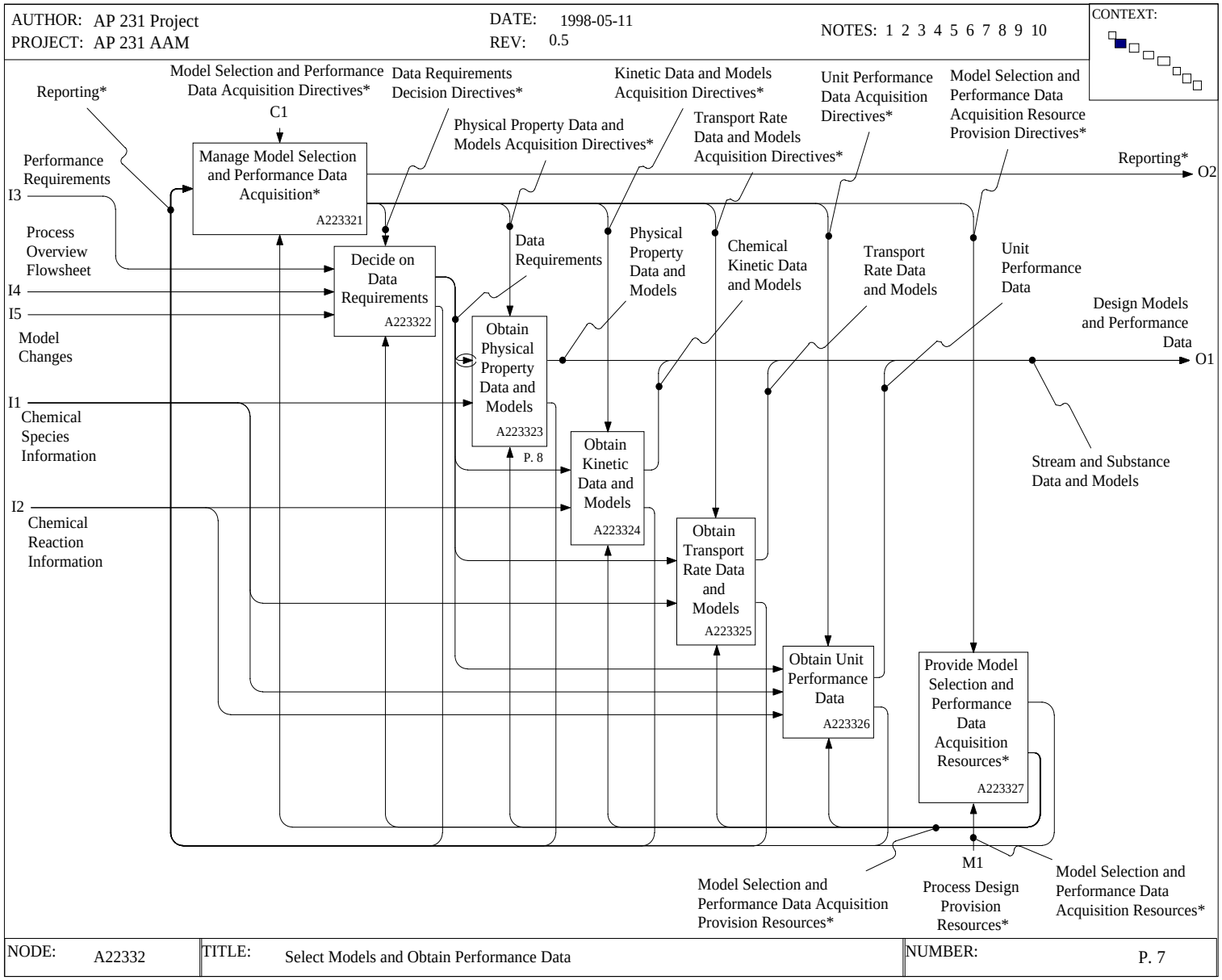


Figure F.9 - A22332: Select models and obtain performance data

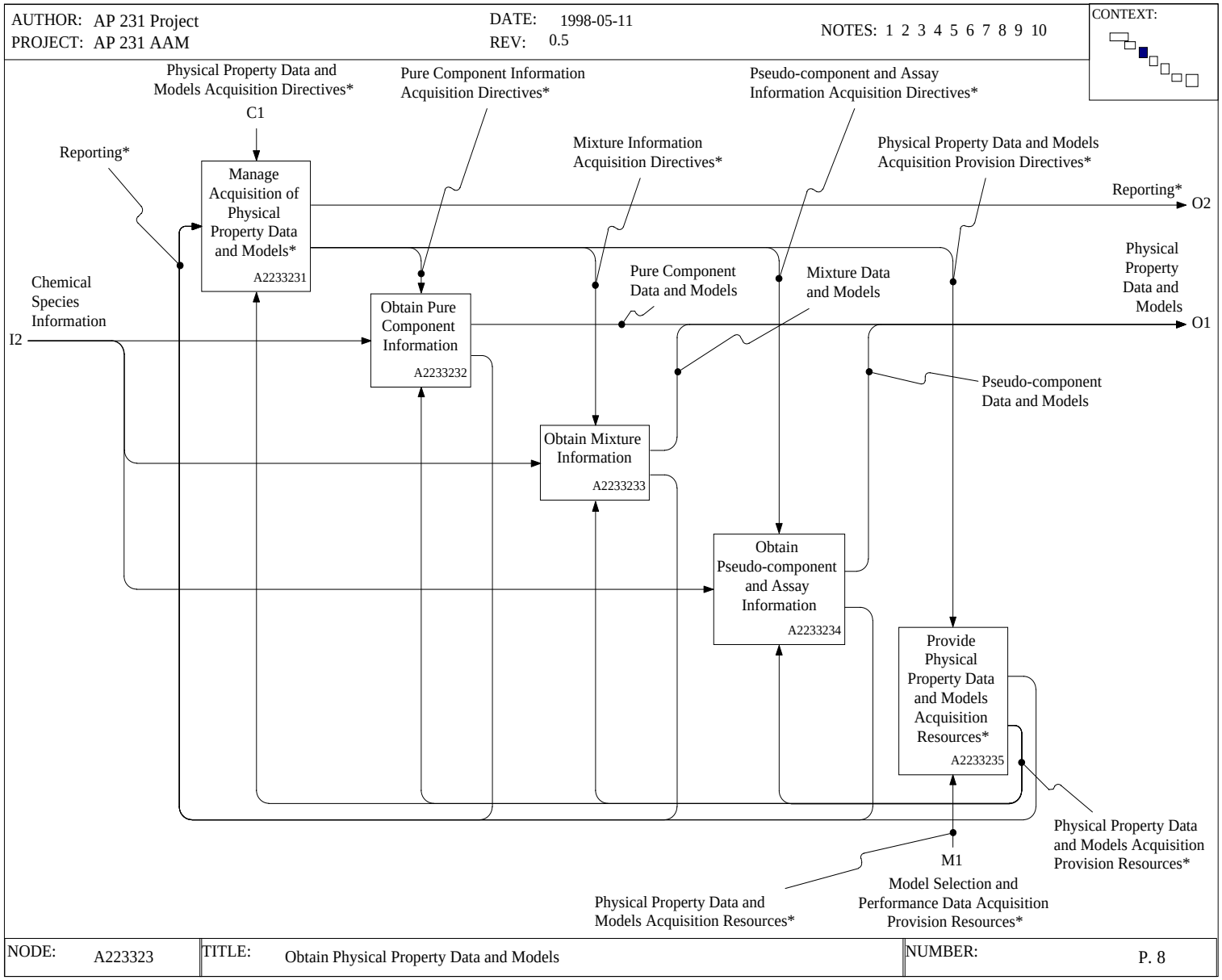


Figure F.10 - A223323: Obtain physical property data and models

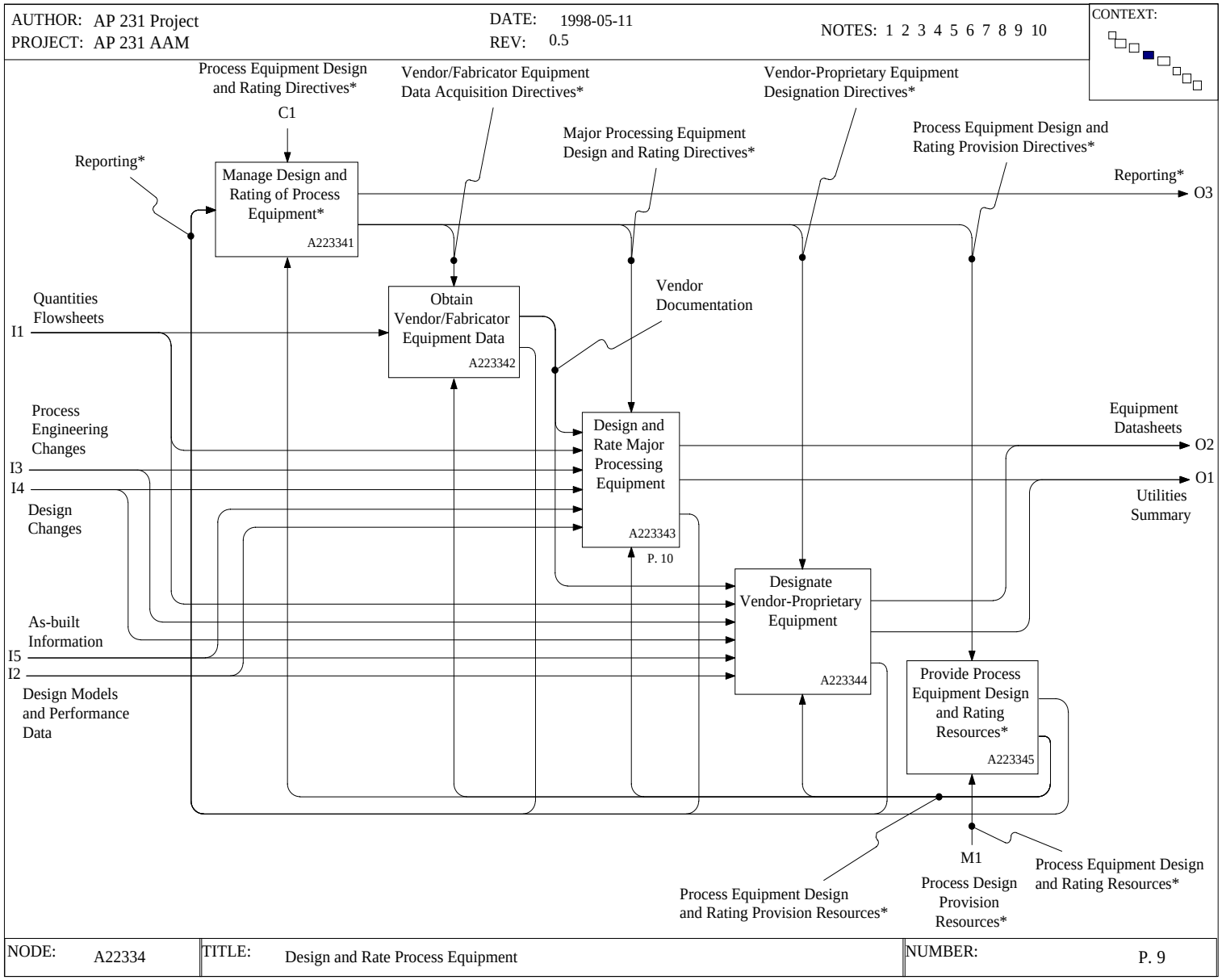


Figure F.11 - A22334: Design and rate process equipment

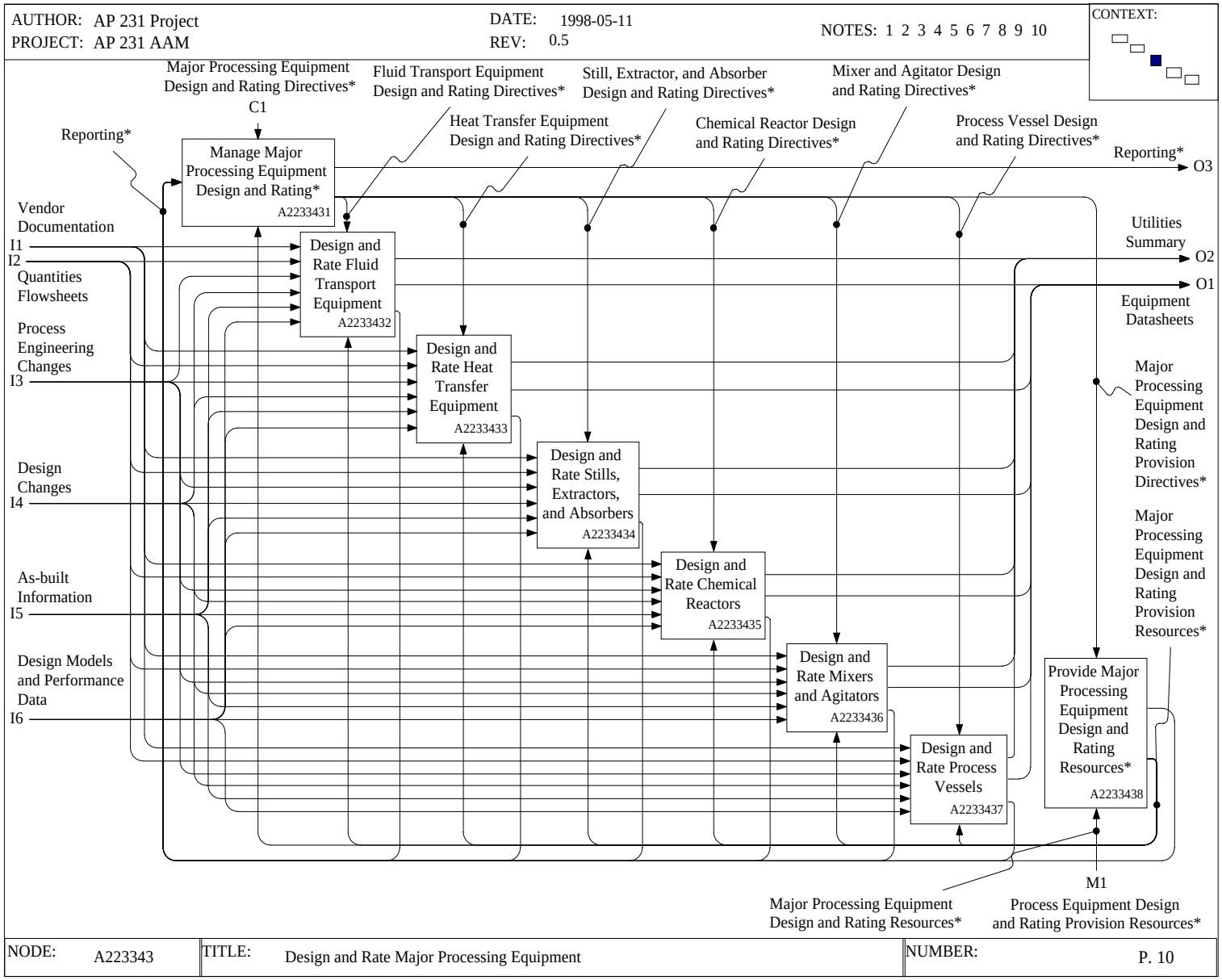


Figure F.12 - A223343: Design and rate major processing equipment

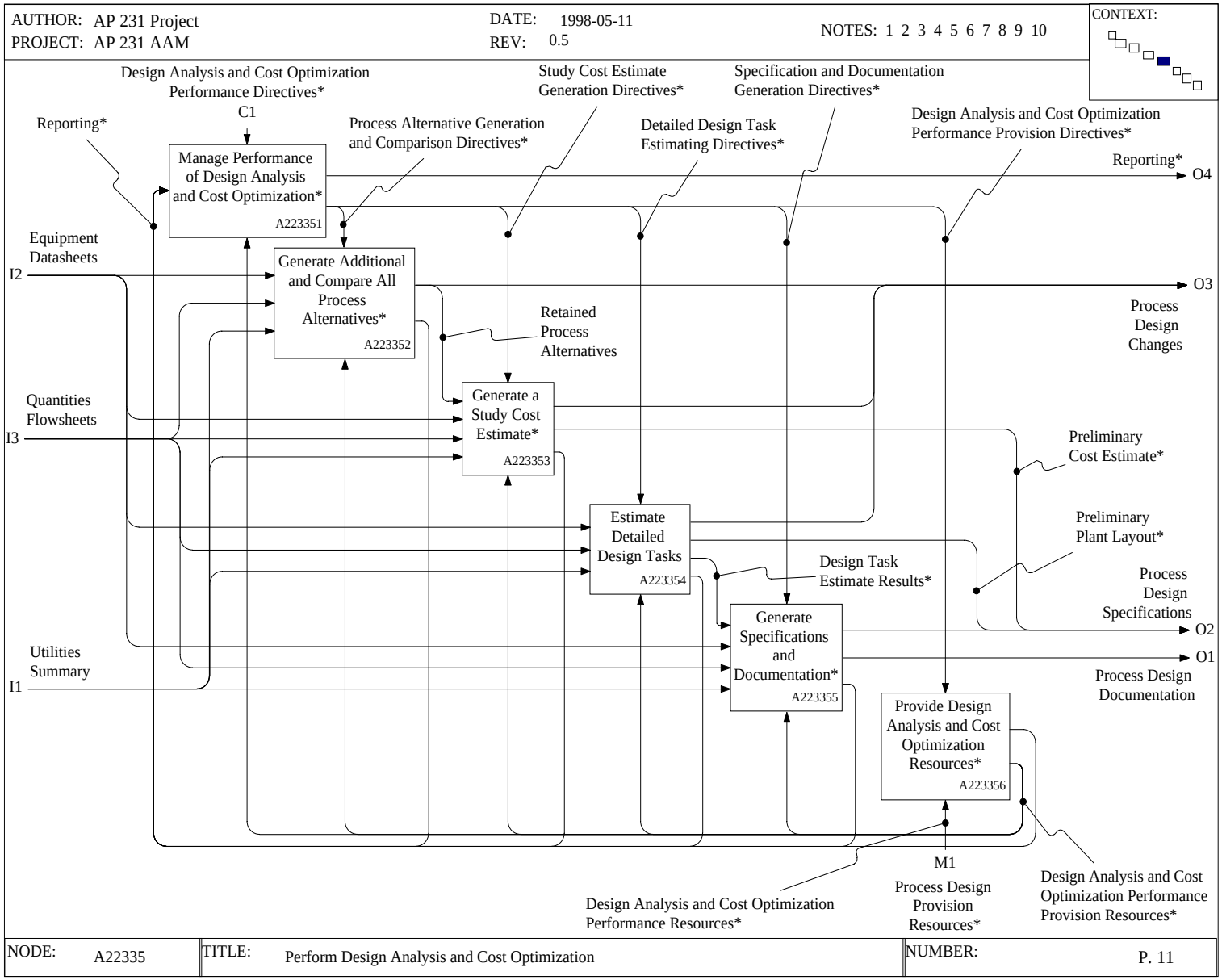


Figure F.13 - A22335: Perform design analysis and cost optimization

F.2 PIEBASE activity model

Working Group 2 (WG2) of PIEBASE[2] (Process Industry Executive for achieving Business Advantage using Standards for data Exchange) is developing a generic activity model[3] describing the process industry's activities. PIEBASE is developing this generic model to aid in the understanding and coordination of current and planned projects to deliver data exchange solutions for the process and process plant industries.

This clause describes only a portion of the generic PIEBASE activity model. This portion of the generic model shows the relationship of those activities and related data flows that directly impact this part of ISO 10303; in a larger context to other process and process plant industry activities. Therefore, F.2 describes the context in which this part of ISO 10303 will satisfy specific requirements for the process plant industries. Because of the broader context of the PIEBASE model, F.2 does not attempt to identify the in or out-of-scope activities or their related ICOMs that directly affect this part of ISO 10303. The in or out-of-scope activities and their related ICOMs are identified in F.1.

Activity A554, "Provide Process Plants" (see figure F.19) of the PIEBASE activity model corresponds to activity A0 (see figure F.4) of the AAM for this part of ISO 10303. There is a one-to-one correspondence between the information flows on the PIEBASE activity model activity A554 and the information flows on activity A0 of the AAM for this part of ISO 10303.

The viewpoint of the generic PIEBASE activity model is a process plant owner/operator's view of creating a product and providing the supporting resources to produce the product with a process plant.

F.2.1 Activity model definitions and abbreviations

The following terms are used in the PIEBASE activity model. The definitions given in this annex do not supersede the definitions given in the main body of the text.

F.2.1.1 Acquire Input (PIEBASE AM A2): Acquisition of the necessary products, energy, and data to support all lifecycle aspects of the core business.

F.2.1.2 Acquired Products and Energy: Materials, goods, and utilities required to support all lifecycle aspects of the core business.

F.2.1.3 Acquisition Contracts: Commitments to procure a product or service described in a legally binding document.

F.2.1.4 Acquisition Directives: A set of instructions that constrain the activities associated with procuring, receiving, and paying for products and services.

---

[2] PIEBASE is an organization of industry consortia actively working on the development and demonstration of standards for data exchange in the process industry. The founding consortia members are: PISTEP (UK), PlantCALS (Japan), PlantSTEP (USA), POSC (International/USA), POSC/CAESAR (Norway) and SPI-NL (The Netherlands). The mission of PIEBASE is to harmonise and coordinate consortia and standards development activities for the common benefit of the global process industry community.

[3] The PIEBASE activity model is a work in progress. The PIEBASE WG2 is responsible for developing and improving the activity model. All three process plant AP projects, i.e., AP 221, AP 227, and AP 231, are participating in the PIEBASE WG2, and all three process plant APs will use the PIEBASE activity model for describing the context for the AP specific AAM.

F.2.1.5 Acquisition Information: The acquired equipment, materials, and physical, chemical, and electrical resources.

F.2.1.6 Acquisition Resources: Human resources, tools, and licensed technology used in the obtaining, receiving, and paying for products, energy, and data.

F.2.1.7 Acquisition Tool Provision Directives: A set of instructions that constrain the activities associated with supplying acquisition tools.

F.2.1.8 Acquisition Tool Provision Resources: Human resources and tools used to supply acquisition tools.

F.2.1.9 Acquisition Tools: All devices or implements used to carry out activities associated with the procuring, receiving, and paying for products and services.

EXAMPLE 99 - Devices and implements include computer hardware and software tools.

F.2.1.10 As-built Information: Site plans, detailed equipment descriptions, electrical instrumentation diagrams, and P&Ids that record the actual condition at a Plant at a specific point in time.

NOTE - These documents aid in meeting government documentation and safety requirements. Frequently, they are simply corrections or modifications to existing design documents delivered to construction.

F.2.1.11 Authorization for Payment: Approval to release monies for the payment of goods supplied or services rendered by a vendor or supplier.

F.2.1.12 Billings: Statements of charges by vendors for goods supplied or services rendered.

F.2.1.13 Cleared Site: A site that has been prepared for the installation of a new process plant.

F.2.1.14 Conduct Core Business (PIEBASE AM A0): The activities involved in the life cycle of a process plant from conception through final disposal. These activities may include: conception, research, design, construction, operation, maintenance, retrofit, and disposal. Major outputs are contractual documents, regulatory compliance information and data retained beyond the life time of the plant, all useful products generated by the operation of the plant and all residual materials remaining in the environment upon completion of the plant life cycle including waste products generated while producing useful product and the disassembled plant.

F.2.1.15 Construction Sold Materials: Material by-products or remains generated during process plant erection activities that are sold for reuse.

F.2.1.16 Construction Waste Materials: Unwanted or unusable material by-products or remains generated during process plant erection activities.

F.2.1.17 Contracts: Commitments to provide or acquire a product or service described in a legally binding document.

F.2.1.18 Create Product (PIEBASE AM A3): Making the product(s) for the core business.

F.2.1.19 Decision Support Information: Information generated by research and development activities that is used in the decision making process to manage the core business.

F.2.1.20 Documentation: The collection of all project management, design, contractual, regulatory, and disposal documents produced during the life cycle of a process plant. This includes all documentation retained past the end of the plant life cycle.

F.2.1.21 Employment Contracts: Commitments to use the services of a person in return for payment described in a legally binding document.

F.2.1.22 Engineering, Procurement, and Construction Performance Information: Information that details how well Engineering, Procurement, and Construction execute or fulfill a task or function.

F.2.1.23 Environmentally Acceptable Waste: Unwanted or unusable material by-products or remains generated during product creation and process plant erection activities that poses no health or safety hazard.

F.2.1.24 External Knowledge: Known Information that is available from sources external to the Core Business and that may be referenced during all phases of the life cycle of the plant.

F.2.1.25 Finance Acquisition Contracts: Commitments to provide or acquire money described in a legally binding document.

F.2.1.26 Financial Resource Performance: Information that details how well Financial Resource is used to conduct core business.

F.2.1.27 Financial Resource Provision Directives: A set of instructions that constrain the activities associated with providing financial resources to the core business.

F.2.1.28 Financial Resource Provision Resources: Human resources and tools used to provide financial resources.

F.2.1.29 Hazardous Materials Waste: Unwanted or unusable remains or by-products of a dangerous or risky nature that are subject to special disposal rules and records.

F.2.1.30 Hired Persons: Human resources that perform a task or function in return for an agreed payment.

F.2.1.31 Human Resource Knowhow Improvement Material: Information generated by research and development activities that is used to enhance personnel knowledge.

F.2.1.32 Human Resource Performance Data: Data that details how well personnel executes or fulfills a given task or function.

F.2.1.33 Human Resource Provision Directives: A set of instructions that constrain the activities associated with providing personnel to perform core business activities.

F.2.1.34 Human Resource Provision Resources: Human resources and tools used to support the core business by providing human resources.

F.2.1.35 Human Resources: The individuals responsible for performing all activities performed by humans over the life cycle of the process plant.

F.2.1.36 Human Resources and Tools Performance Data: Data that details how well personnel and tools execute or fulfill a task.

F.2.1.37 Information: Facts, concepts, or instructions.

F.2.1.38 Knowledge: A theoretical or practical understanding of a subject.

F.2.1.39 Knowledge Provision Resources: Human resources and tools used to provide knowledge necessary to conduct research and development activities.

F.2.1.40 Laid-off Personnel: Human resources that are surplus to requirements and whose contracts of employment have been terminated.

F.2.1.41 Legal, Regulatory, and Societal Constraints: All controls imposed by local, national, or supranational laws, regulatory agencies, or society that influence the design, construction, operation, and disposal of a process plant.

F.2.1.42 Licensed Technology: Patented or proprietary processes or design information purchased or licensed from an outside source, such as a process processor, vendor, or fabricator. Such technology may range from laboratory synthesis data through unit operation process data to complete, detailed plant designs or equipment items and modules.

F.2.1.43 Lifecycle Information: The collection of all project management, design, contractual, regulatory, and disposal information produced during the life cycle of a process plant. This includes all information retained past the end of the plant life cycle.

F.2.1.44 Loaned or Earned Money: Funds acquired either by borrowing or in payment for goods or services rendered. In lieu of monies, a supplier may advance credits to a customer.

F.2.1.45 Maintenance Excess Materials: Materials that result from process plant maintenance activities that are to be disposed of by selling them.

F.2.1.46 Manage Physical Asset Provision (PIEBASE AM A551): Provide sufficient resources to execute the activities associated with providing the necessary physical assets to support creation of the core business product(s) and check that the execution is done in accordance with the plan for these activities and any required regulations.

F.2.1.47 Manage Supporting Resource Provision (PIEBASE AM A51): Provide sufficient resources to execute the activities associated with providing the necessary funds, personnel, tools, and knowledge to support creation of the core business product(s) and check that the execution is done in accordance with the plan for these activities and any required regulations.

F.2.1.48 Manage the Business (PIEBASE AM A1): Provide sufficient resources to execute the business plan and check that the execution is done in accordance with the plan and any required regulations. This activity establishes a detailed technical plan and a financial plan that are consistent with the engineering, construction, and commissioning activities required to fulfill the company business objectives.

F.2.1.49 Management Directives: A set of instructions that constrain the activities associated with managing the core business.

F.2.1.50 Management Resources: Human resources, tools, and licensed technology used in activities associated with management of the core business.

F.2.1.51 Management Tool Provision Directives: A set of instructions that constrain the activities associated with providing management tools.

F.2.1.52 Management Tool Provision Resources: Human resources and tools used in providing management with the tools necessary to perform tool provision activities.

F.2.1.53 Management Tools: All devices or implements used to carry out activities associated with managing the provision of resources to support creation of the core business product(s).

F.2.1.54 Market Information: Information regarding the availability, costs, etc., of a specific commodity or service.

F.2.1.55 Paid Money: Funds provided in payment for goods or services rendered.

F.2.1.56 Payment Requests: A request for compensation in the form of money, services, or goods to compensate for the delivery of services, goods, or good will.

F.2.1.57 Process Plant Provision Directives: A set of instructions that constrain the activities associated with providing process plants.

F.2.1.58 Process Plant Provision Resources: Human resources and tools used in providing a process plant.

F.2.1.59 Process Plant to be Maintained: Process plant or part thereof that requires checking, servicing, or repair in order to remain in or be restored to an operable condition.

F.2.1.60 Process Plants: Produces chemicals, pharmaceutical, electrical power, petroleum, and similar products (i.e., produces "stuff" rather than "things").

F.2.1.61 Procured Materials and Services: Item that has been obtained from vendor or supplier or assistance or advice provided by a vendor or supplier.

F.2.1.62 Procured Services: Assistance or advice provided by a vendor or supplier.

F.2.1.63 Product and Emission Samples: Samples of produced products and material or energy released from a process plant taken for the purpose of conducting business process research and safety, health, and environmental protection research.

F.2.1.64 Product Sales Contracts: Commitments to provide a product or service described in a legally binding document.

F.2.1.65 Production Directives: A set of instructions that constrain the activities associated with creating the core business product(s).

F.2.1.66 Production Resources: Human resources and tools used in activities associated with creating the product(s).

F.2.1.67 Provide Acquisition Tools (PIEBASE AM A553): Supplying or furnishing all devices or implements used to carry out activities associated with the obtaining, receiving, and paying for products, energy, and data.

F.2.1.68 Provide Financial Resources (PIEBASE AM A52): Supplying or furnishing the money necessary to support the core business activities.

F.2.1.69 Provide Human Resources (PIEBASE AM A53): Supplying or furnishing the people necessary to support the core business activities.

F.2.1.70 Provide Knowledge and Technology (PIEBASE AM A54): Supplying or furnishing information on new technologies and ways to improve human resources and tools to support the core business activities.

F.2.1.71 Provide Management Tools (PIEBASE AM A552): Supplying or furnishing tools necessary to perform activities associated with the management of core business activities.

F.2.1.72 Provide Physical Asset Provision Support (PIEBASE AM A556): Supplying or furnishing human resources or tools used to perform activities necessary to support the provision of physical assets.

F.2.1.73 Provide Physical Assets (PIEBASE AM A55): Supplying or furnishing tools used to perform core business activities.

F.2.1.74 Provide Process Plants (PIEBASE AM A554): Supplying or furnishing the process plants necessary to create the core business product(s).

F.2.1.75 Provide Sales Tools (PIEBASE AM A555): Supplying or furnishing tools necessary to perform activities associated with marketing of the core business product(s).

F.2.1.76 Provide Supporting Resource Provision Support (PIEBASE AM A56): Supplying or furnishing human resources or tools used to perform activities necessary to support provision of supporting resources.

F.2.1.77 Provide Supporting Resources (PIEBASE AM A5): The acquisition and deployment of the resources necessary to conduct core business activities. These resources include, but are not limited to, human resources, financial resources, knowledge, and tools (in the most generic sense, ranging from a wrench and a PC to a complete process plant).

F.2.1.78 Purchase Orders and Contracts for Materials: Purchase order or contract between two parties to provide materials for designated payment.

F.2.1.79 Purchase Orders and Contracts for Services: Purchase order or contract between two parties to provide services for designated payment.

F.2.1.80 Purchase Orders and Contracts for Tools: Purchase order or contract between two parties to provide tools for designated payment.

F.2.1.81 Reconditioned Site: A site that has been restored to meet environmental requirements or prepared for the installation of a new process plant.

F.2.1.82 Reporting: Narrating or describing, usually in writing, the status, results, costs, profits, conformance to requirements, etc. of some activity or task.

F.2.1.83 Reporting to Authorities: Narrating or describing, usually in writing, the status, results, conformance to requirements, etc. of some activity or task related to the core business.

F.2.1.84 Reporting to Stockholders: Narrating or describing, usually in writing, the status, results, costs, profits, etc. of the core business activities.

F.2.1.85 Research and Development Directives: A set of instructions that constrain the activities associated with providing knowledge gained from research and development to other core business activities.

F.2.1.86 Resource Provision Directives: A set of instructions that constrain the activities associated with providing resources to support core business activities.

F.2.1.87 Resource Requirements: Information that details the requirements to be met in the detailed design of a process plant.

F.2.1.88 Resources: Available energy, tools, materials, money, and human assets that can be used to fulfill a task or requirement.

F.2.1.89 Sales Directives: A set of instructions that constrain the activities associated with marketing the core business product(s).

F.2.1.90 Sales Information: Sales Resources (Icom) Human resources and tools used to perform activities necessary to sell the output of the process plant.

F.2.1.91 Sales Tool Provision Directives: A set of instructions that constrain the activities associated with providing tools for the marketing of the core business product(s).

F.2.1.92 Sales Tool Provision Resources: Human resources and tools used in providing the sales tools.

F.2.1.93 Sales Tools: All devices or implements used to carry out activities associated with selling the core business product(s).

F.2.1.94 Sell Output (PIEBASE AM A4): Taking the core business product(s) and marketing them to the customer(s).

F.2.1.95 Service Provider Resources: Human resources and tools used to provide a service.

F.2.1.96 Sold Product and Energy: The materials or energy sold for money or traded for services or other goods.

F.2.1.97 Strategic Information: Information related to the achievement of the long-term vision, goals, or direction of the core business.

F.2.1.98 Supplier Information: Documentation received from a vendor concerning procured items, usually in the form of drawings, manuals, or calculations, which provides information concerning design details and/or performance of the procured items.

Kinds of vendor documentation include:

— Preliminary: in process design information;

— Certified: information from the supplier of equipment or other components which is warranted to correctly describe the as-delivered functional or physical data;

— Released for fabrication/construction.

F.2.1.99 Support Human Resources: Human resources provided to support activities necessary to provide supporting resources.

F.2.1.100 Supporting Resource Provision Directives: A set of instructions that constrain the activities associated with providing resources to support the core business activities.

F.2.1.101 Supporting Resource Provision Resources: Human resources and tools used to support activities associated with managing supporting resources.

F.2.1.102 Supporting Resource Provision Support Directives: A set of instructions that constrain the activities associated with providing supporting resource provision support.

F.2.1.103 Supporting Resource Provision Support Resources: Human resources and tools used to support activities associated with providing supporting resources.

F.2.1.104 Supporting Resources: Available energy, tools, materials, money, and human assets that can be used to support fulfillment of a task or requirement.

F.2.1.105 Tool Improvement Recommendation: Information generated by research and development activities that is used to enhance the capabilities of tools provided to produce the core business product(s).

F.2.1.106 Tool Performance Data: Data about how well a tool is carrying out or fulfilling its function.

EXAMPLE 100 - Data retrieved from an existing plant to optimize the new process plant design.

F.2.1.107 Tool Provision Directives: A set of instructions that constrain the activities associated with providing tools to support core business activities.

F.2.1.108 Tool Provision Management Resources: Human resources and tools used in the management of activities necessary to provide tools.

F.2.1.109 Tool Provision Resource Requirements: A set of needs or wants defined during tool provision activities.

F.2.1.110 Tool Provision Resources: Human resources and tools used in the provision of tools provided to support the core business.

F.2.1.111 Tool Provision Support Directives: A set of instructions that constrain the activities associated with providing tool provision support.

F.2.1.112 Tools: All hardware and software devices or implements that are used to produce the hardware and software products directly involved or used in plant construction or operation.

EXAMPLE 101 - Devices and implements include computer hardware and software tools as well as hardware tools to do physical activities on the process plant such as pliers and welding devices.

F.2.1.113 Trading Information: An article or raw material that is acquired, but is not used in the creation of the product.

EXAMPLE 102 - Packing material that the product is shipped in.

F.2.1.114 Waste Substances: Material outcome of production that cannot be sold or exchanged for economic gain.

F.2.2 Activity model diagrams

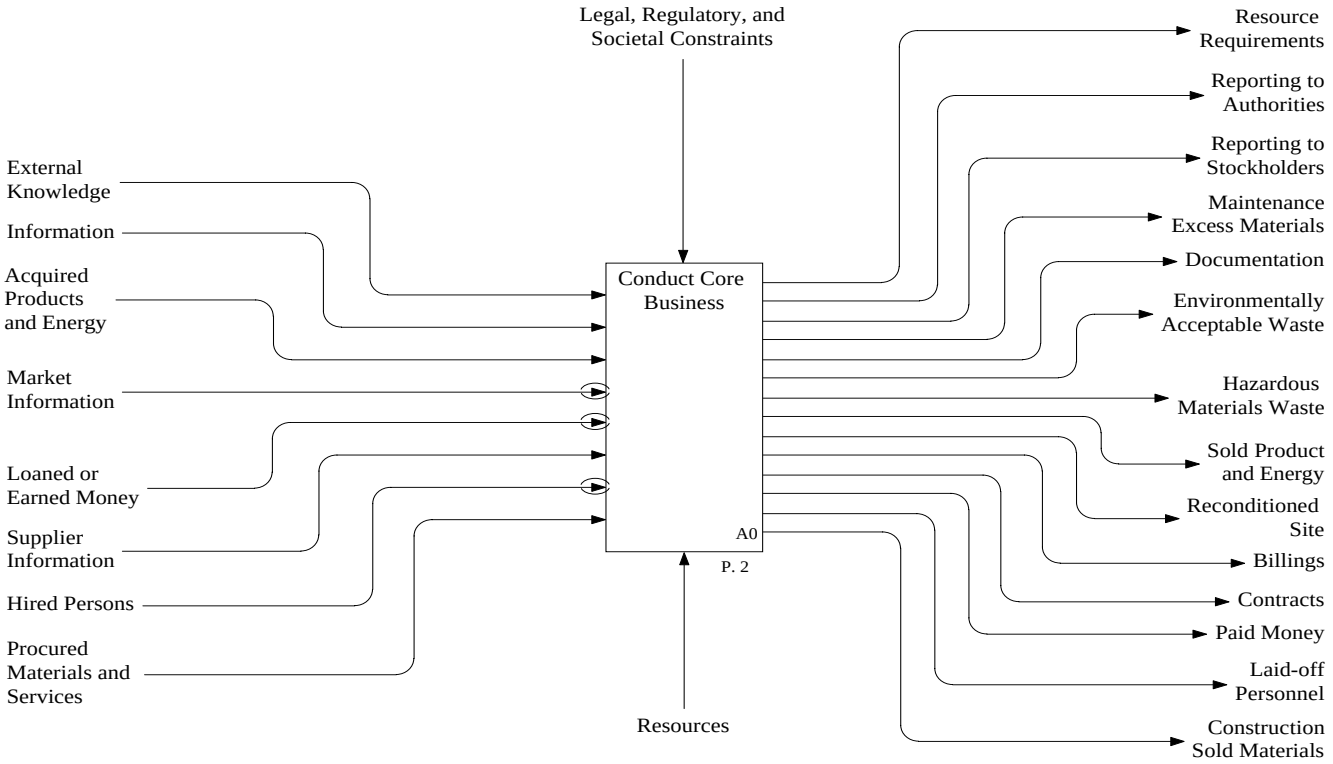
The PIEBASE activity model diagrams are given in figures F.16 through F.19. The graphical form of the activity model is presented in the IDEF0 activity modelling format and uses the manage, do, provide resources template described in F.1.2.

Figure F.15 is an indented node listing of the activities shown on figures F.16 through F.19 that provides a hierarchical view of the activity relationships.

[A0] Conduct Core Business
- [A1] Manage the Business
- [A2] Acquire Input
- [A3] Create Product
- [A4] Sell Output
- [A5] Provide Supporting Resources
  - [A51] Manage Supporting Resource Provision
  - [A52] Provide Financial Resources
  - [A53] Provide Human Resources
  - [A54] Provide Knowledge and Technology
  - [A55] Provide Physical Assets
    - [A551] Manage Physical Asset Provision
    - [A552] Provide Management Tools
    - [A553] Provide Acquisition Tools
    - [A554] Provide Process Plants
    - [A555] Provide Sales Tools
    - [A556] Provide Physical Asset Provision Support
  - [A56] Provide Supporting Resource Provision Support

Figure F.14 - PIEBASE activity model indented node list

AUTHOR: PWG2
PROJECT: PIEBASE Activity Model
DATE: 1998-05-06
REV: 0.2.5
NOTES: 1 2 3 4 5 6 7 8 9 10
CONTEXT: Top



PURPOSE: To describe the activities and information flows related to the generation and use of information needed to conduct the core business and to provide the context for the detailed activity models for the Process Plant Application Protocols.

VIEWPOINT: A process plant owner/operator's view of creating a product and providing the supporting resources to produce the product with a process plant.

NODE: A-0	TITLE: Enterprise activities	NUMBER: P. 1

Figure F.15 - A-0: Enterprise activities

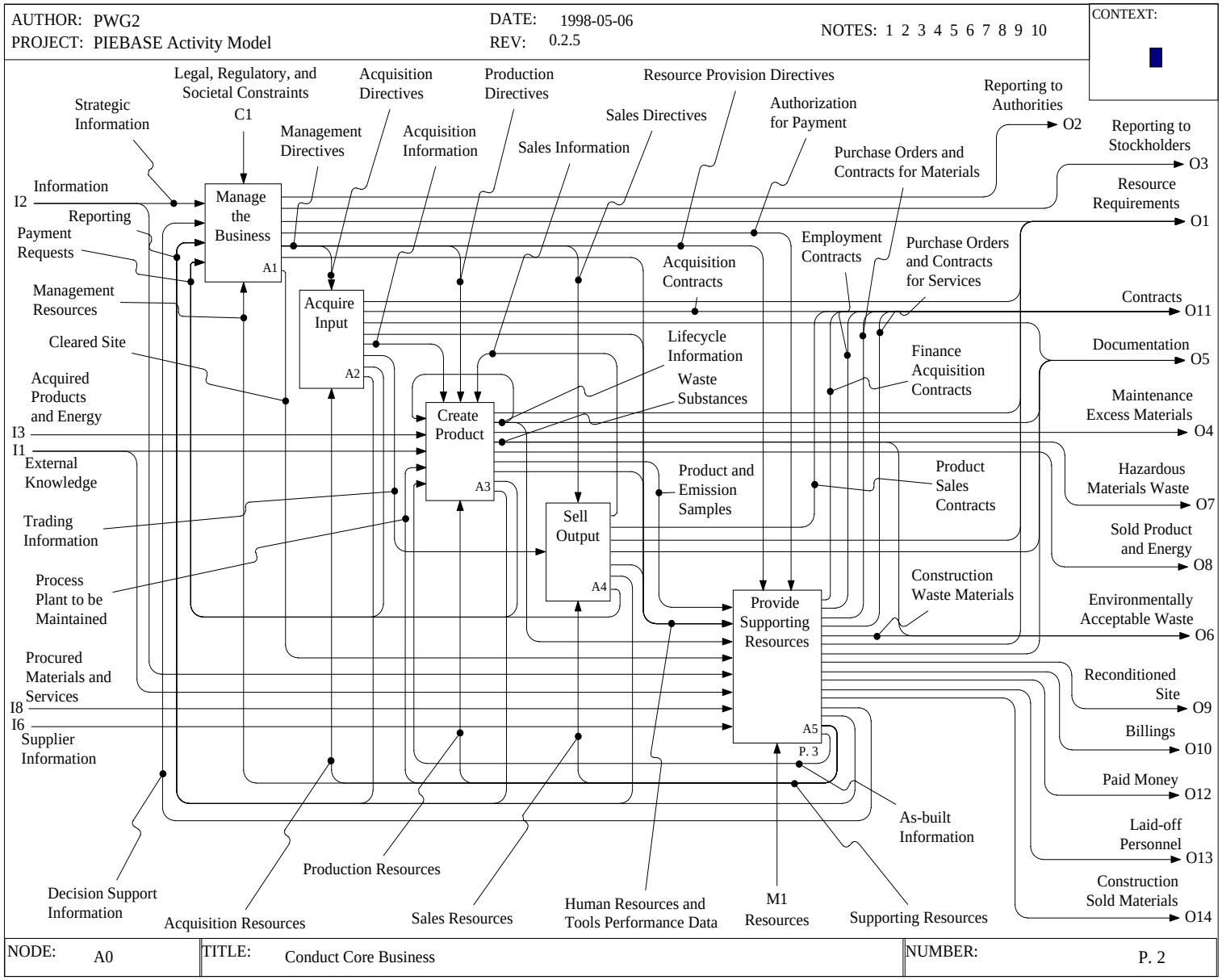


Figure F.16 - A0: Conduct core business

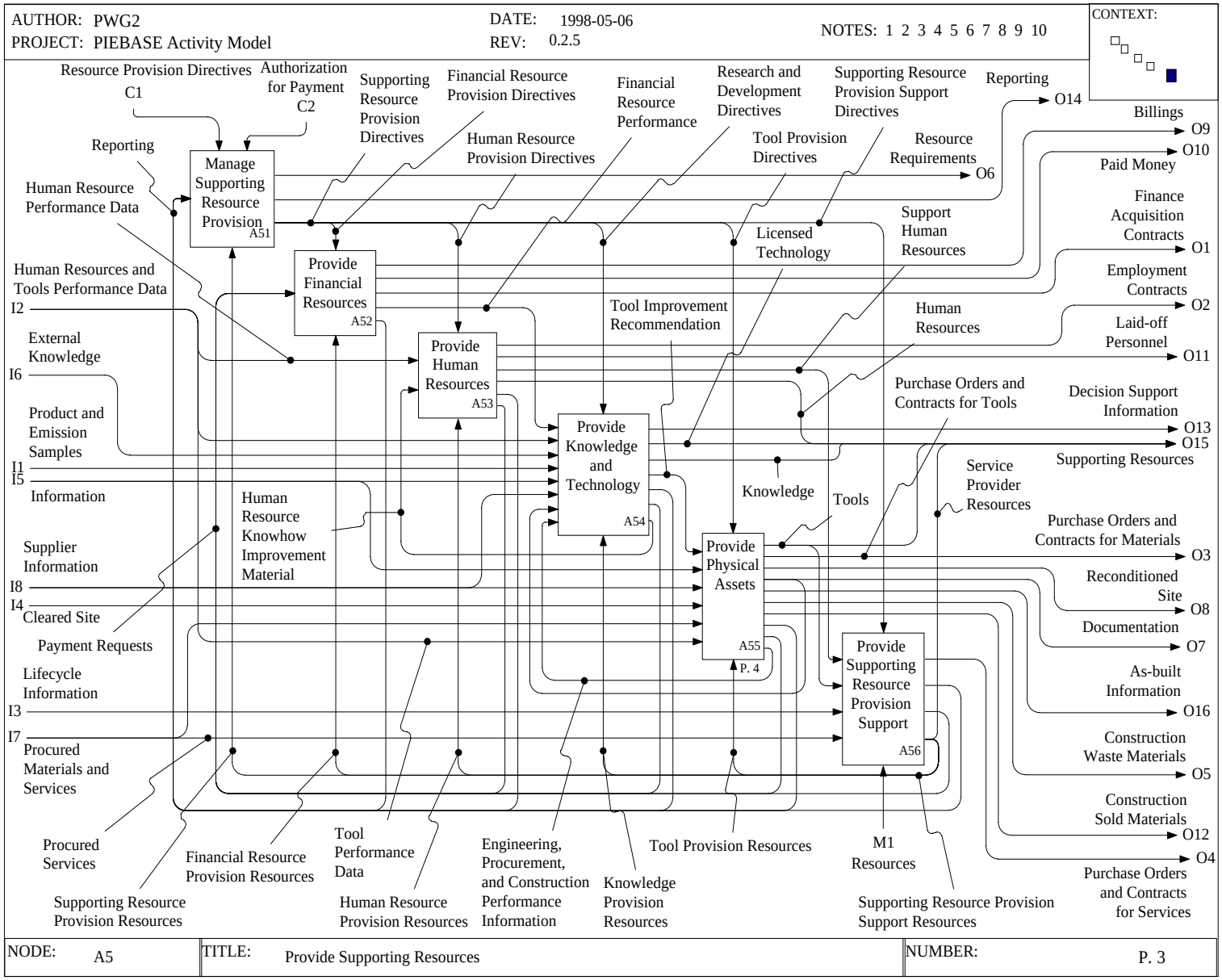


Figure F.17 - A5: Provide supporting resources

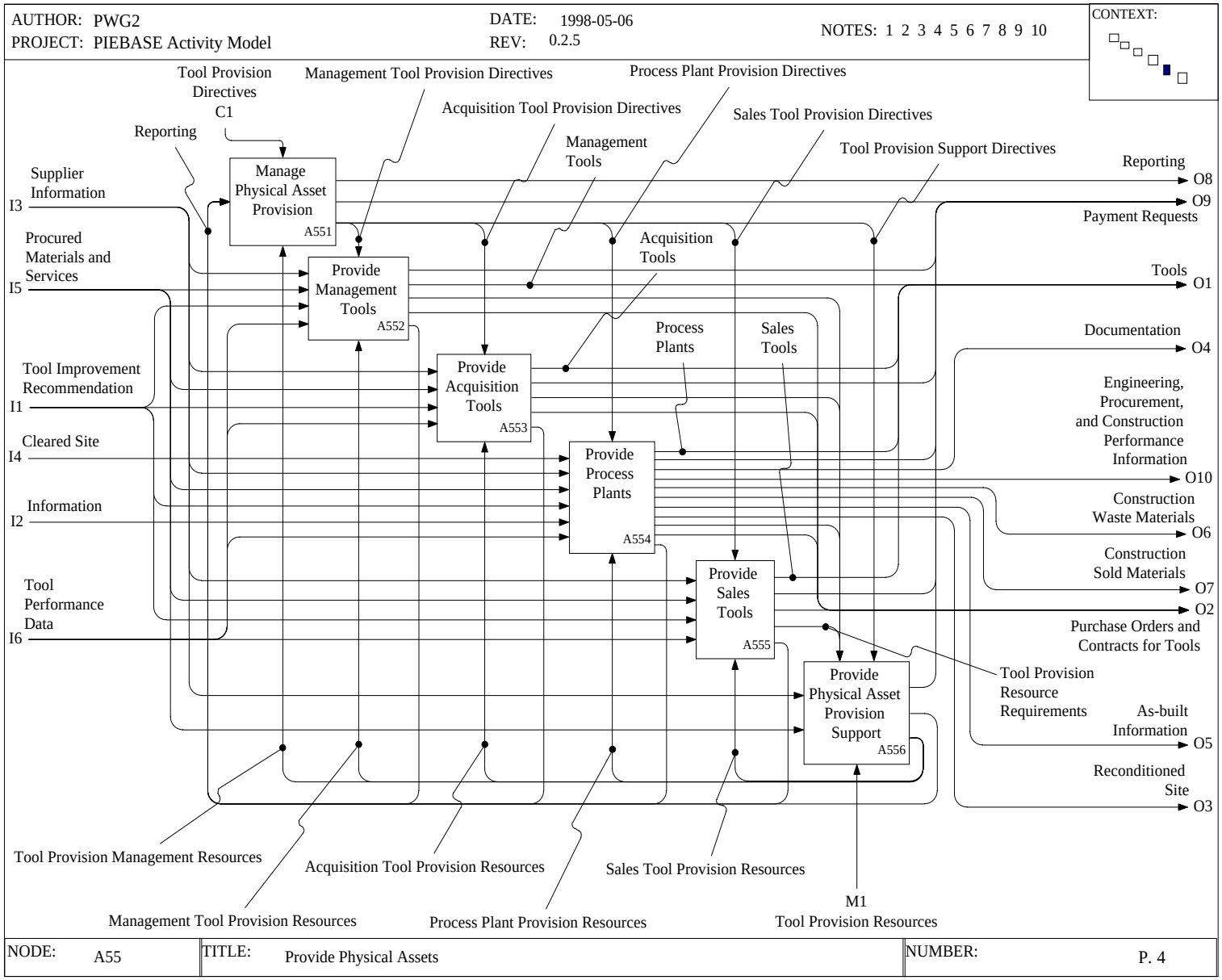


Figure F.18 - A55: Provide physical assets

Table G.1 - ARM UoF templates (concluded)

Annex G
(informative)

Application reference model wallpaper version

This annex provides the application reference model for this part of ISO 10303 and is given in figures G.1 through G.55. The application reference model is a graphical representation of the structure and constraints of the application objects specified in clause 4. The graphical form of the application reference model is presented in IDEF1X. The application reference model is independent of any implementation method.

Some relationships on the IDEF1X diagrams are to entities that are defined in a UoF other than the one that is being depicted in the particular diagram. These entities are shown as entity boxes with the UoF name in which the entity is defined in the non-key attribute field. The key attributes, if any are defined, for the alien entities are shown in the key attribute area of the entity box.

NOTE - The application reference model is presented in a tiled diagram format. The application reference model has been broken up into several smaller groupings that correspond to the UoFs detailed in clause 4.1. Each UoF grouping may be assembled according to the templates shown in Table G.1.

Table G.1 - ARM UoF templates

Chemical_reaction_data UoF		
Figure G.1		
Control_strategy UoF		
Figure G.2	Figure G.3	
Heat_transfer_equipment_data UoF		
Figure G.4	Figure G.5	
Figure G.6	Figure G.7	
Major_process_equipment_data UoF		
Figure G.8	Figure G.9	
Mass_transfer_equipment_data UoF		
Figure G.10	Figure G.11	

Table G.1 - ARM UoF templates (continued)

Figure G.12	Figure G.13	
Figure G.14	Figure G.15	
Material_data UoF		
Figure G.16	Figure G.17	
Figure G.18	Figure G.19	
Material_transfer_equipment_data UoF		
Figure G.20	Figure G.21	
Figure G.22	Figure G.23	
Plant_context UoF		
Figure G.24	Figure G.25	
Figure G.26	Figure G.27	
Plant_item_data UoF		
Figure G.28	Figure G.29	
Figure G.30	Figure G.31	
Figure G.32	Figure G.33	
Plant_system_definition UoF		
Figure G.34		
Process_description UoF		
Figure G.35		
Process_flow_diagram UoF		
Figure G.36		

Table G.1 - ARM UoF templates (concluded)

Process_simulation_data UoF		
Figure G.37		
Figure G.38		
Process_vessel_equipment_data UoF		
Figure G.39	Figure G.40	
Figure G.41	Figure G.42	
Stream_data UoF		
Figure G.43	Figure G.44	
	Figure G.45	
Substance_experimental_data UoF		
Figure G.46		
Substance_model_data UoF		
Figure G.47	Figure G.48	
Figure G.49		
Unit_operation UoF		
Figure G.50	Figure G.51	Figure G.52
Figure G.53	Figure G.54	Figure G.55

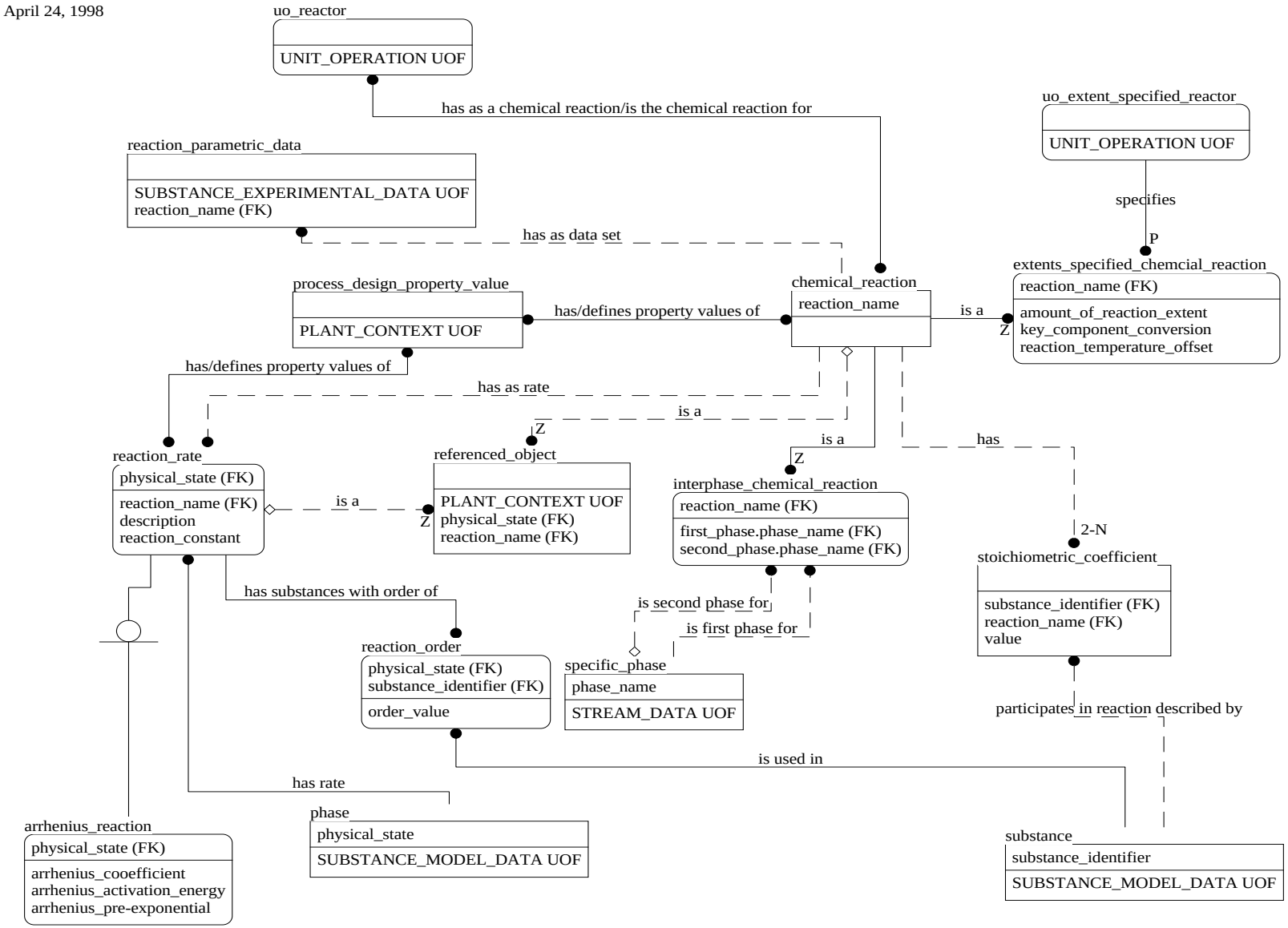


Figure G.1 - ARM Chemical_reaction_data UoF diagram 1 of 1

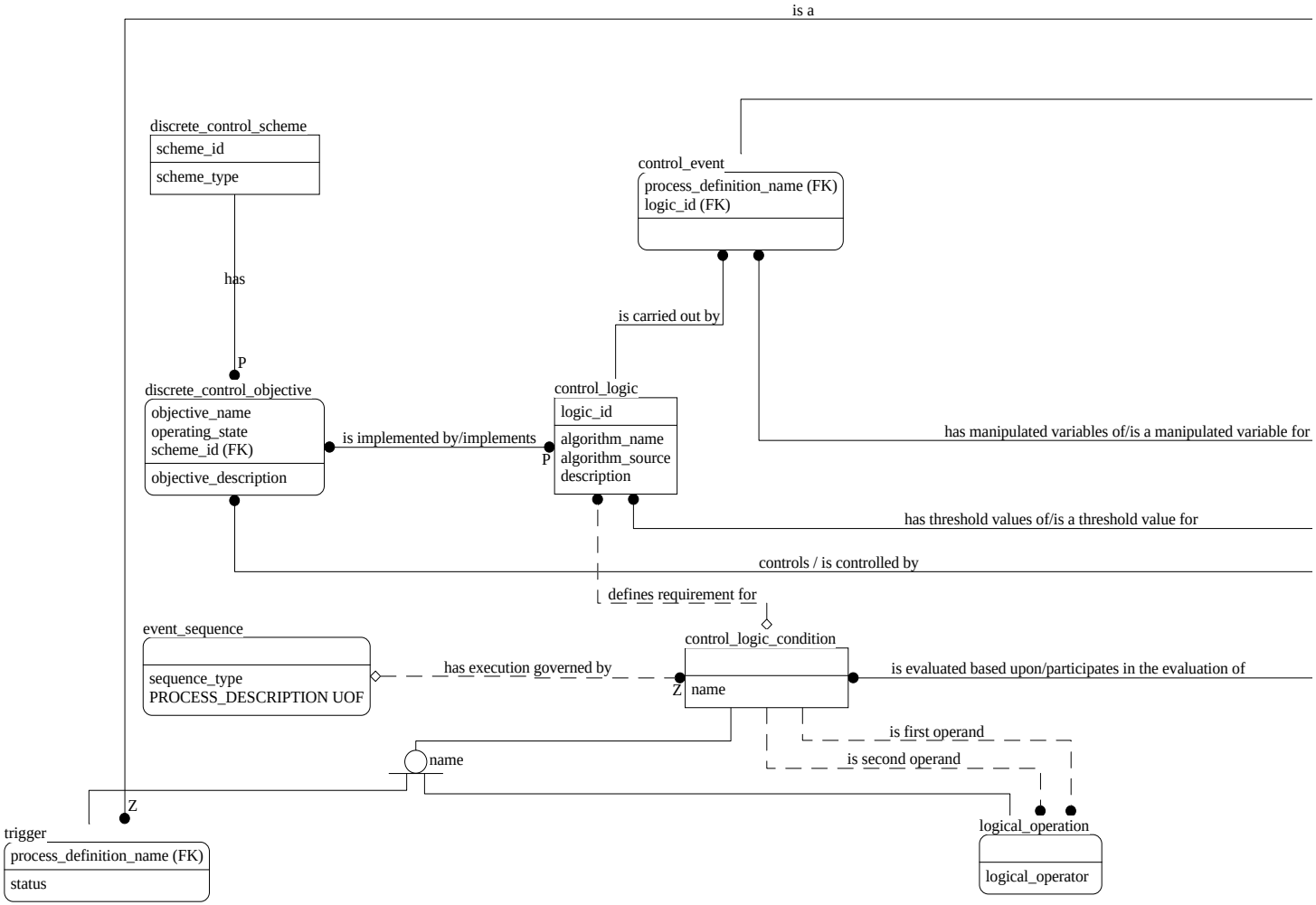


Figure G.2 - ARM Control_strategy UoF diagram 1 of 2

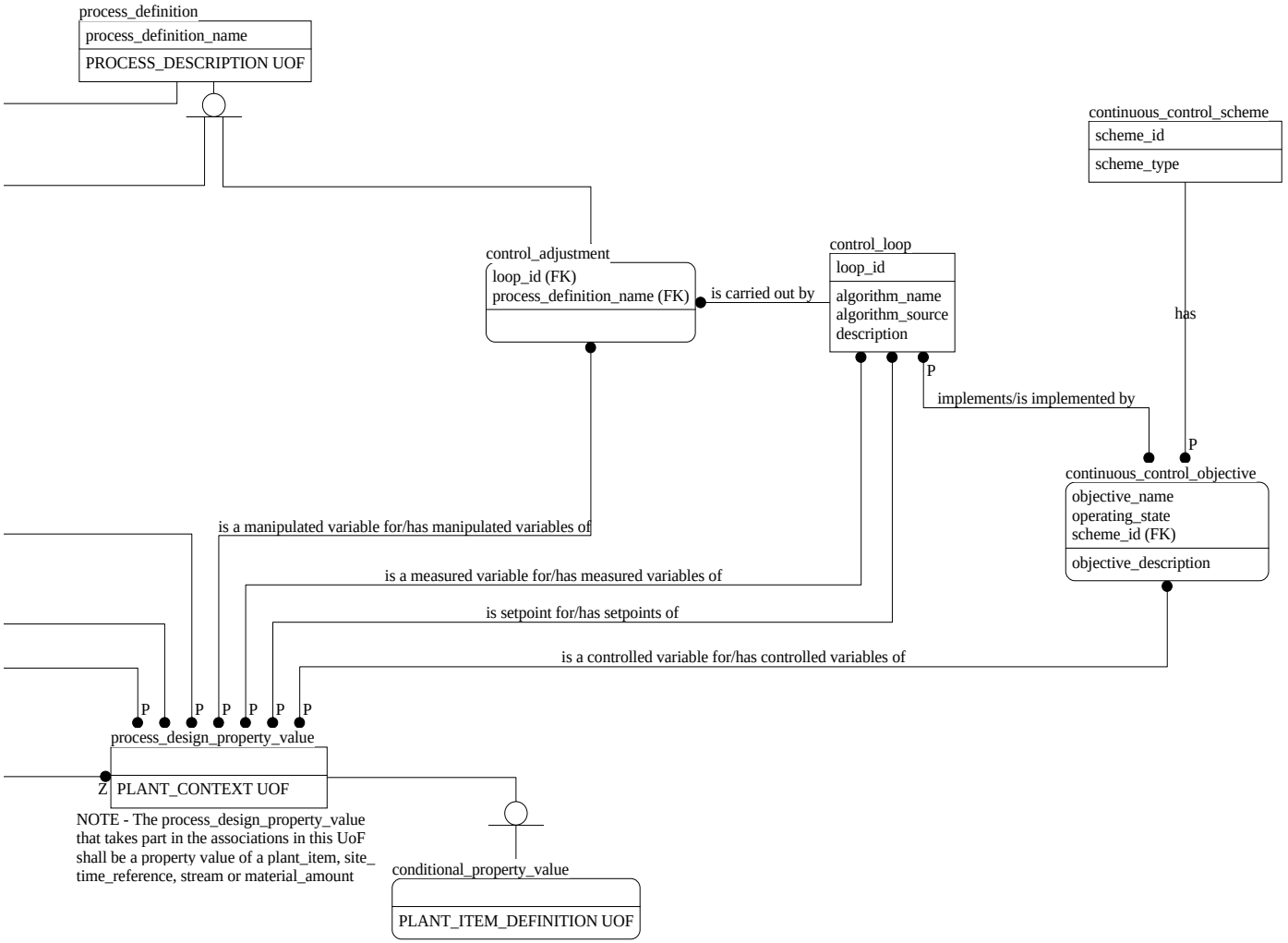


Figure G.3 - ARM Control_strategy UoF diagram 2 of 2

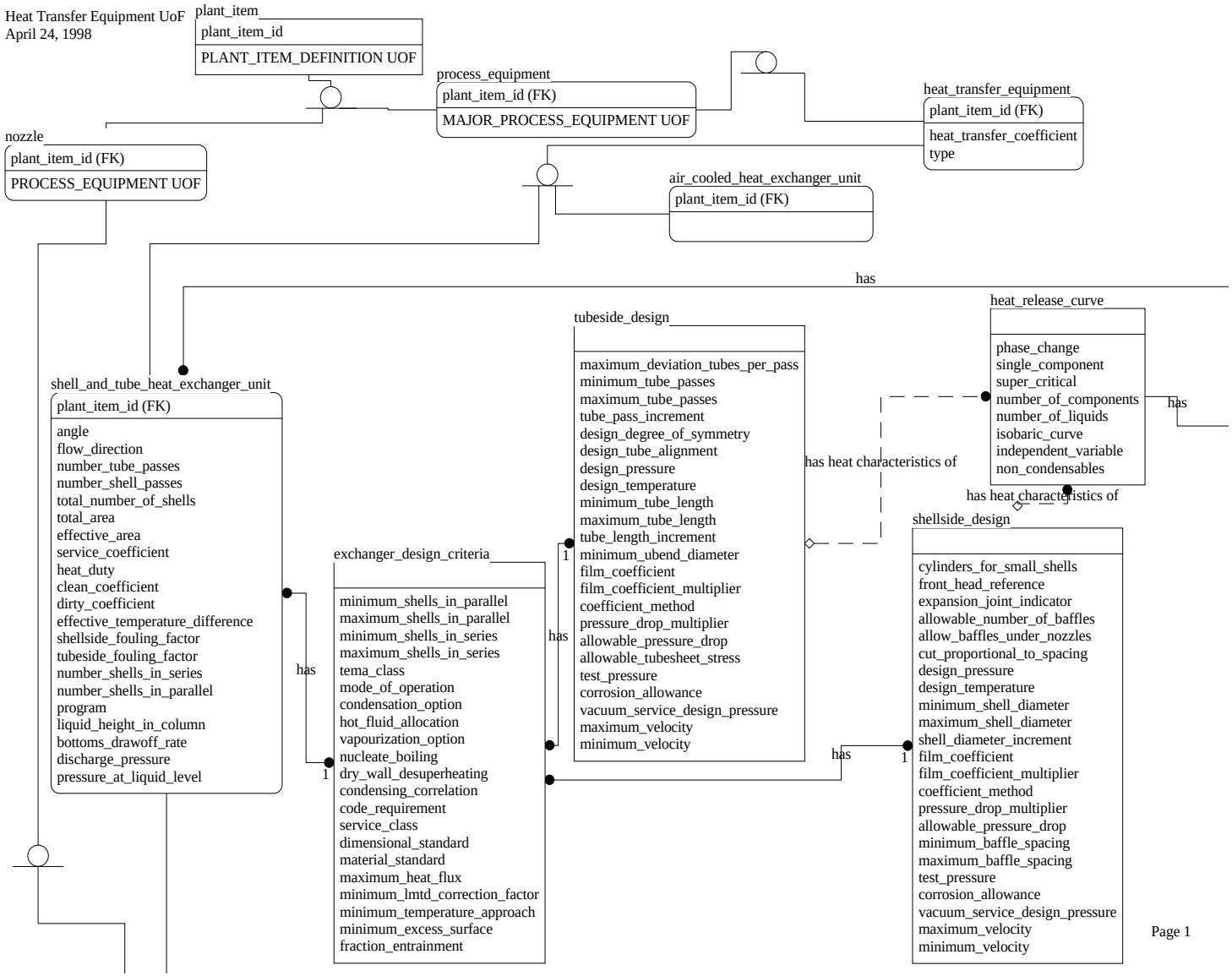


Figure G.4 - ARM Heat_transfer_equipment_data UoF diagram 1 of 4

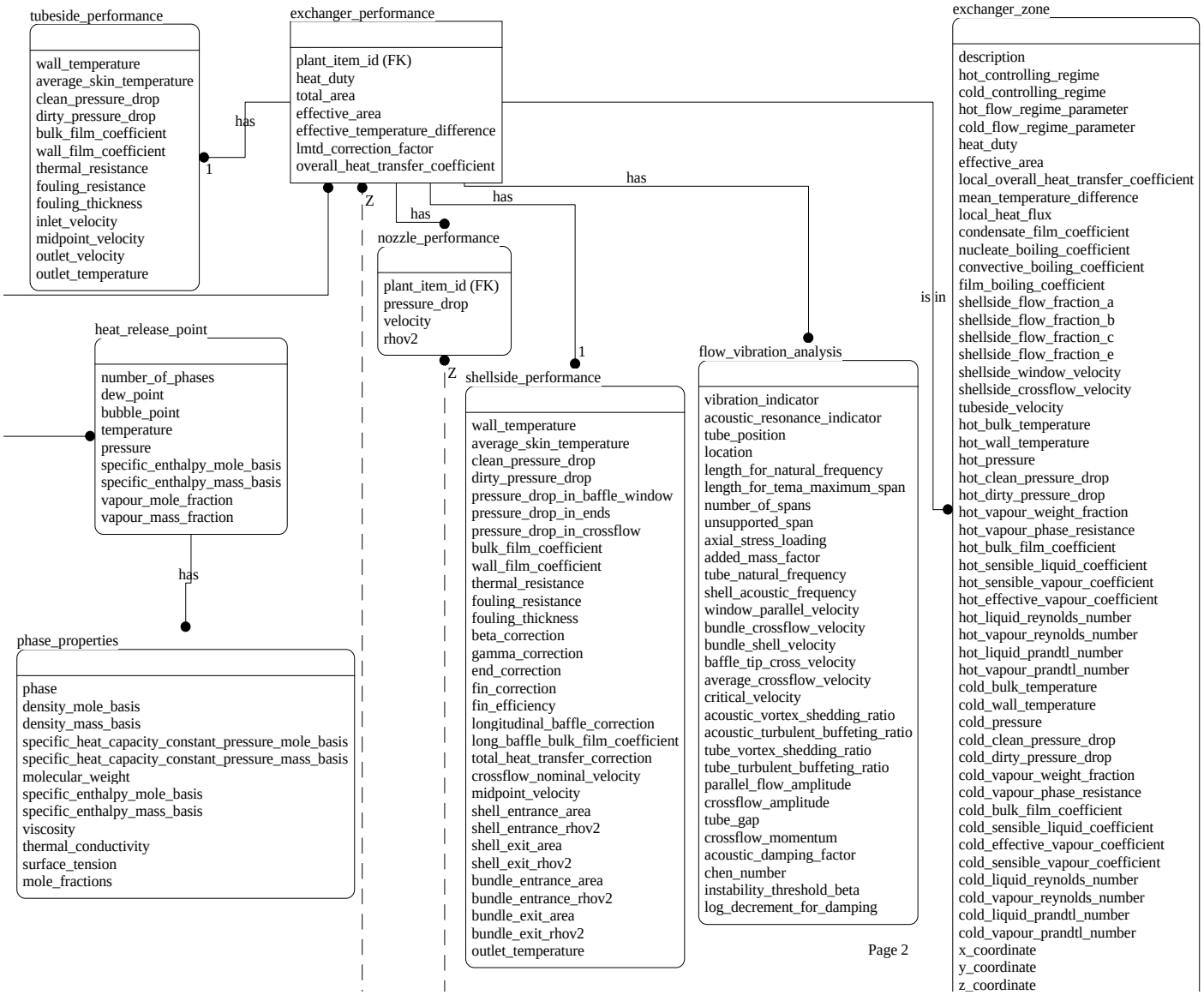


Figure G.5 - ARM Heat_transfer_equipment_data UoF diagram 2 of 4

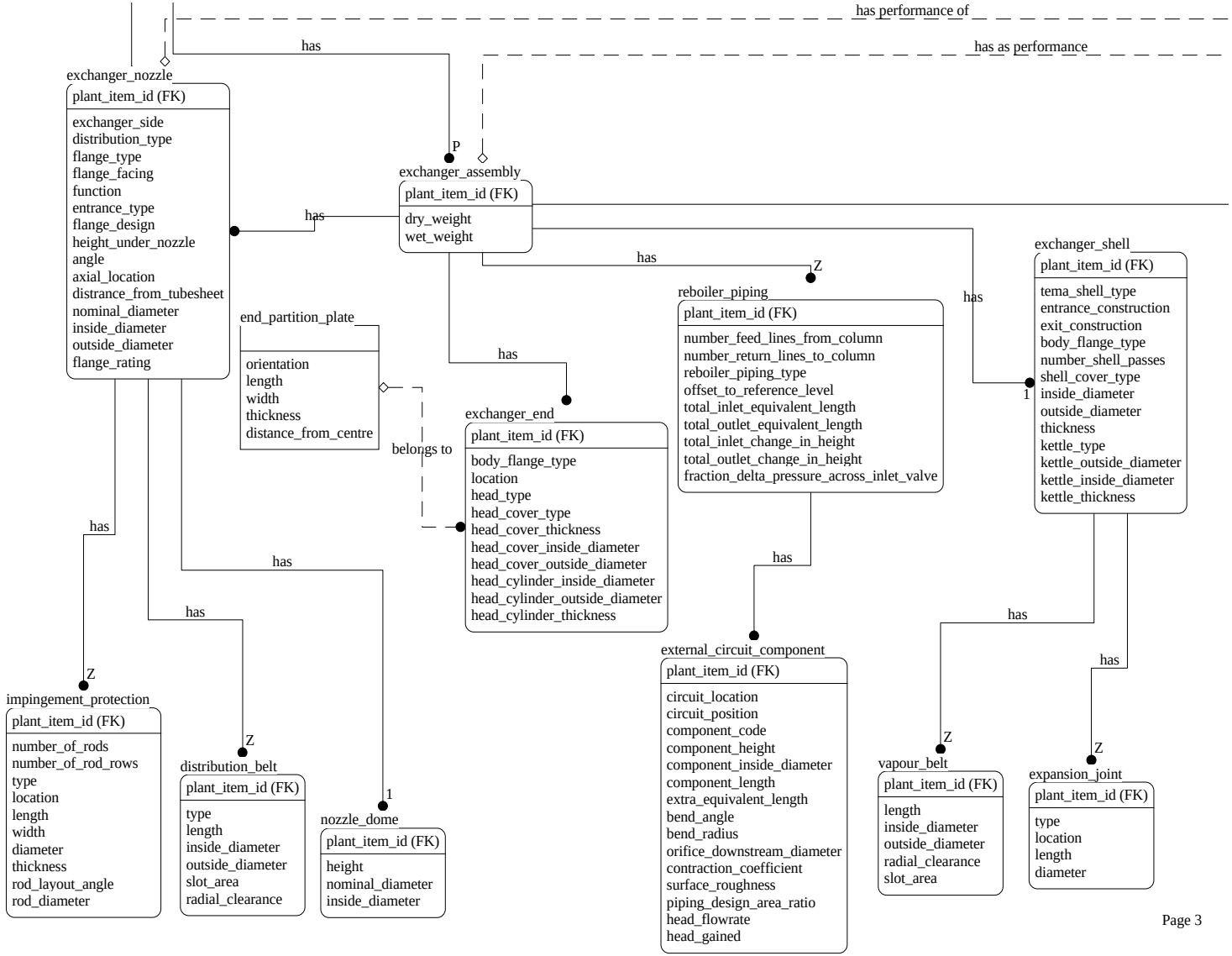


Figure G.6 - ARM Heat_transfer_equipment_data UoF diagram 3 of 4

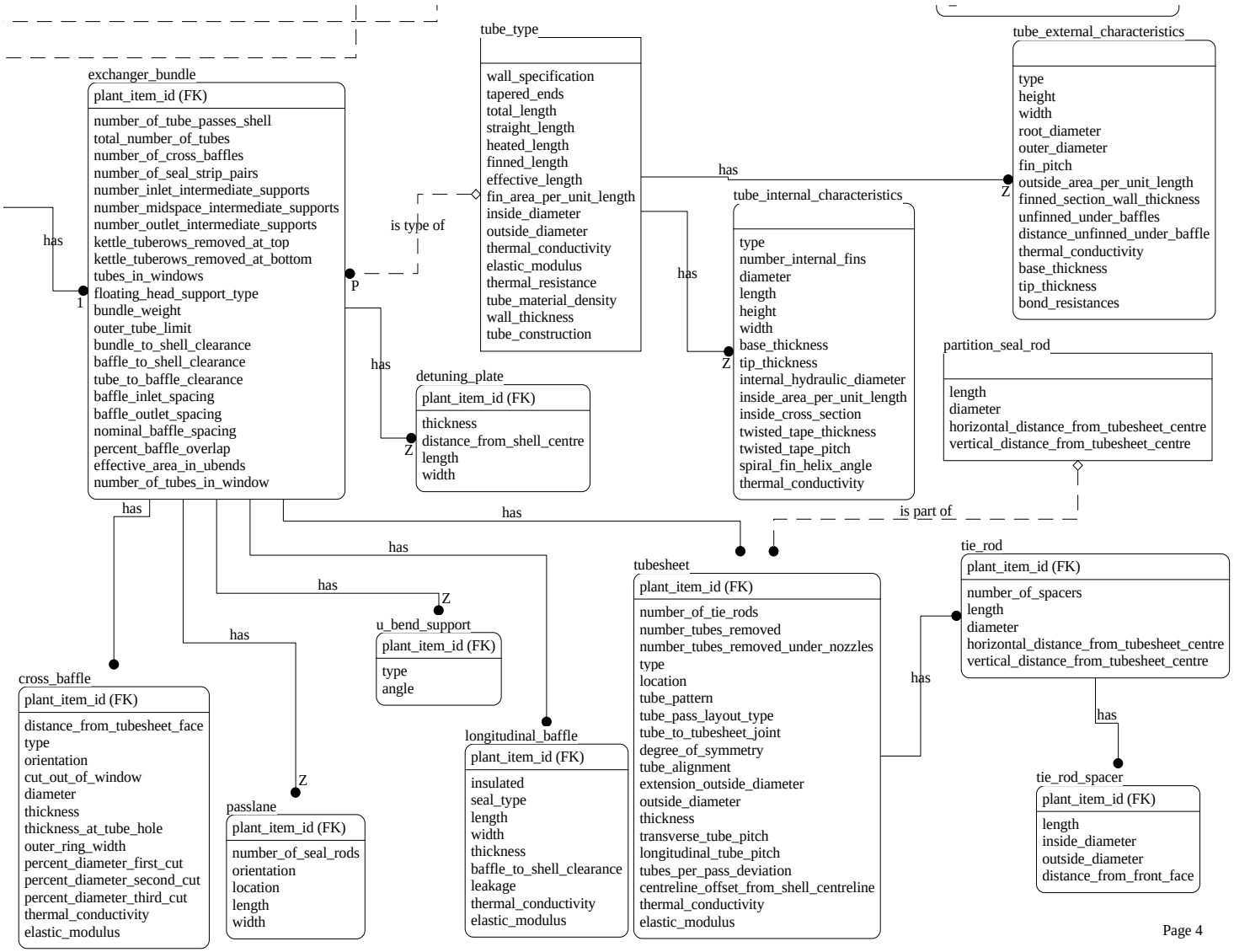


Figure G.7 - ARM Heat_transfer_equipment_data UoF diagram 4 of 4

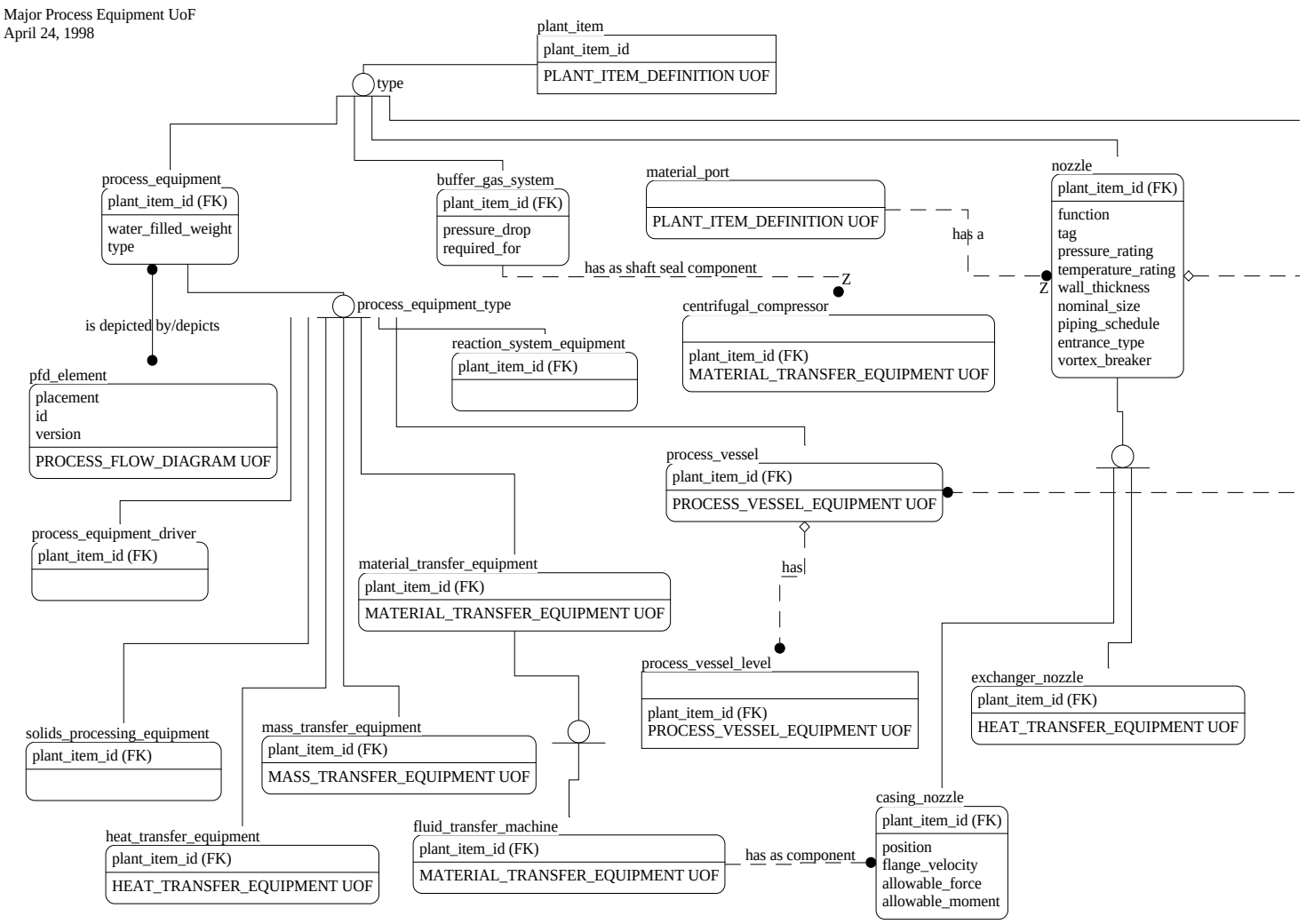


Figure G.8 - ARM Major_process_equipment_data UoF diagram 1 of 2

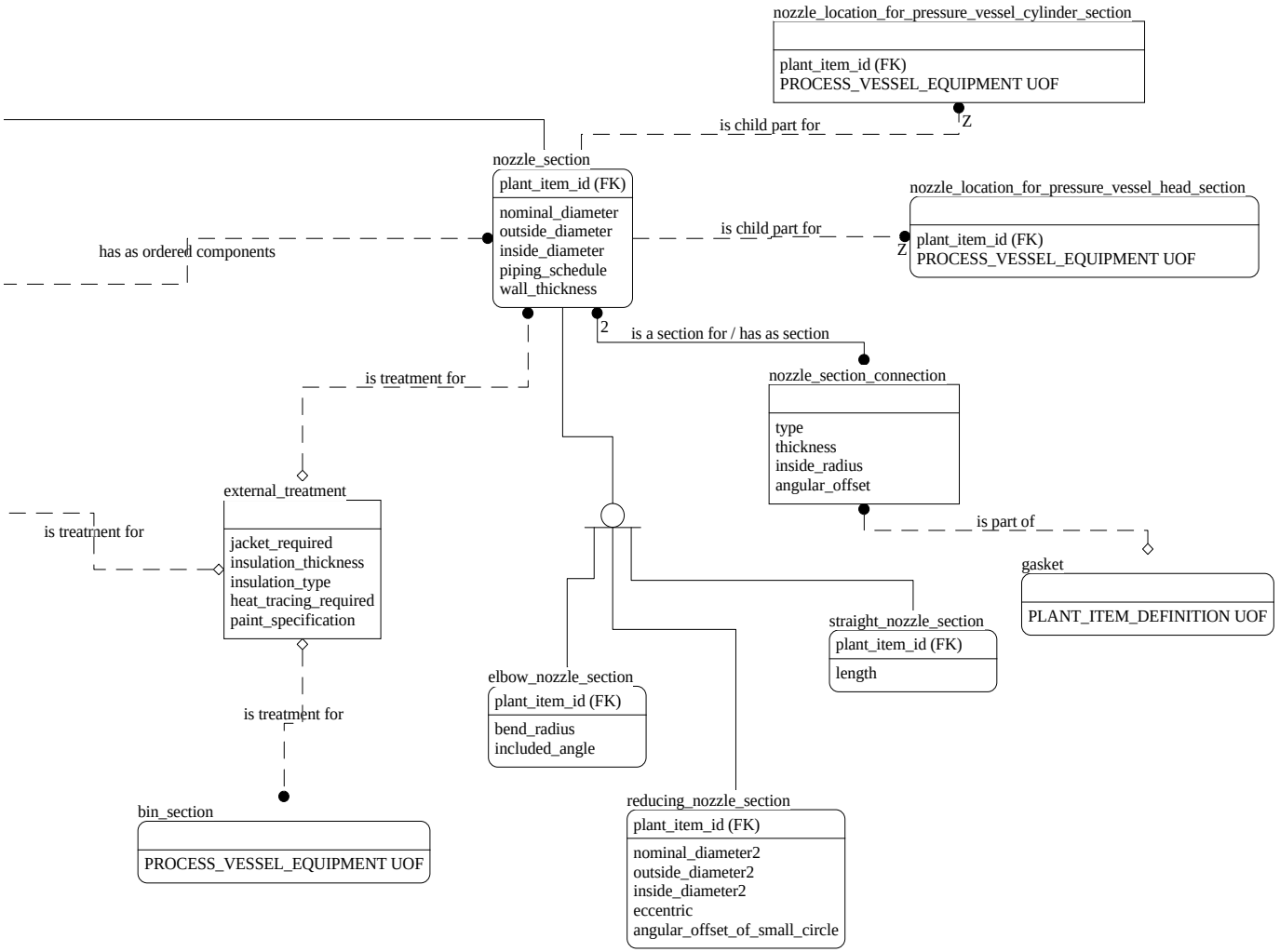


Figure G.9 - ARM Major_process_equipment_data UoF diagram 2 of 2

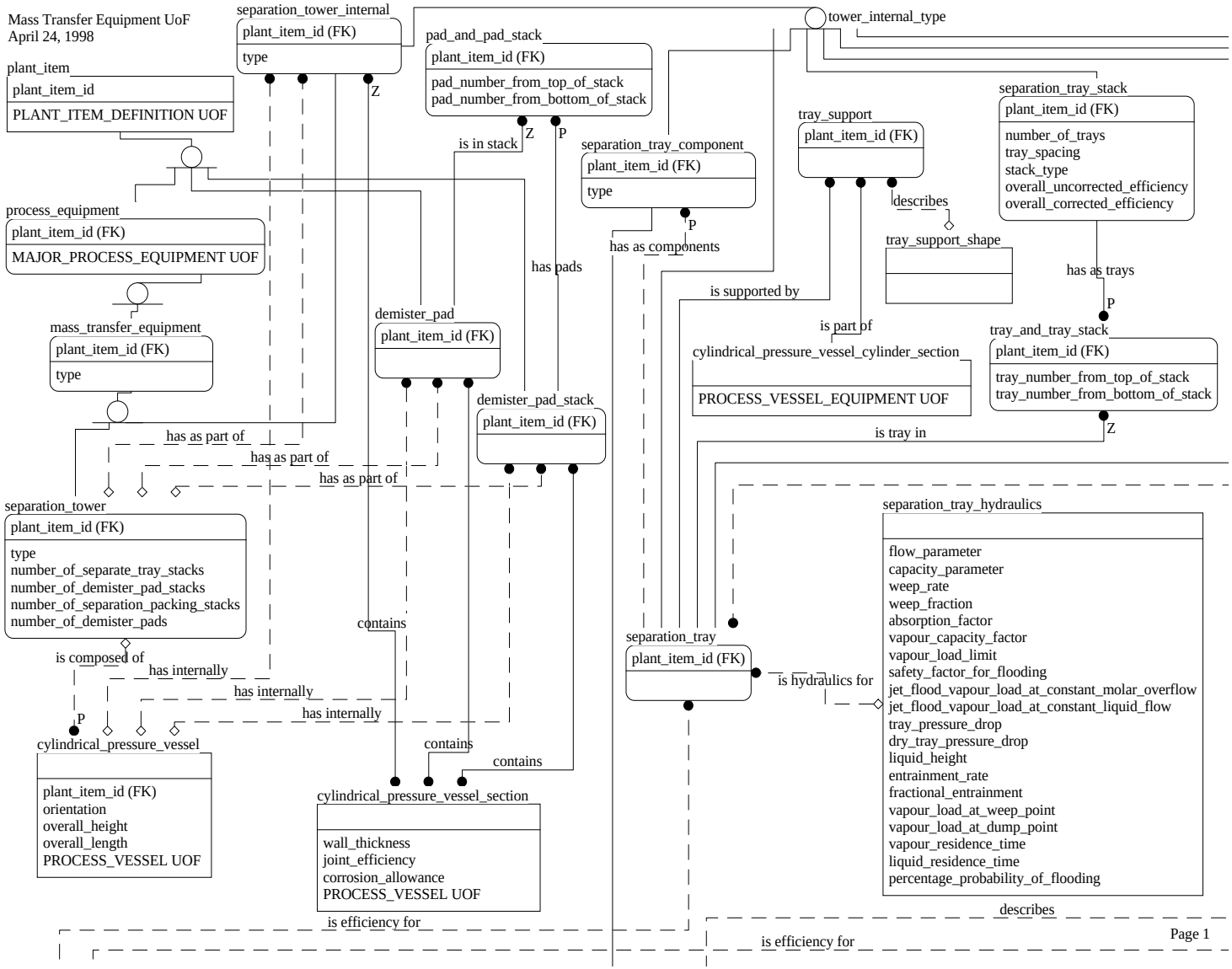


Figure G.10 - ARM Mass_transfer_equipment_data UoF diagram 1 of 6

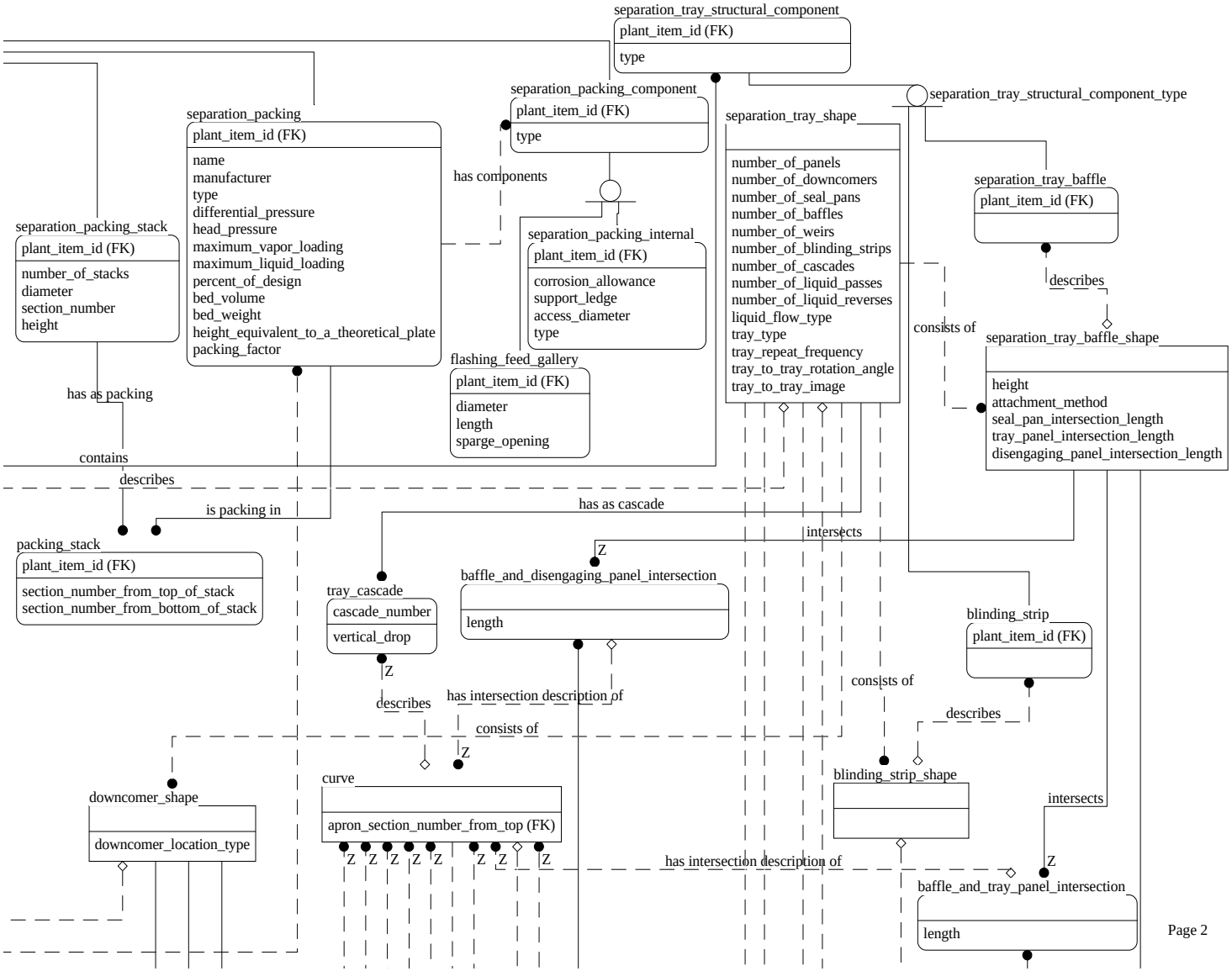


Figure G.11 - ARM Mass_transfer_equipment_data UoF diagram 2 of 6

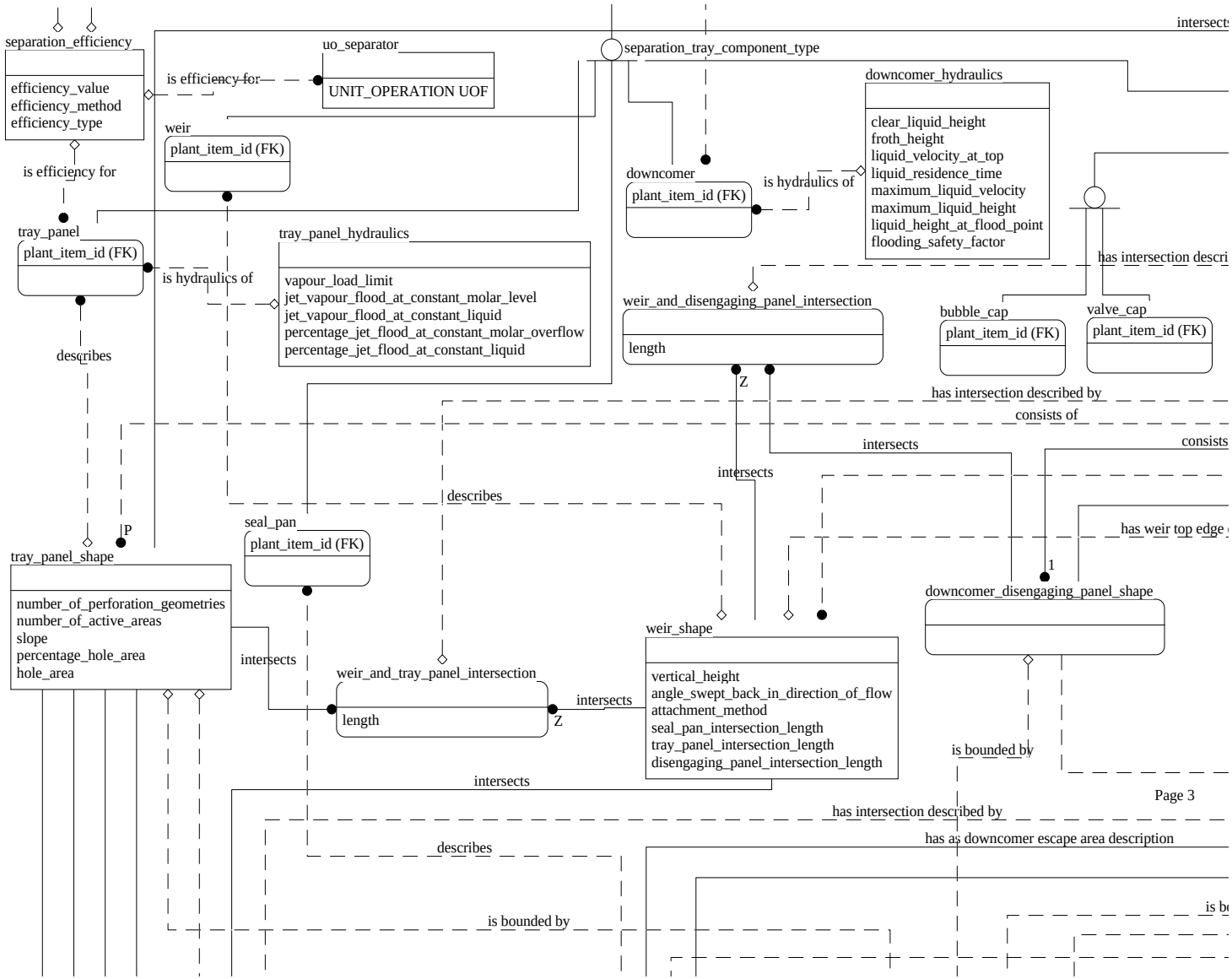


Figure G.12 - ARM Mass_transfer_equipment_data UoF diagram 3 of 6

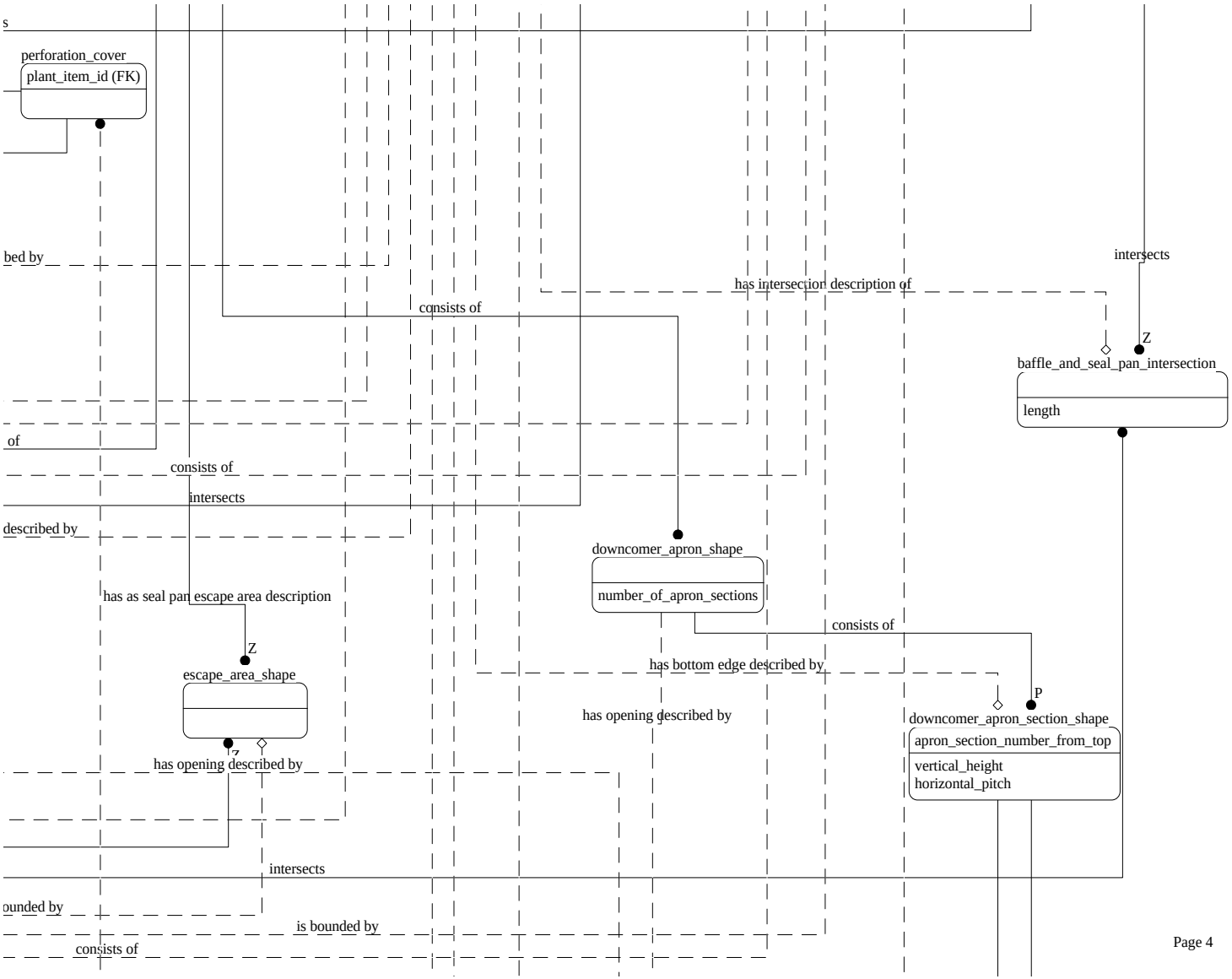


Figure G.13 - ARM Mass_transfer_equipment_data UoF diagram 4 of 6

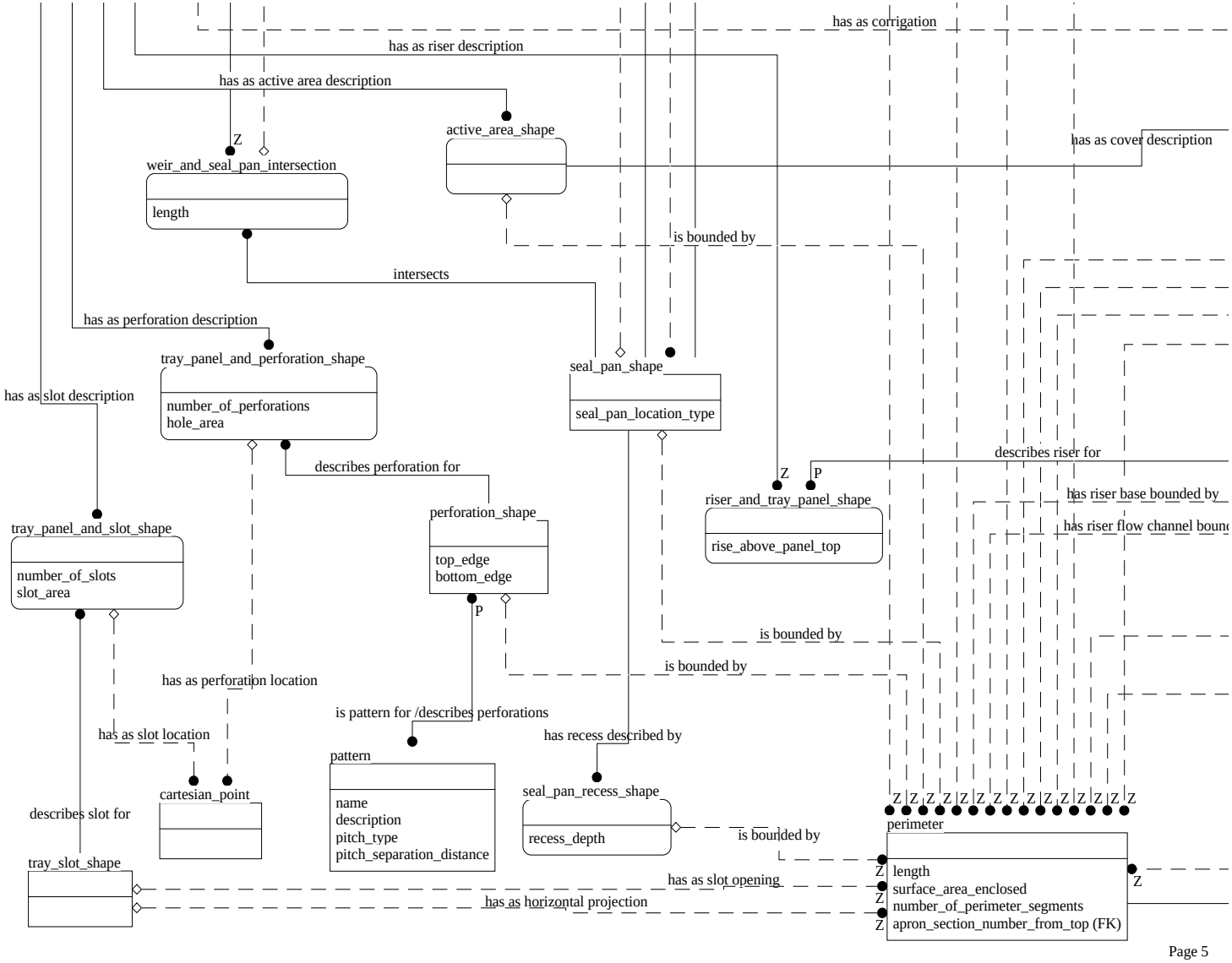
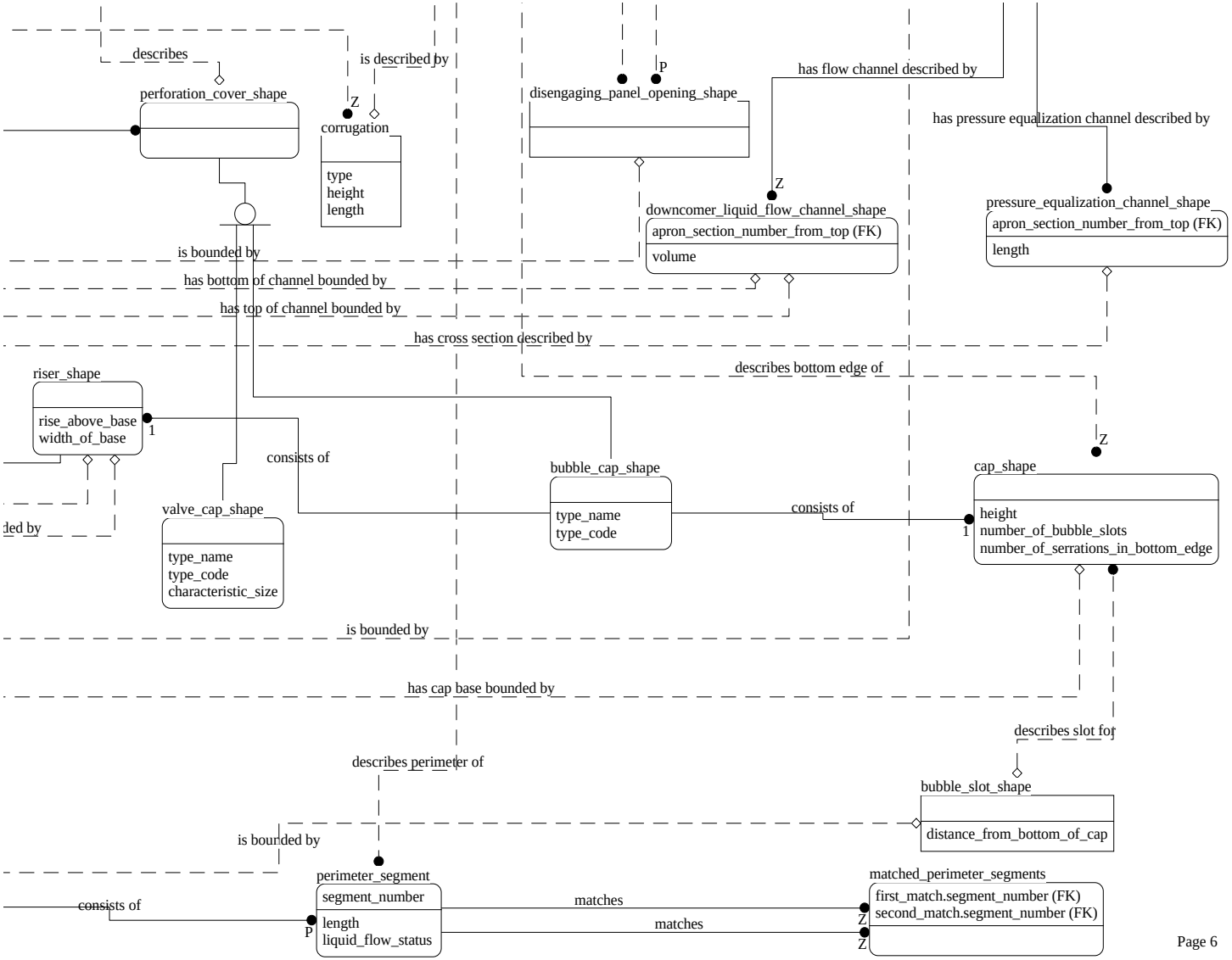


Figure G.14 - ARM Mass_transfer_equipment_data UoF diagram 5 of 6



Page 6

Figure G.15 - ARM Mass_transfer_equipment_data UoF diagram 6 of 6

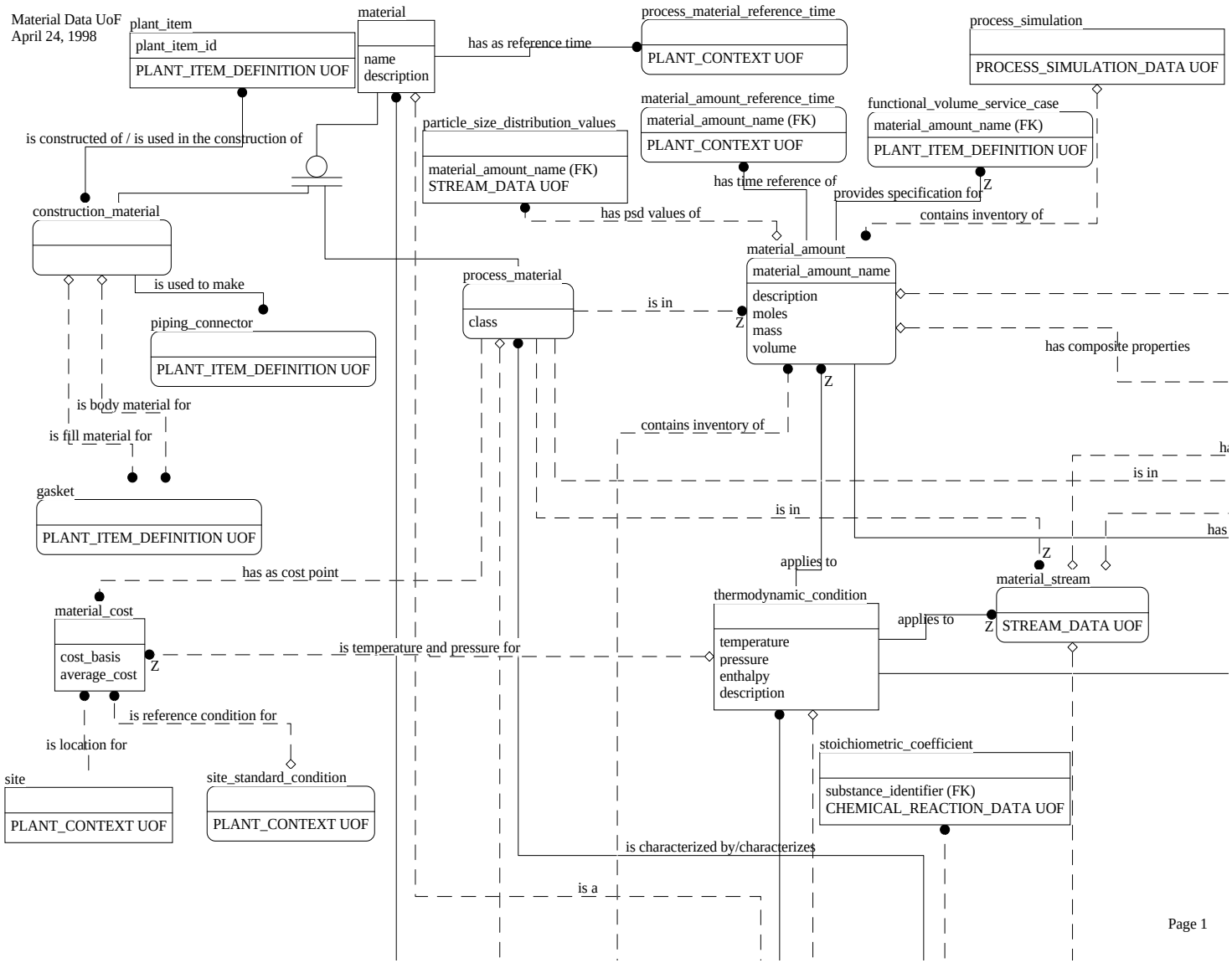


Figure G.16 - ARM Material_data UoF diagram 1 of 4

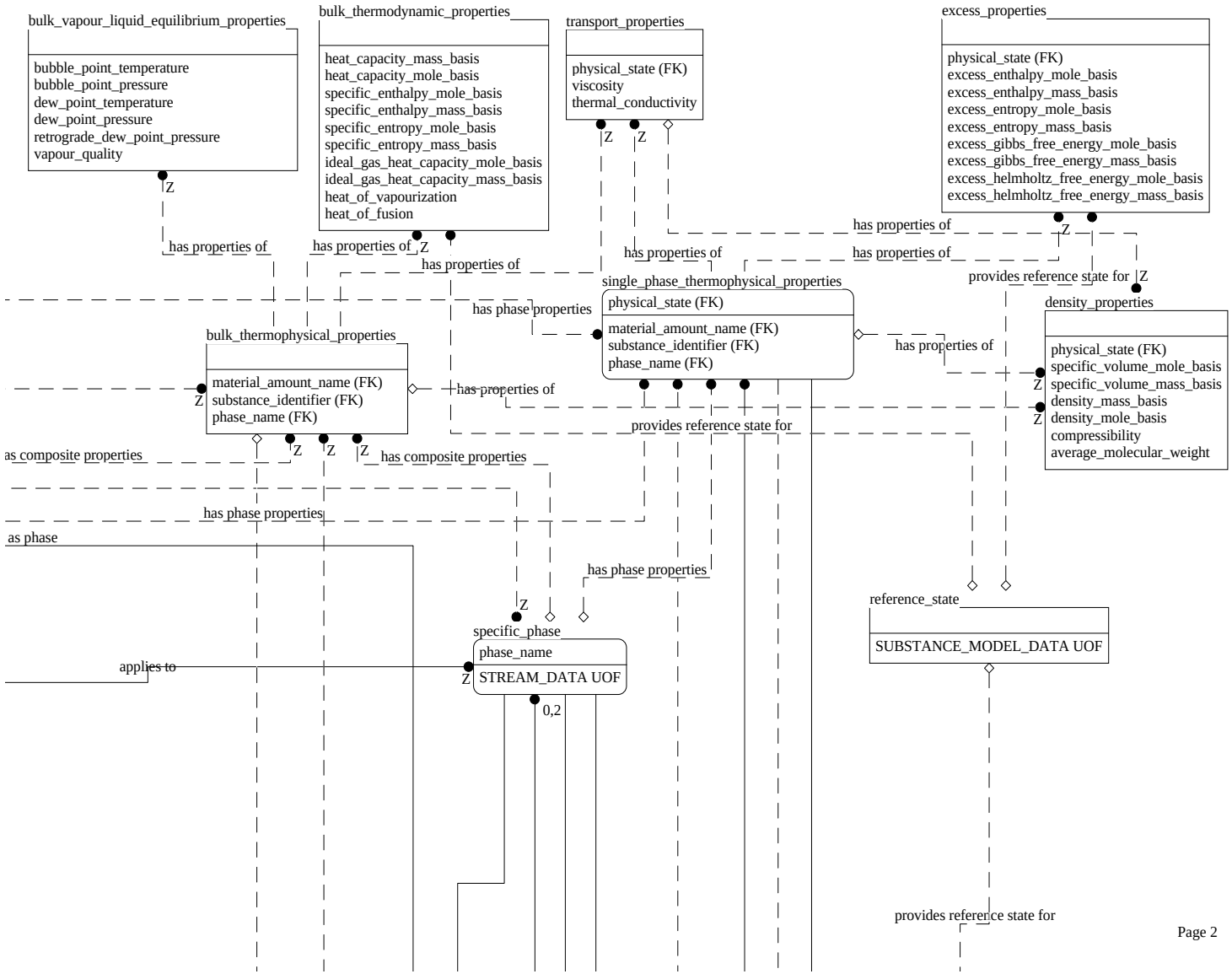


Figure G.17 - ARM Material_data UoF diagram 2 of 4

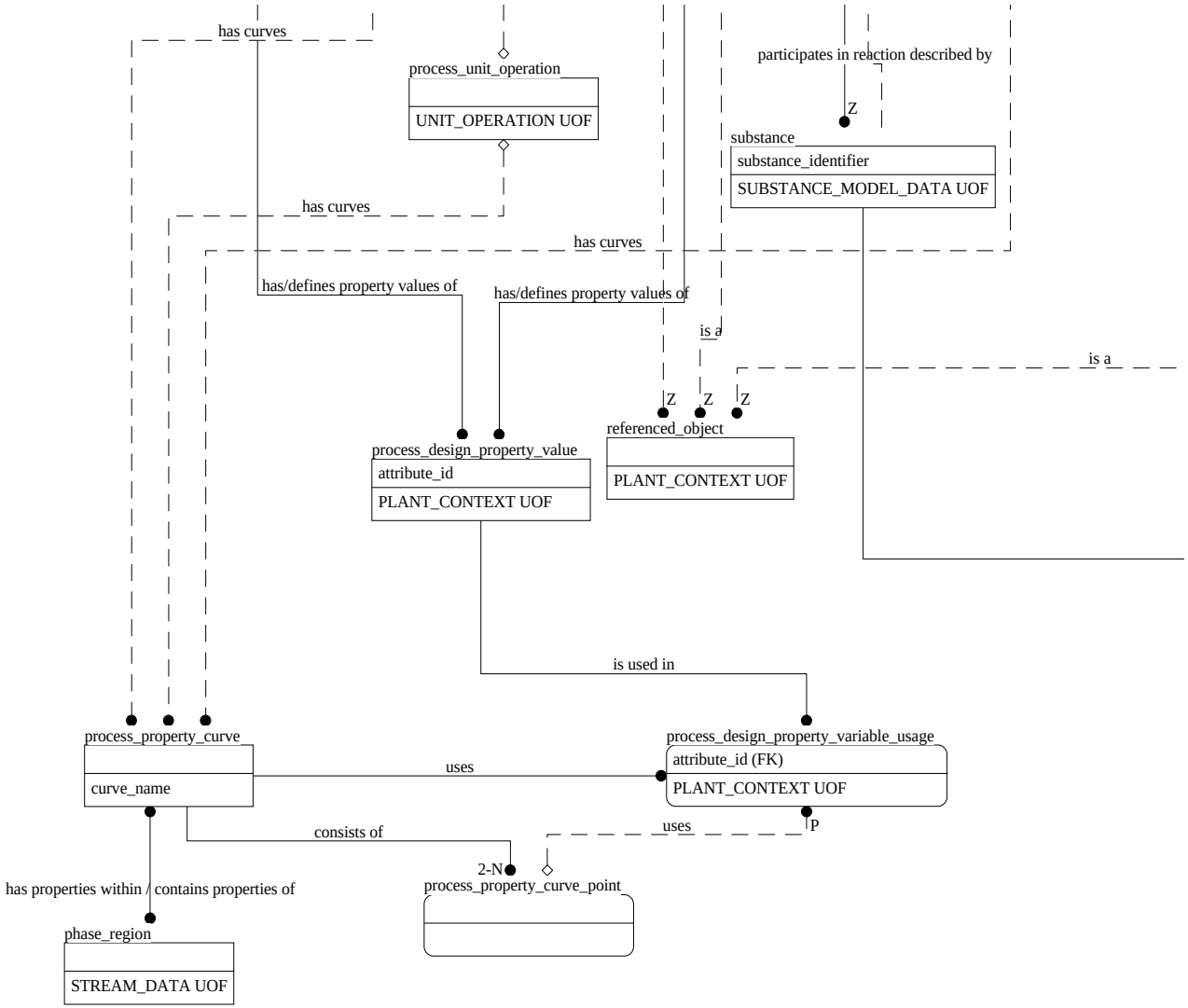


Figure G.18 - ARM Material_data UoF diagram 3 of 4

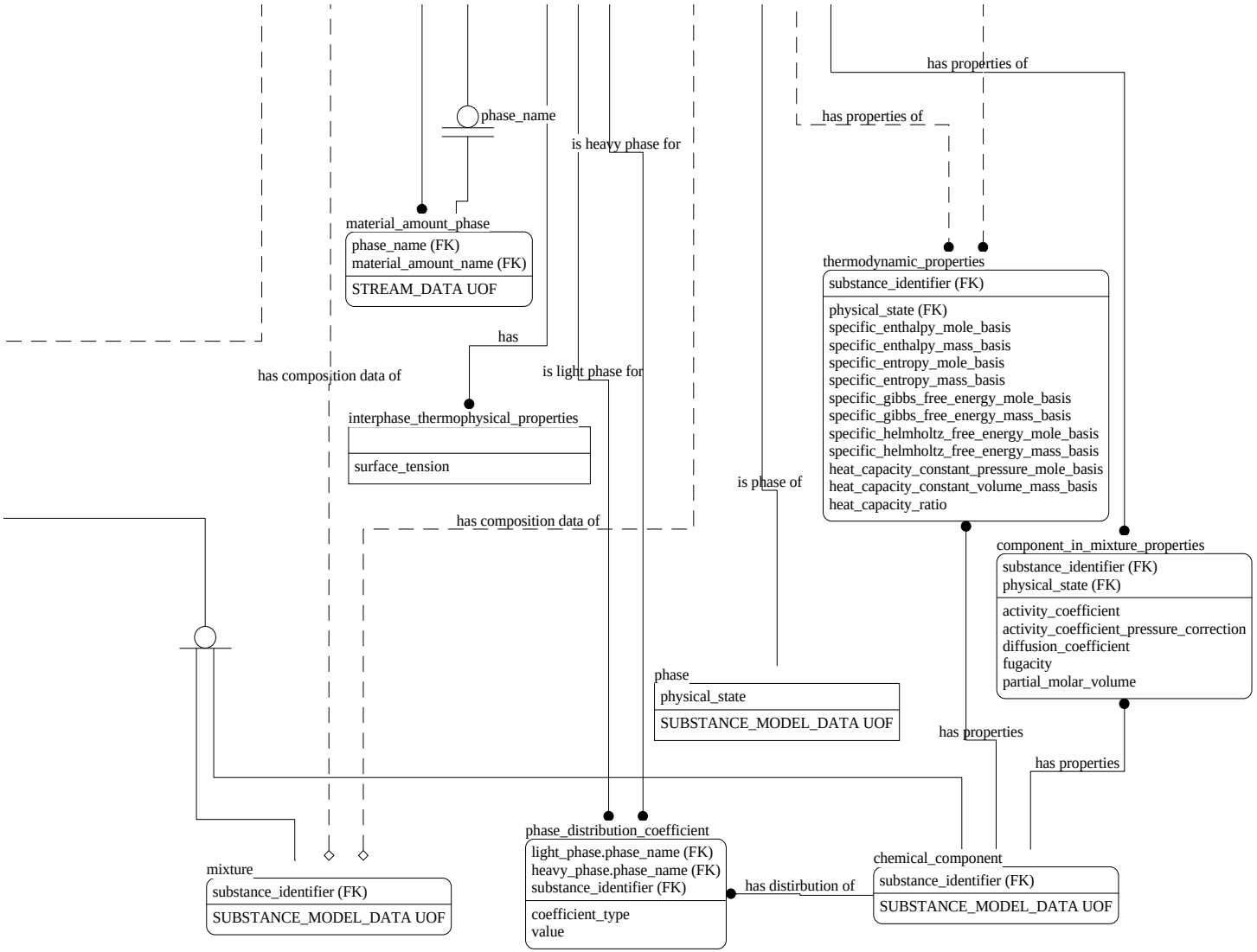


Figure G.19 - ARM Material_data UoF diagram 4 of 4

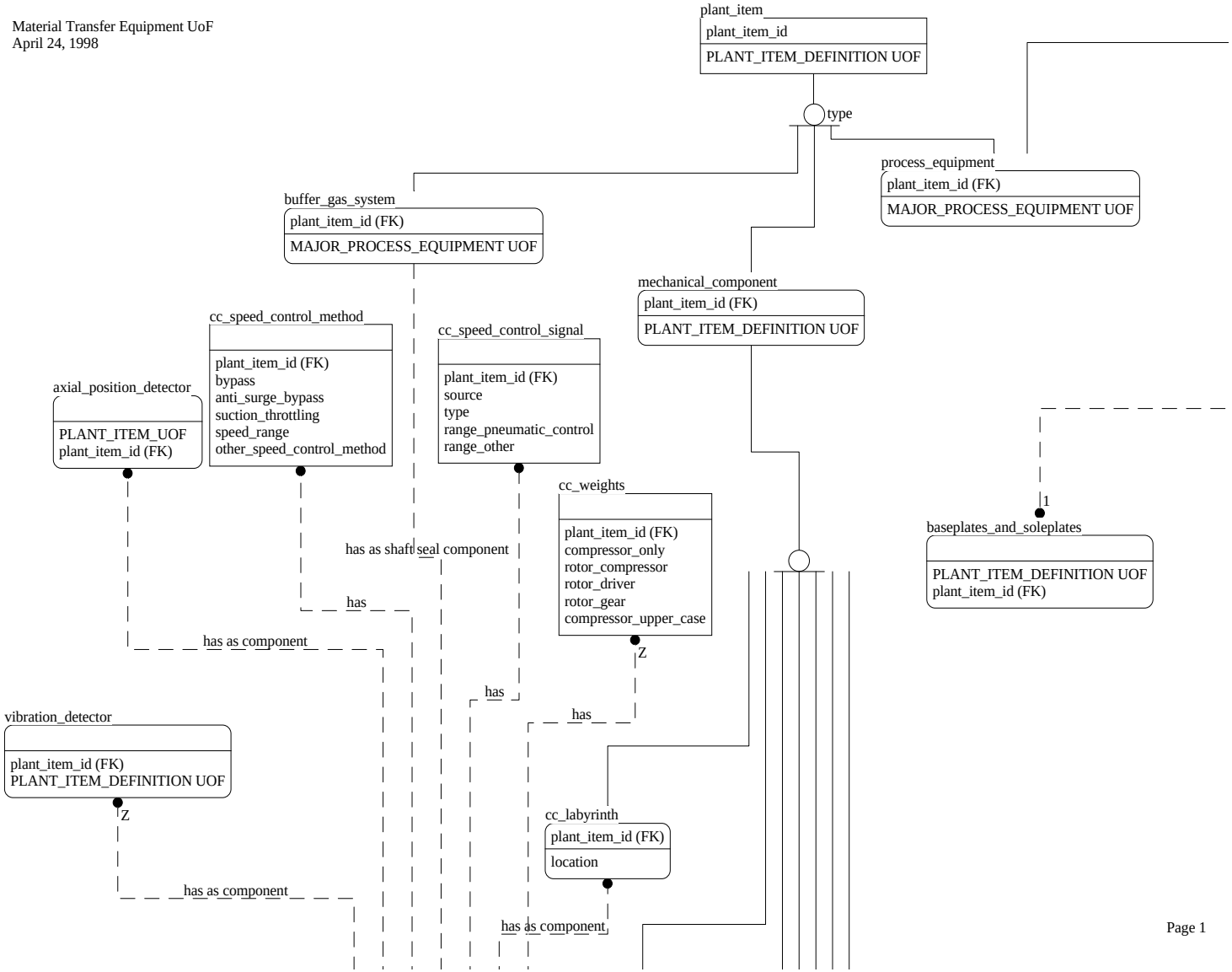
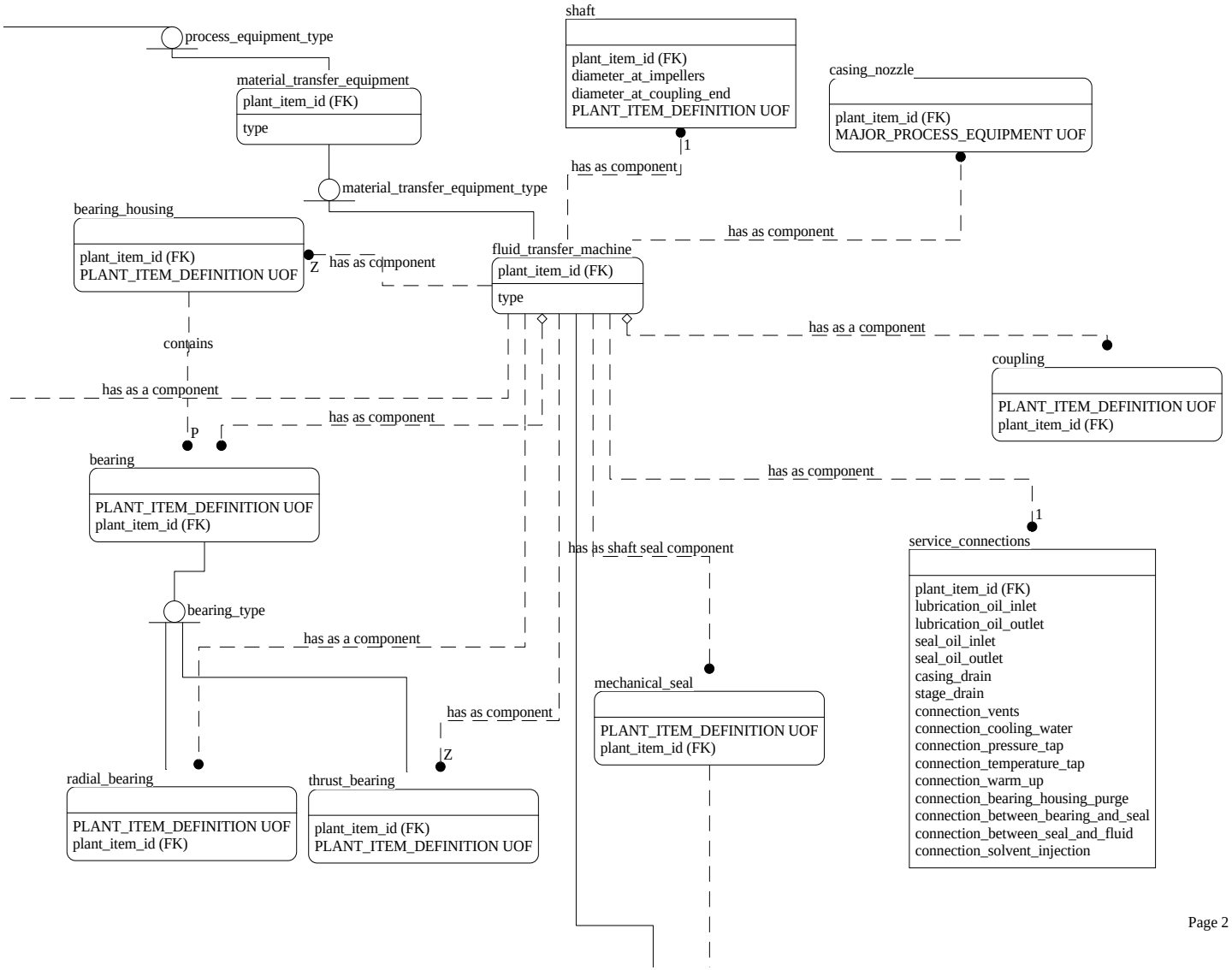


Figure G.20 - ARM Material_transfer_equipment_data UoF diagram 1 of 4



Page 2

Figure G.21 - ARM Material_transfer_equipment_data UoF diagram 2 of 4

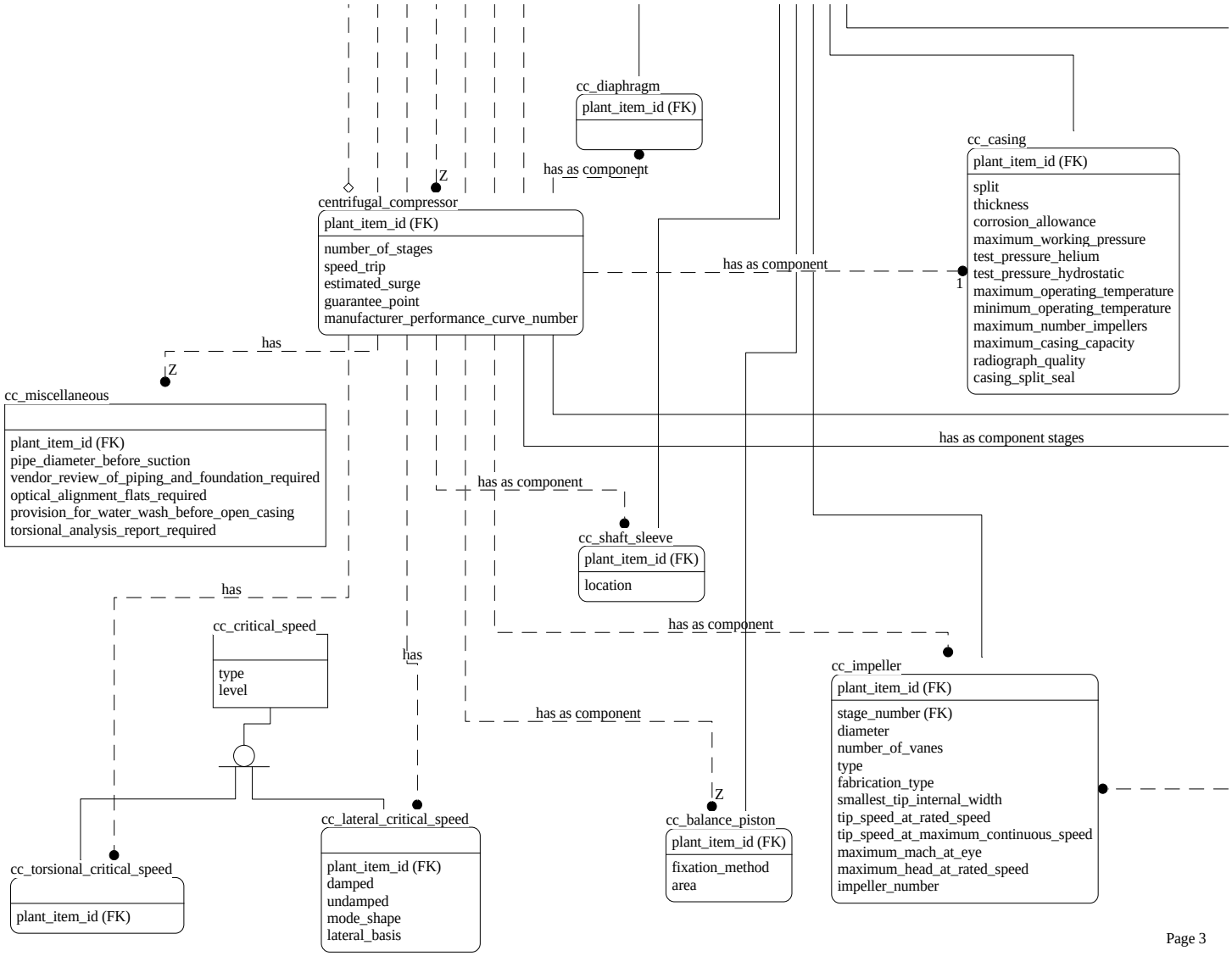
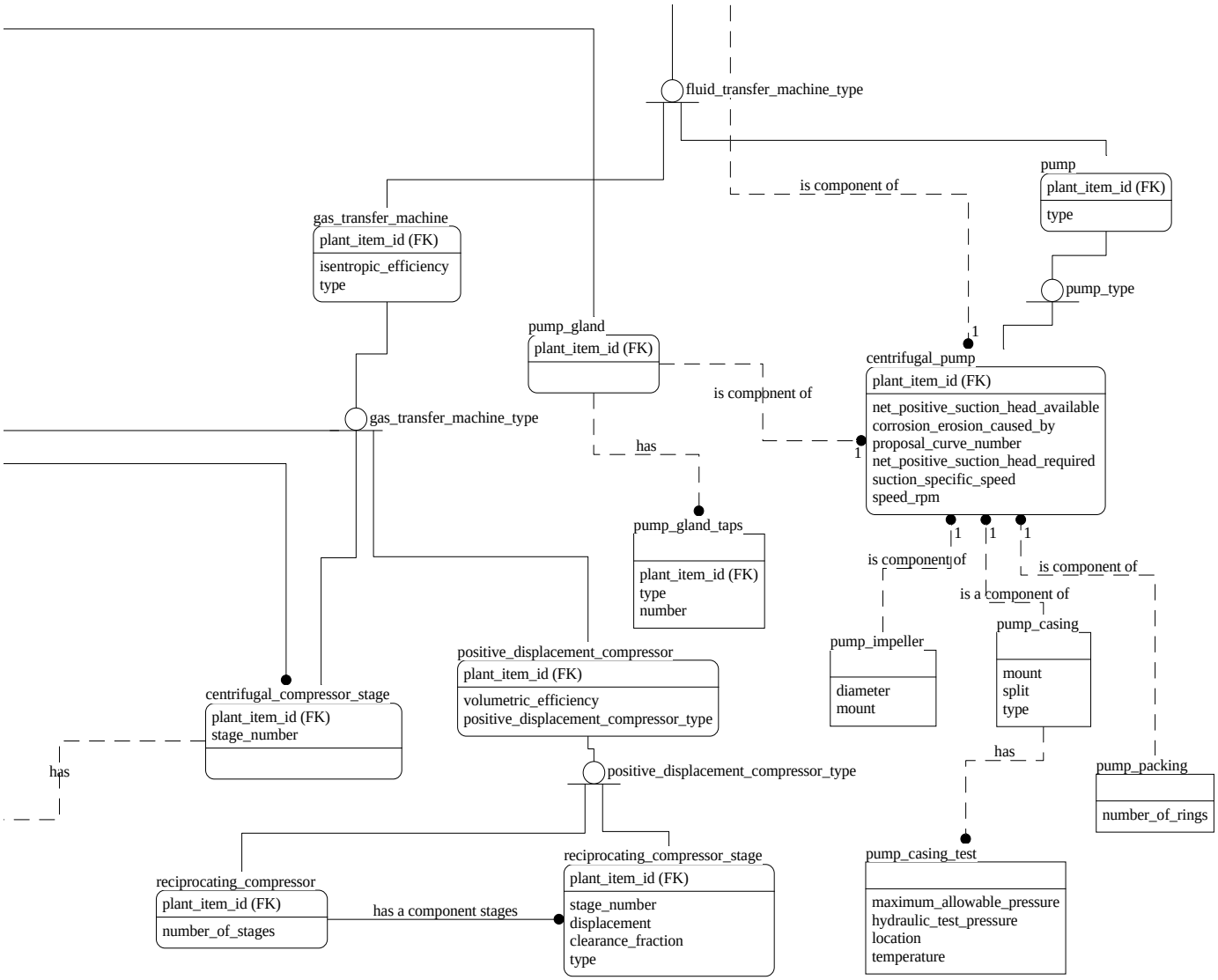


Figure G.22 - ARM Material_transfer_equipment_data UoF diagram 3 of 4



Page 4

Figure G.23 - ARM Material_transfer_equipment_data UoF diagram 4 of 4

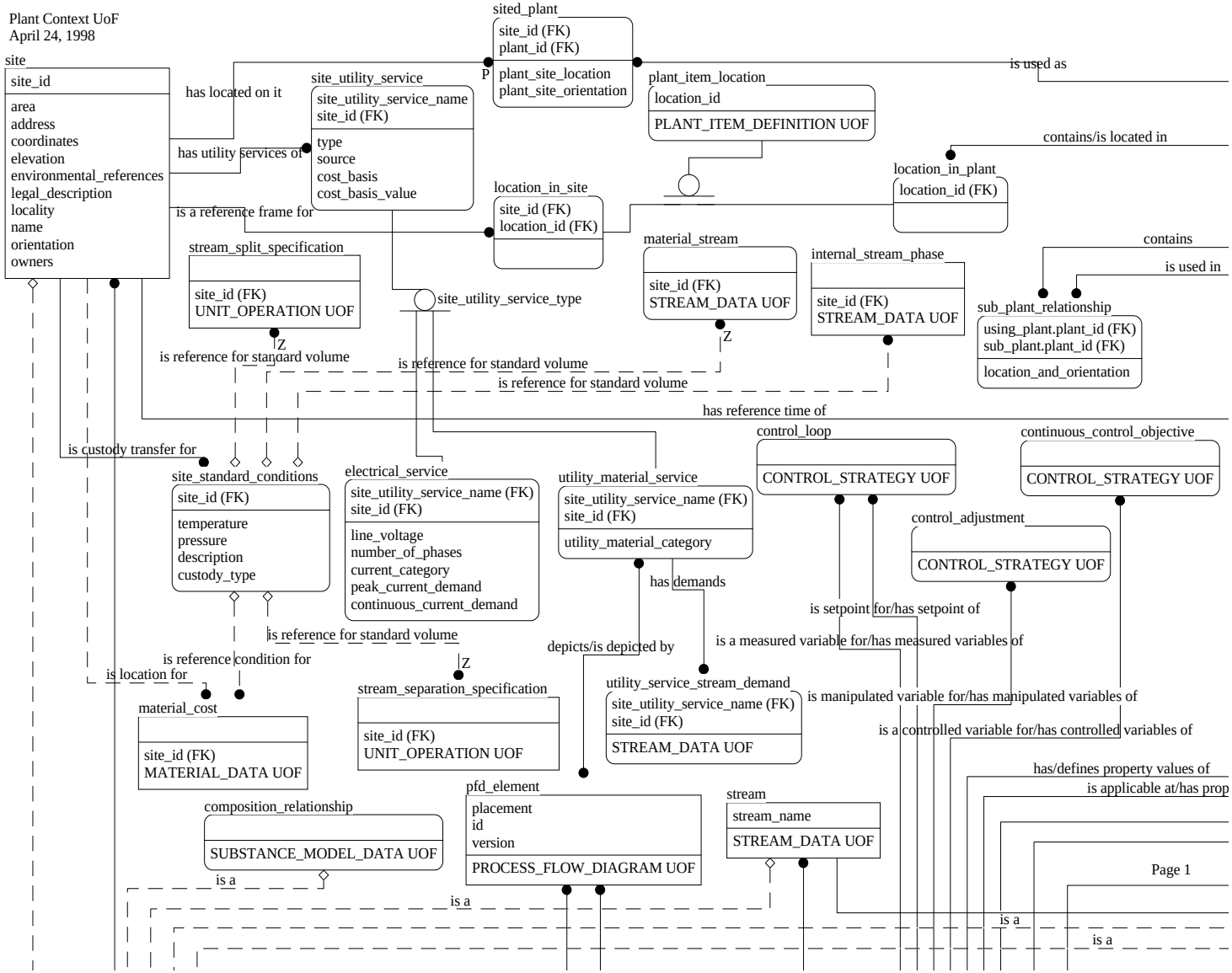


Figure G.24 - ARM Plant_context UoF diagram 1 of 4

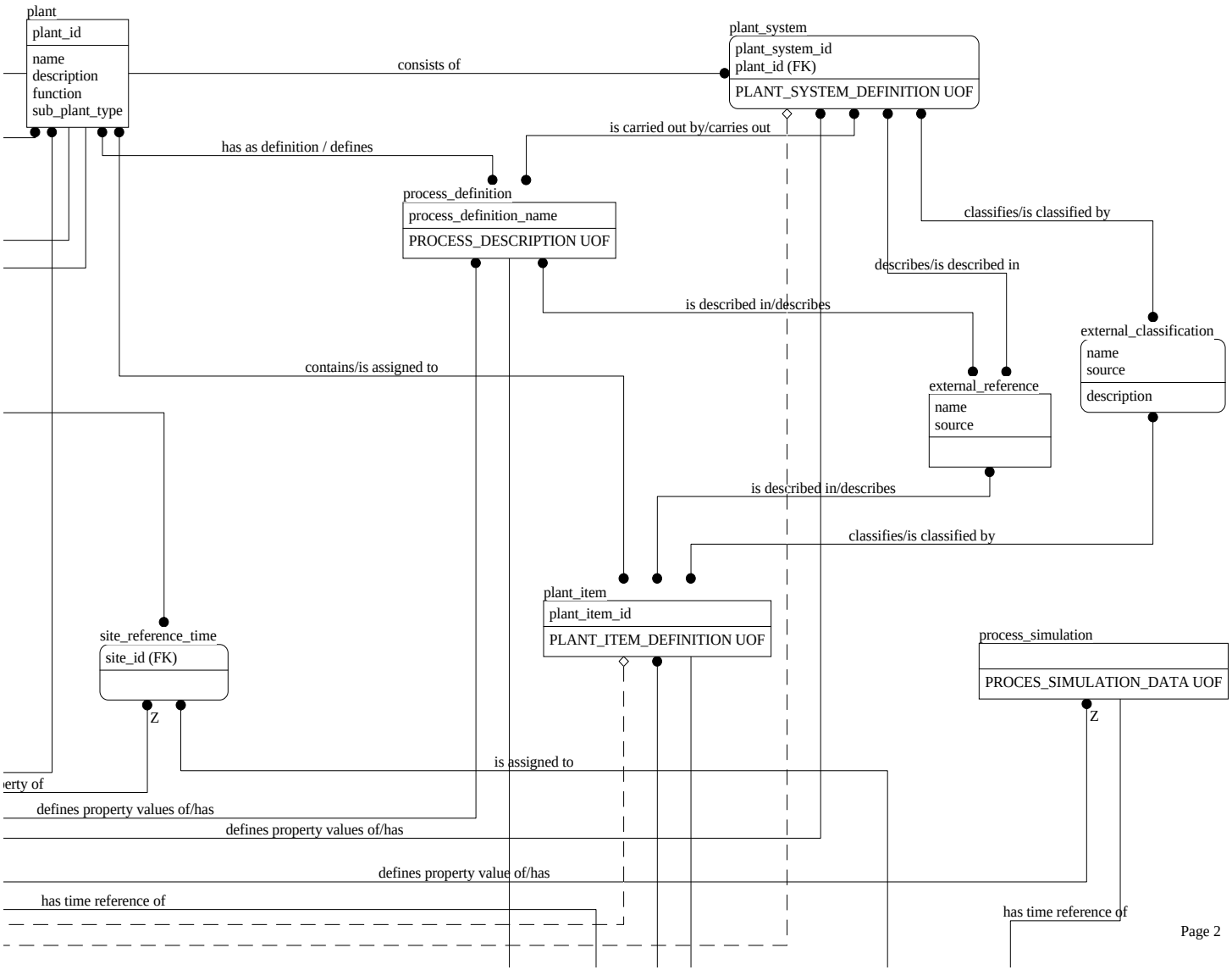


Figure G.25 - ARM Plant_context UoF diagram 2 of 4

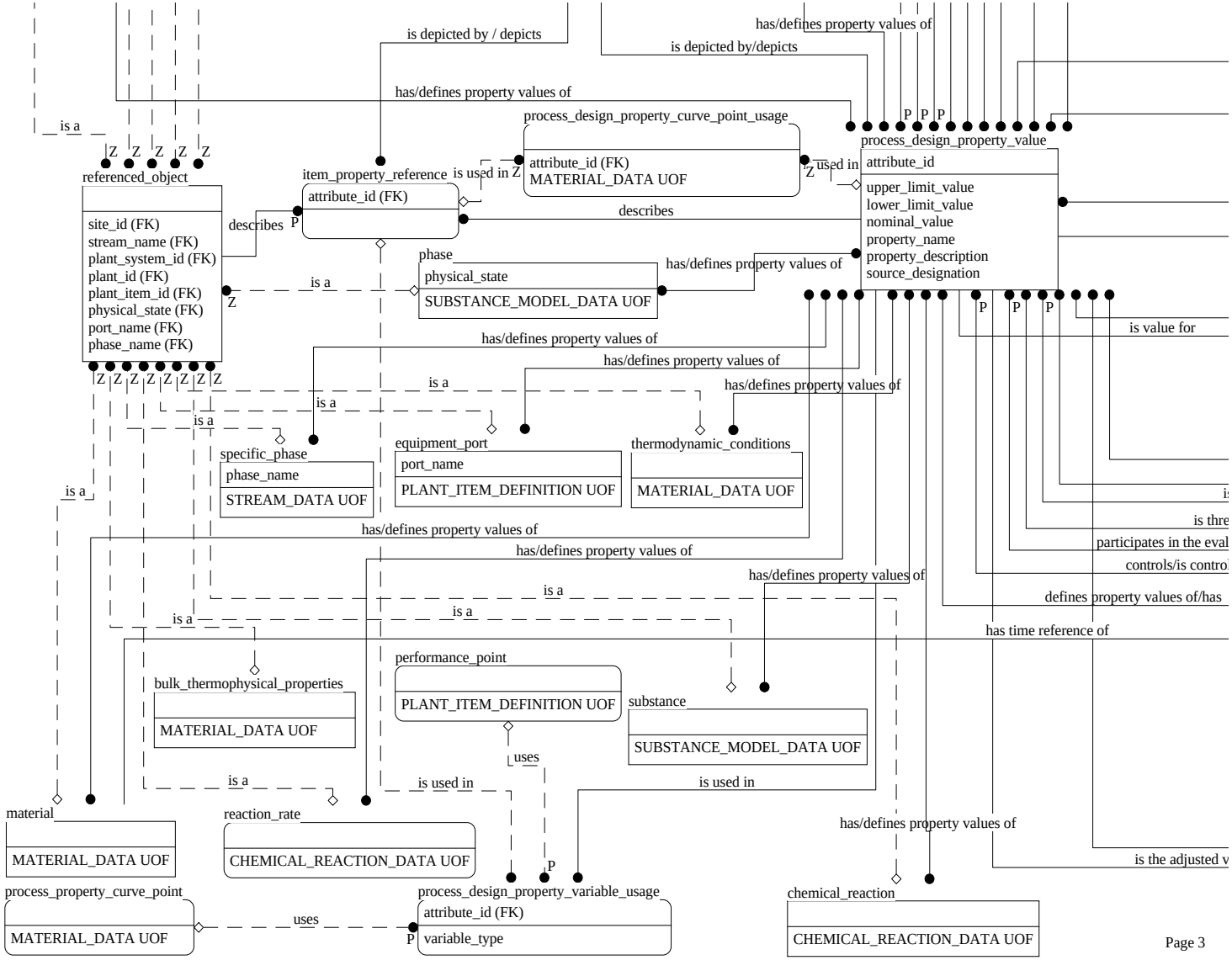


Figure G.26 - ARM Plant_context UoF diagram 3 of 4

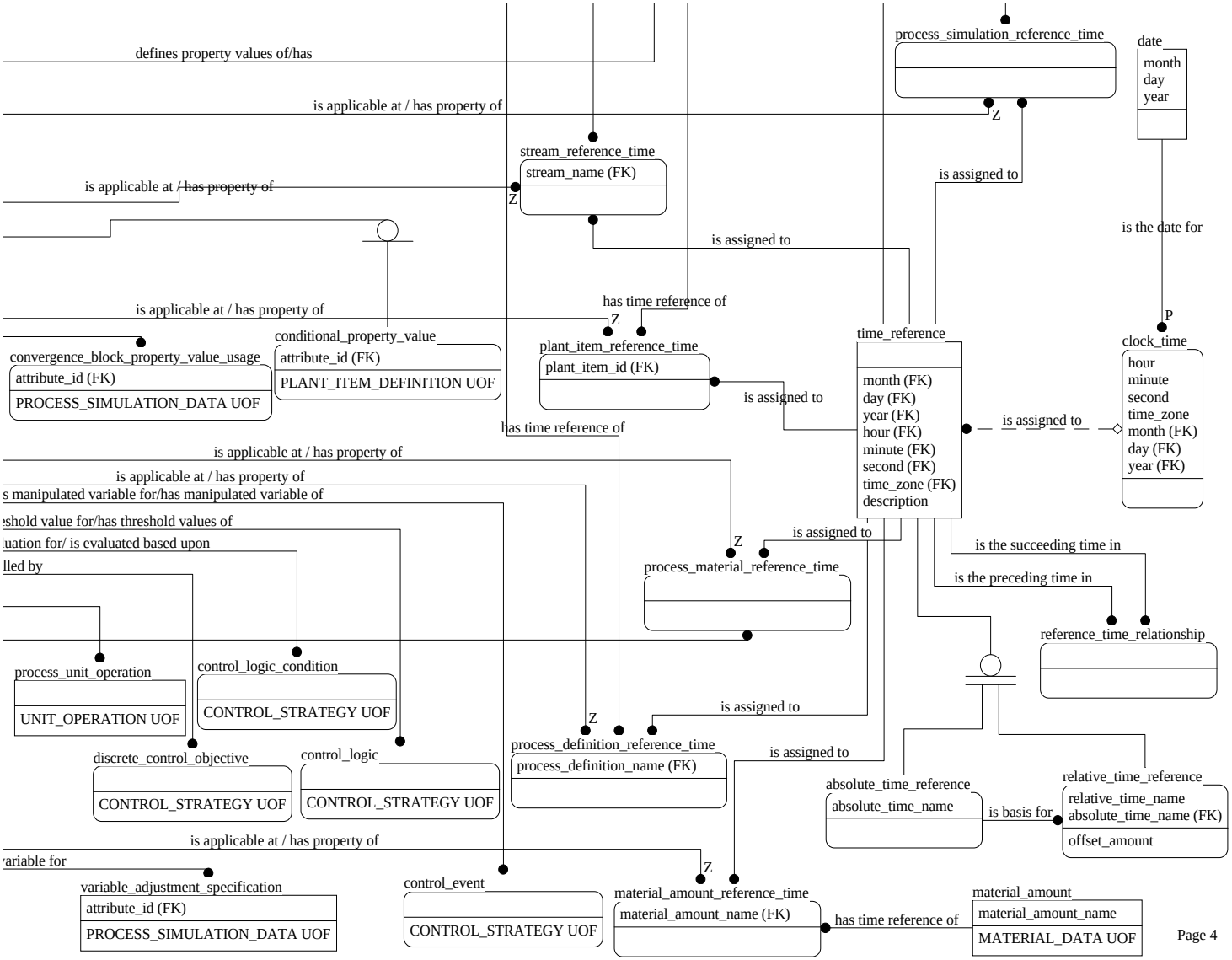


Figure G.27 - ARM Plant_context UoF diagram 4 of 4

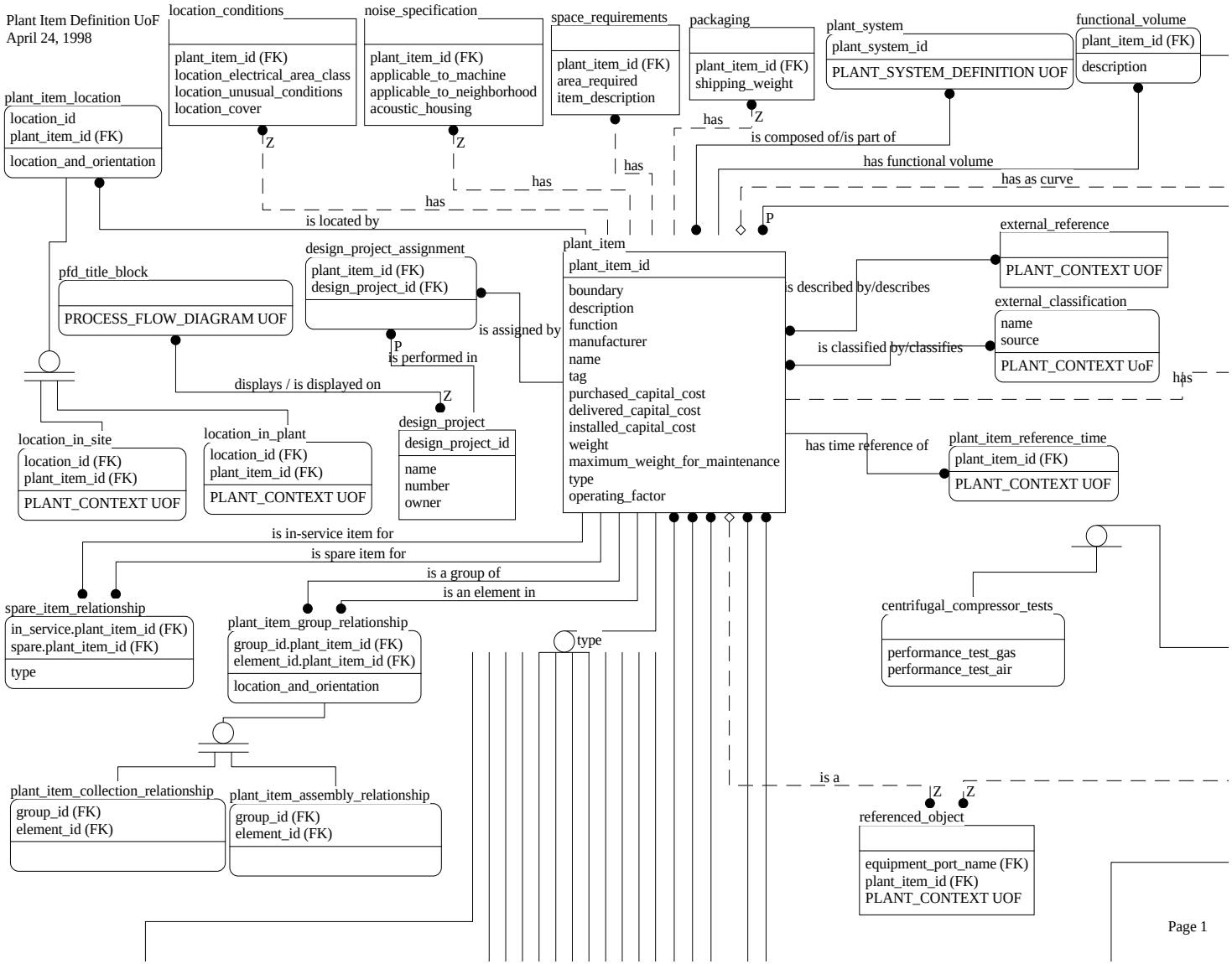


Figure G.28 - ARM Plant_item_data UoF diagram 1 of 6

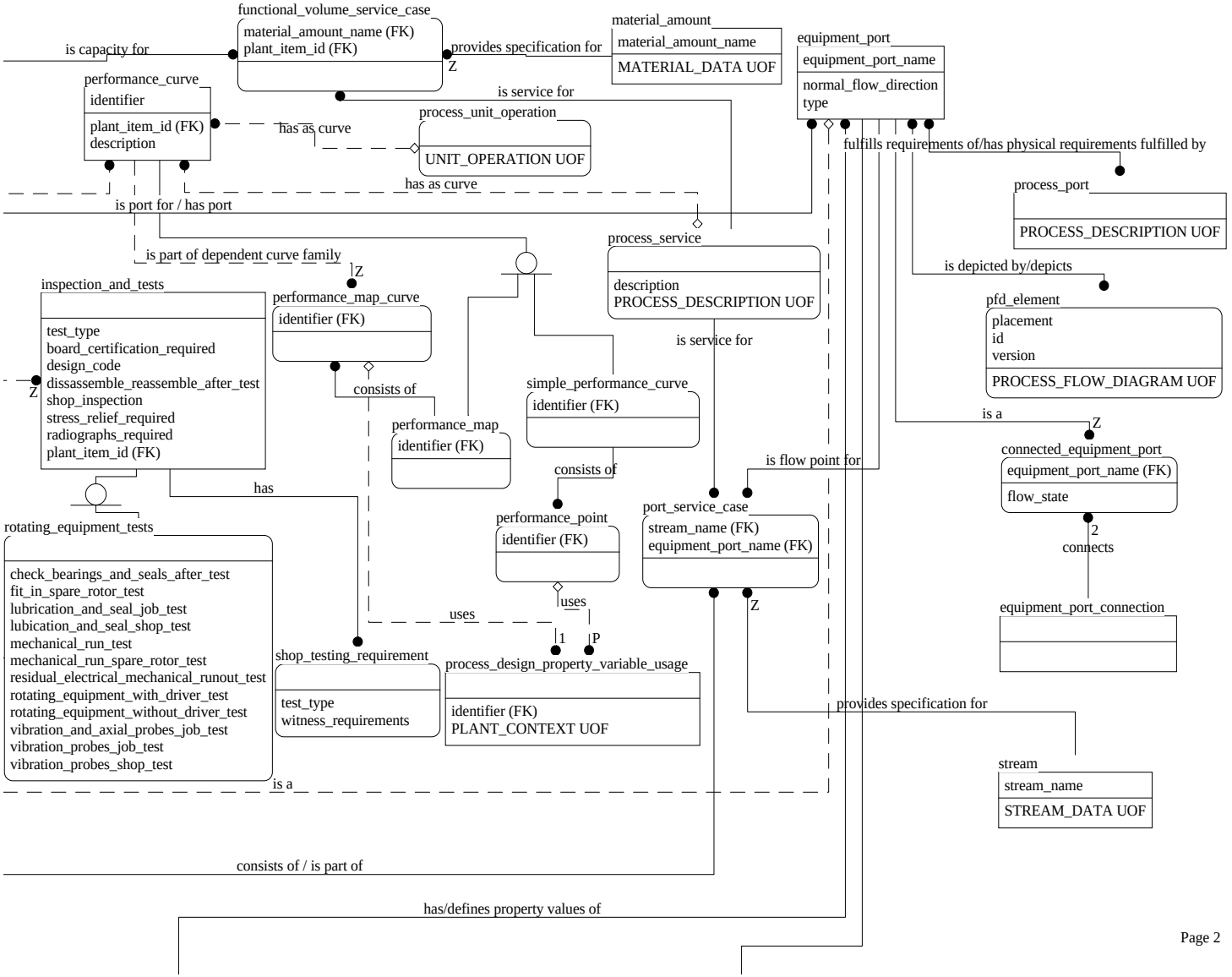


Figure G.29 - ARM Plant_item_data UoF diagram 2 of 6

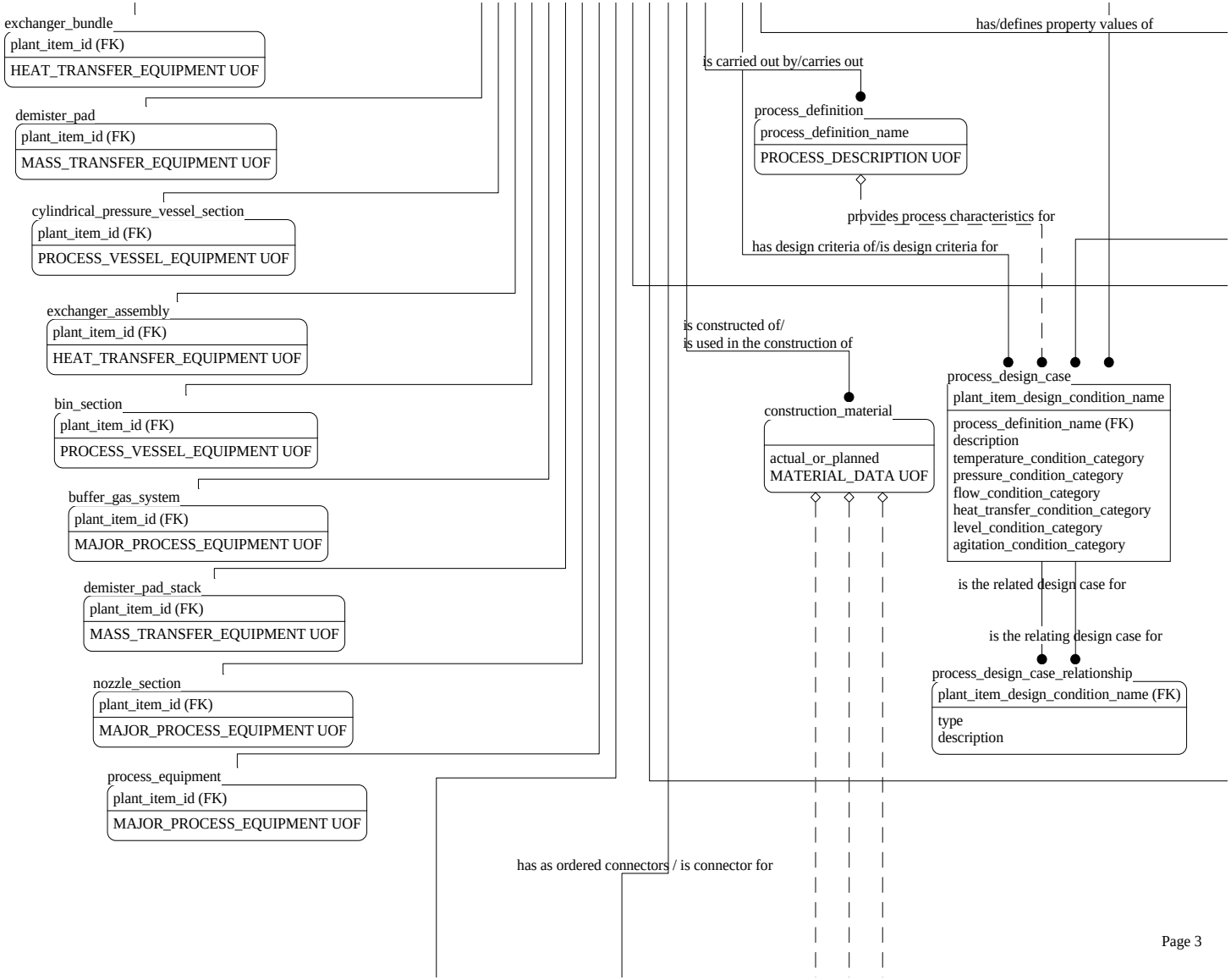
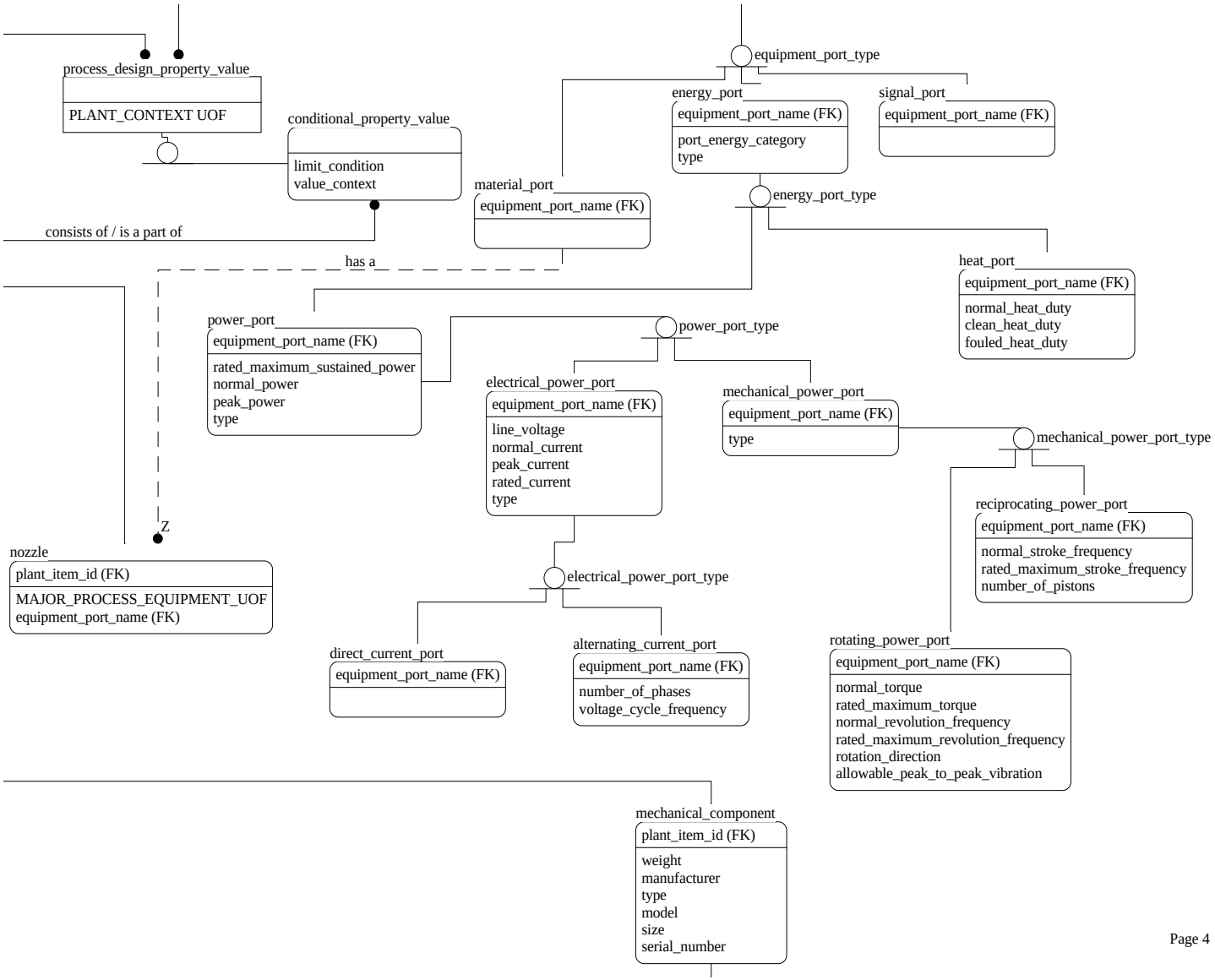


Figure G.30 - ARM Plant_item_data UoF diagram 3 of 6



Page 4

Figure G.31 - ARM Plant_item_data UoF diagram 4 of 6

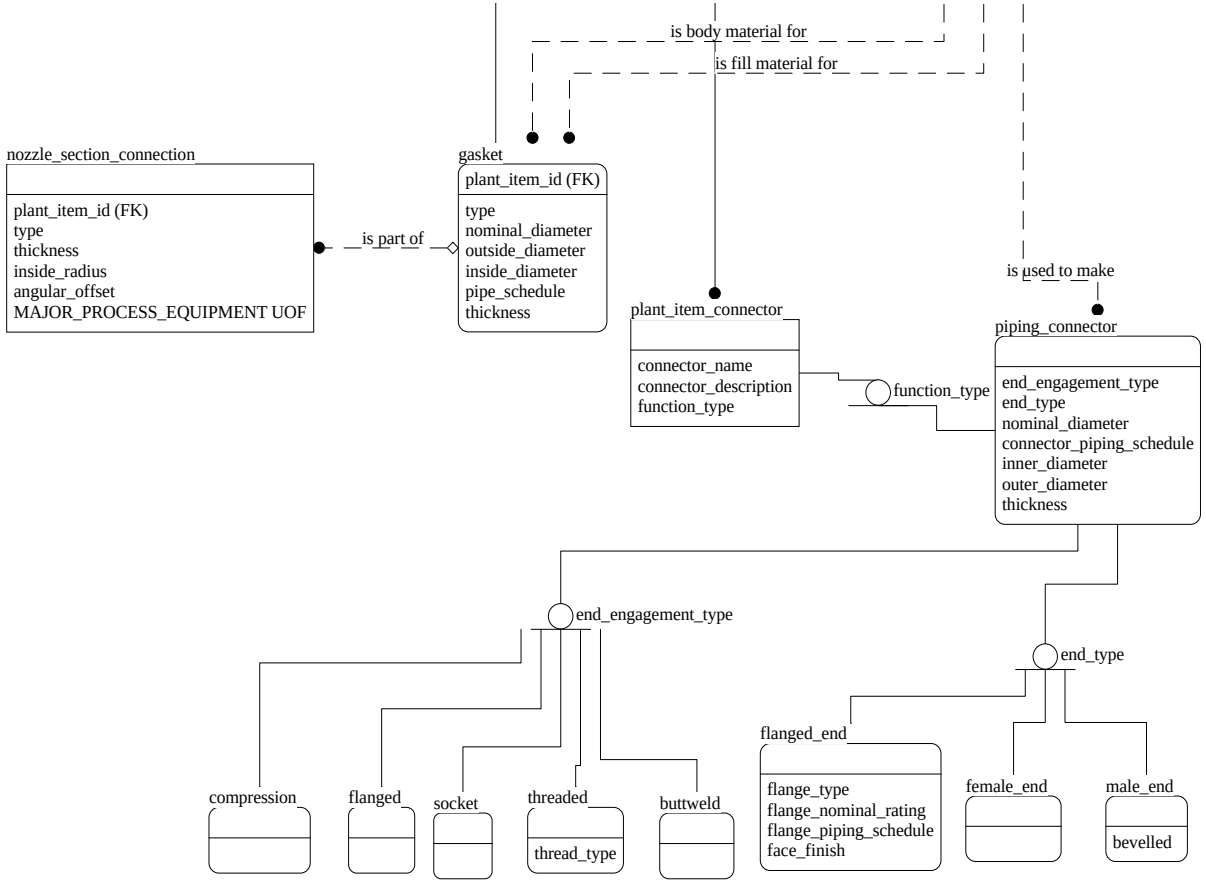


Figure G.32 - ARM Plant_item_data UoF diagram 5 of 6

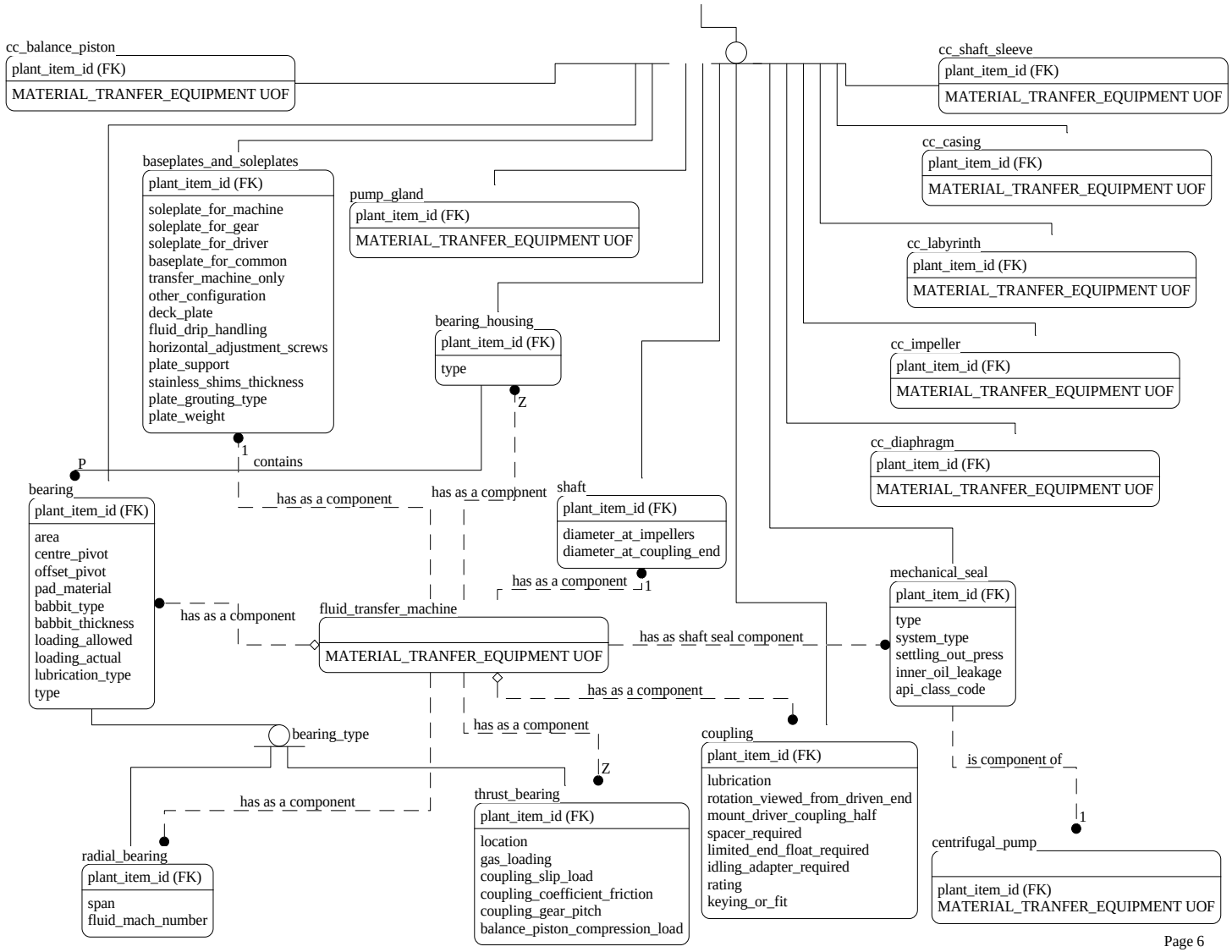


Figure G.33 - ARM Plant_item_data UoF diagram 6 of 6

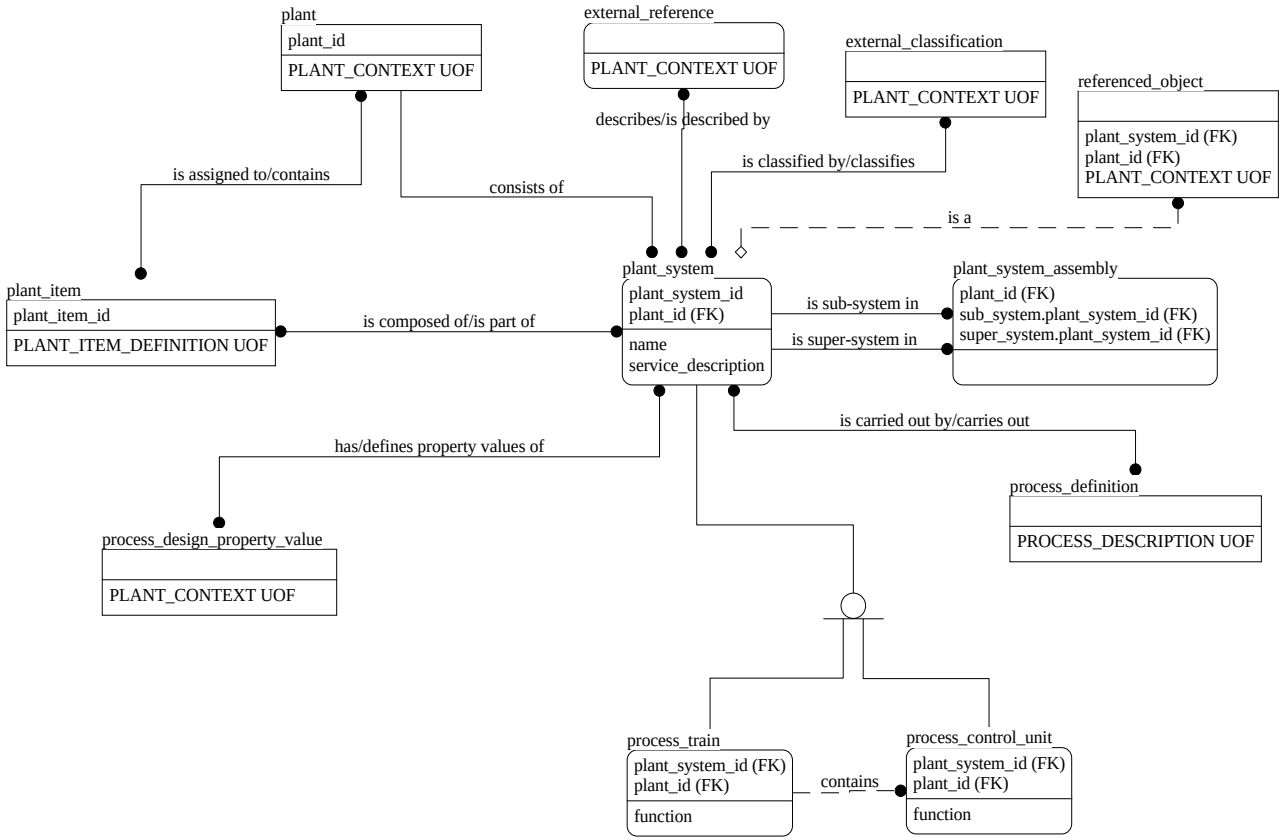


Figure G.34 - ARM Plant_system_definition UoF diagram 1 of 1

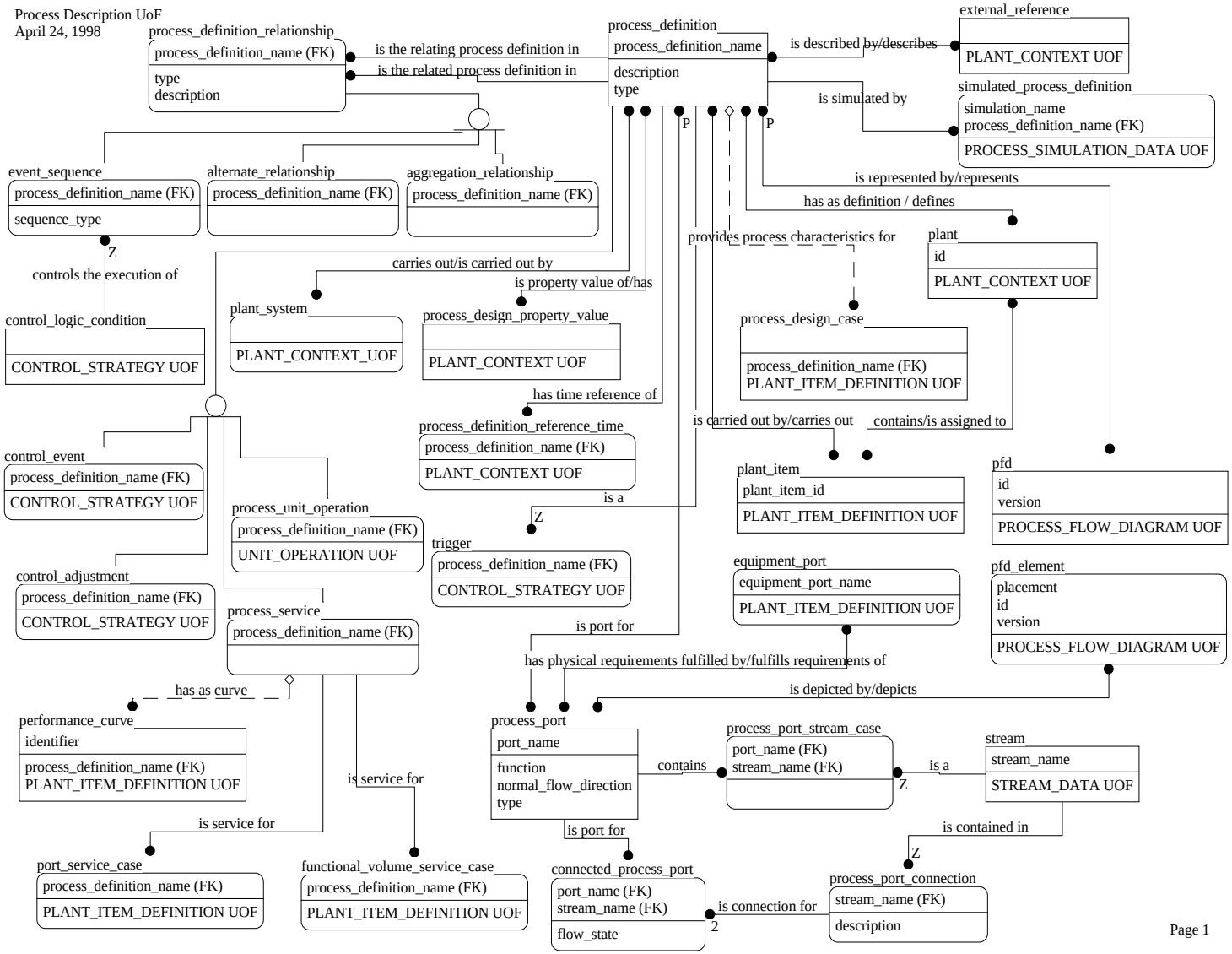


Figure G.35 - ARM Process_description UoF diagram 1 of 1

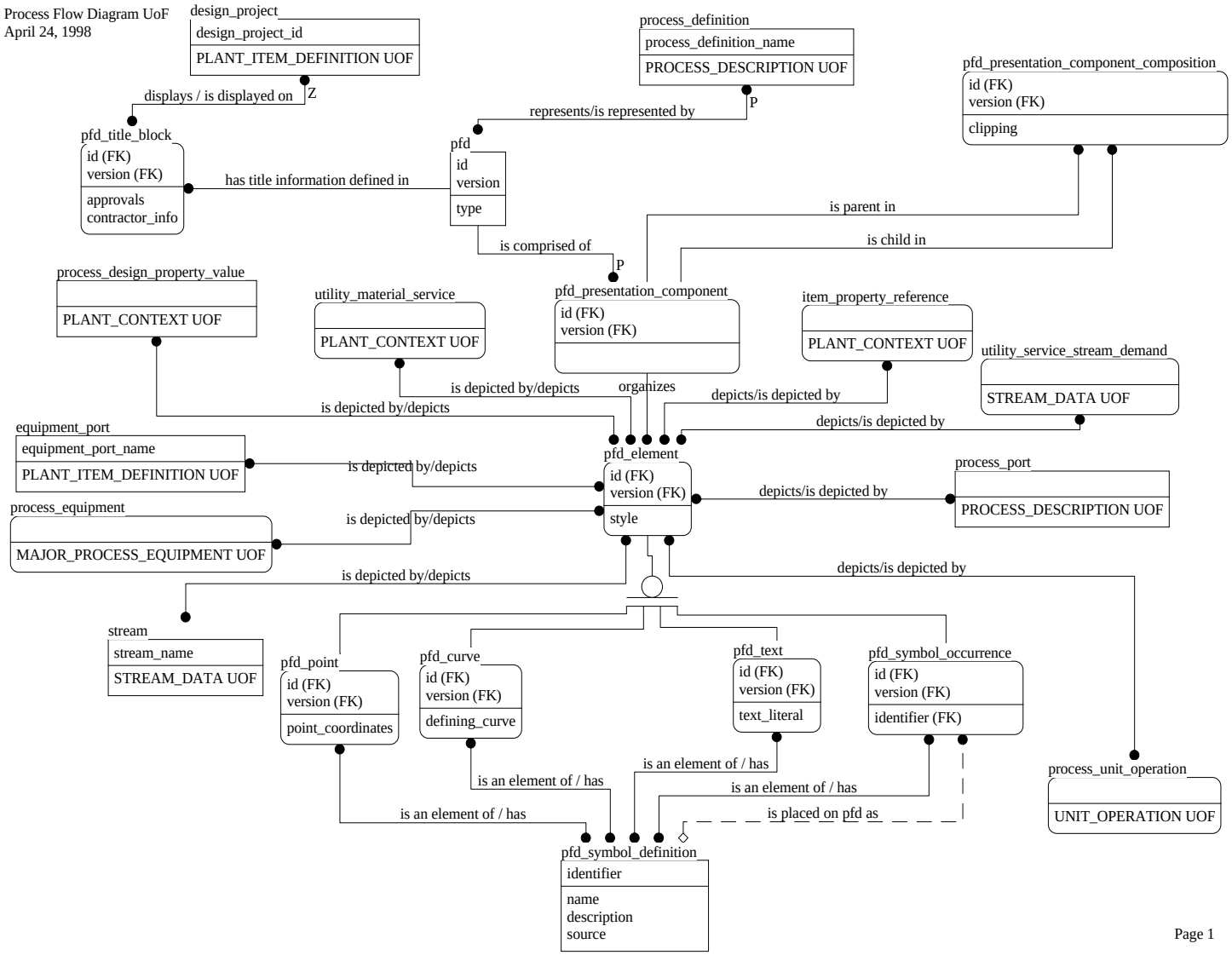


Figure G.36 - ARM Process_flow_diagram UoF diagram 1 of 1

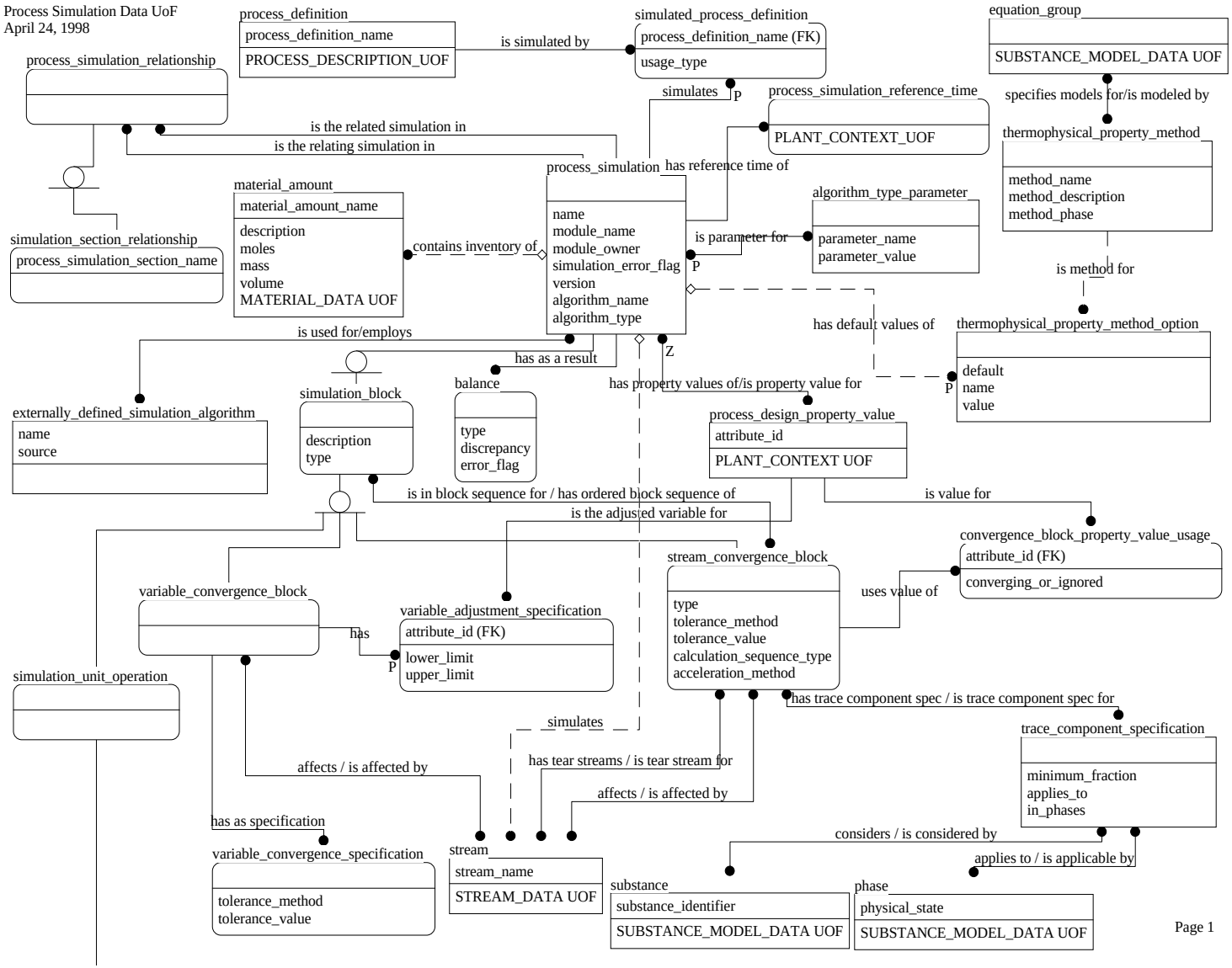


Figure G.37 - ARM Process_simulation_data UoF diagram 1 of 2

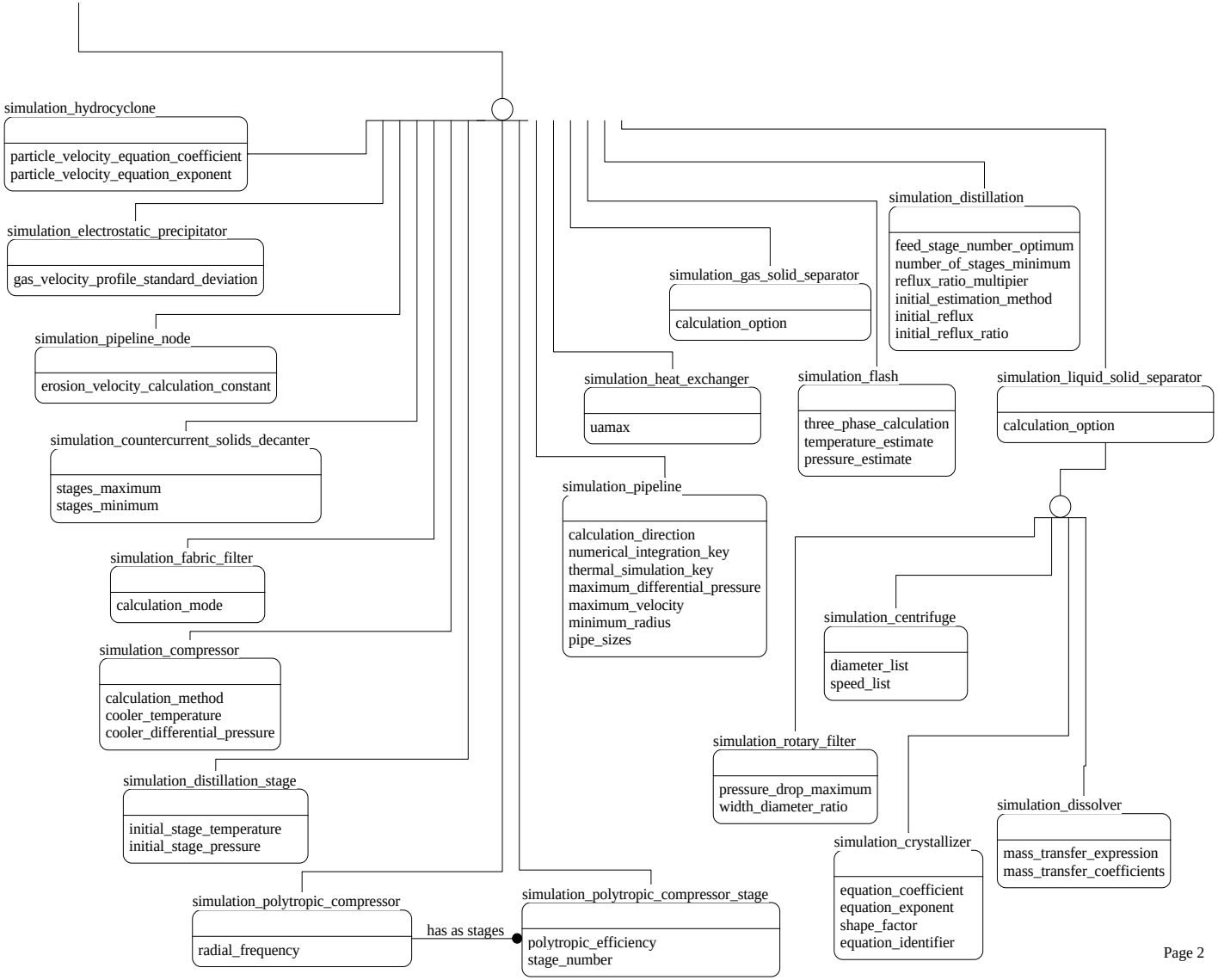


Figure G.38 - ARM Process_simulation_data UoF diagram 2 of 2

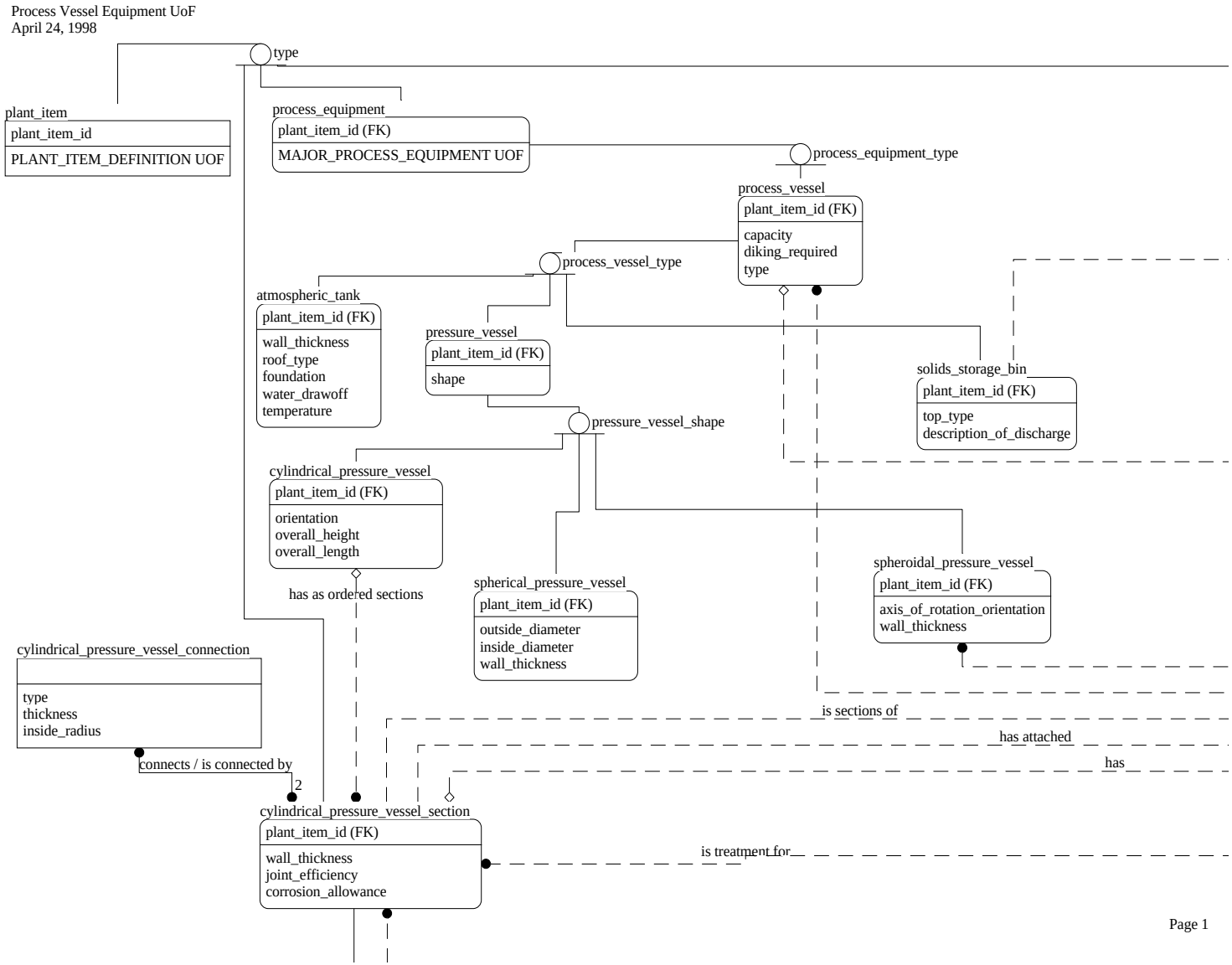


Figure G.39 - ARM Process_vessel_equipment_data UoF diagram 1 of 4

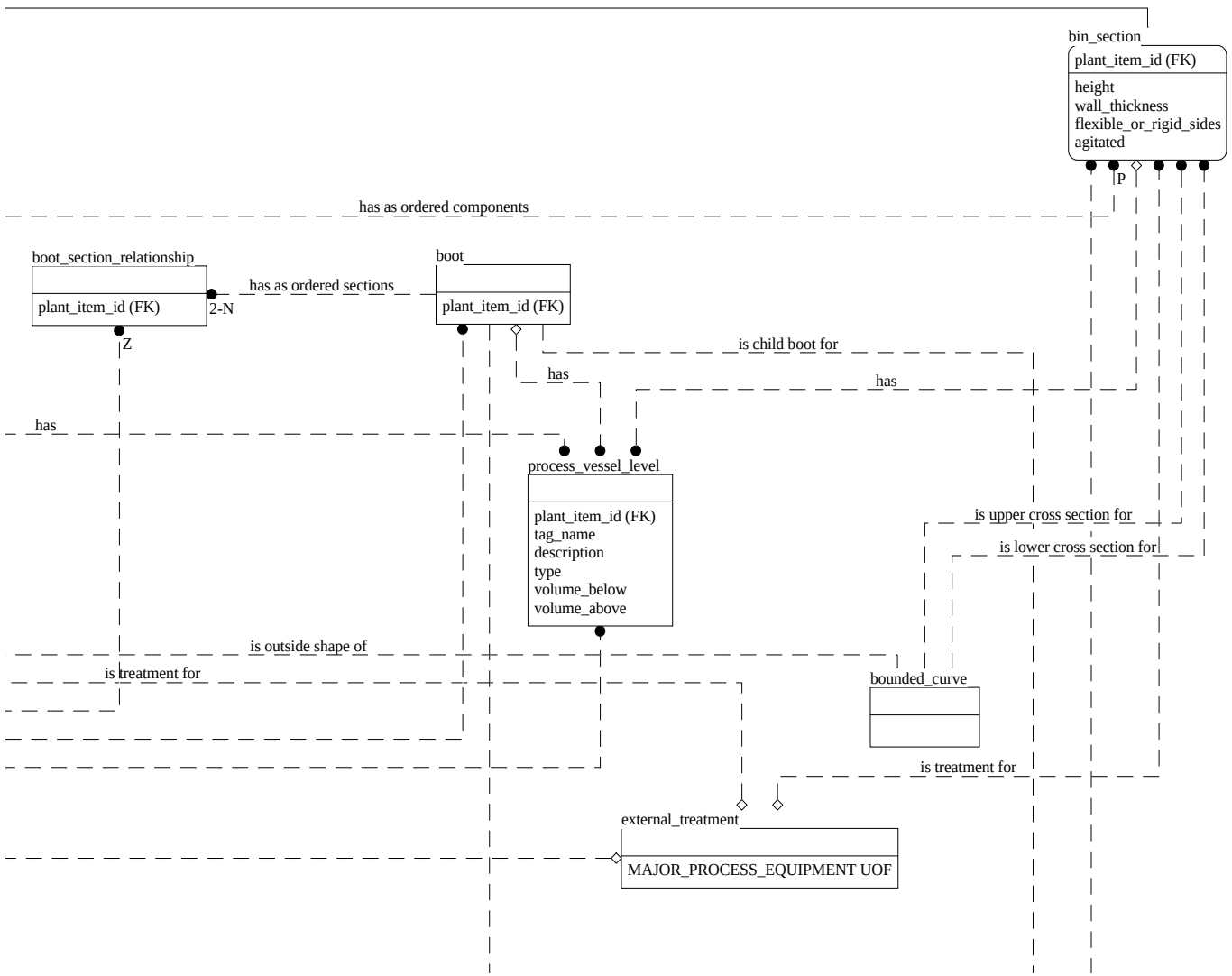


Figure G.40 - ARM Process_vessel_equipment_data UoF diagram 2 of 4

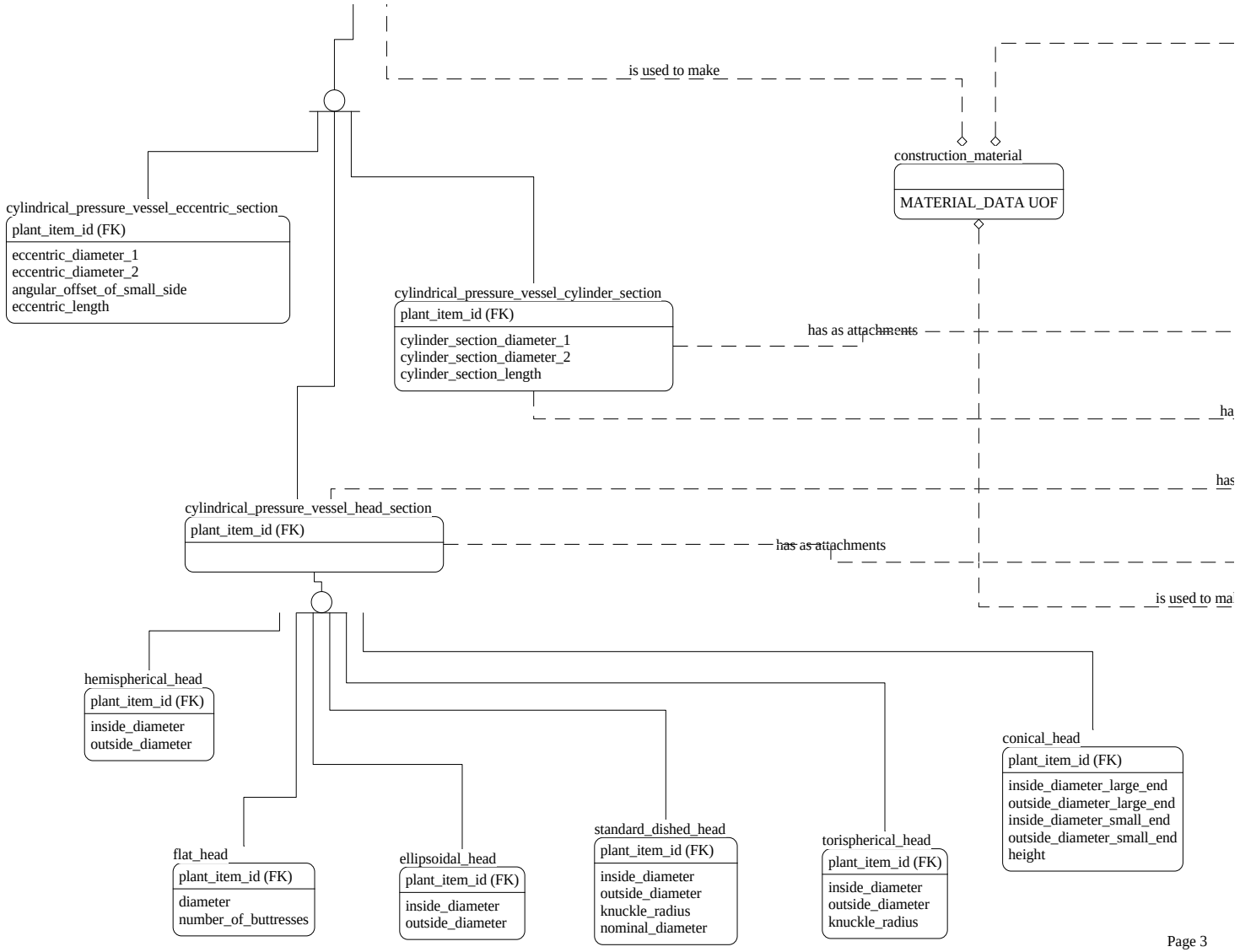


Figure G.41 - ARM Process_vessel_equipment_data UoF diagram 3 of 4

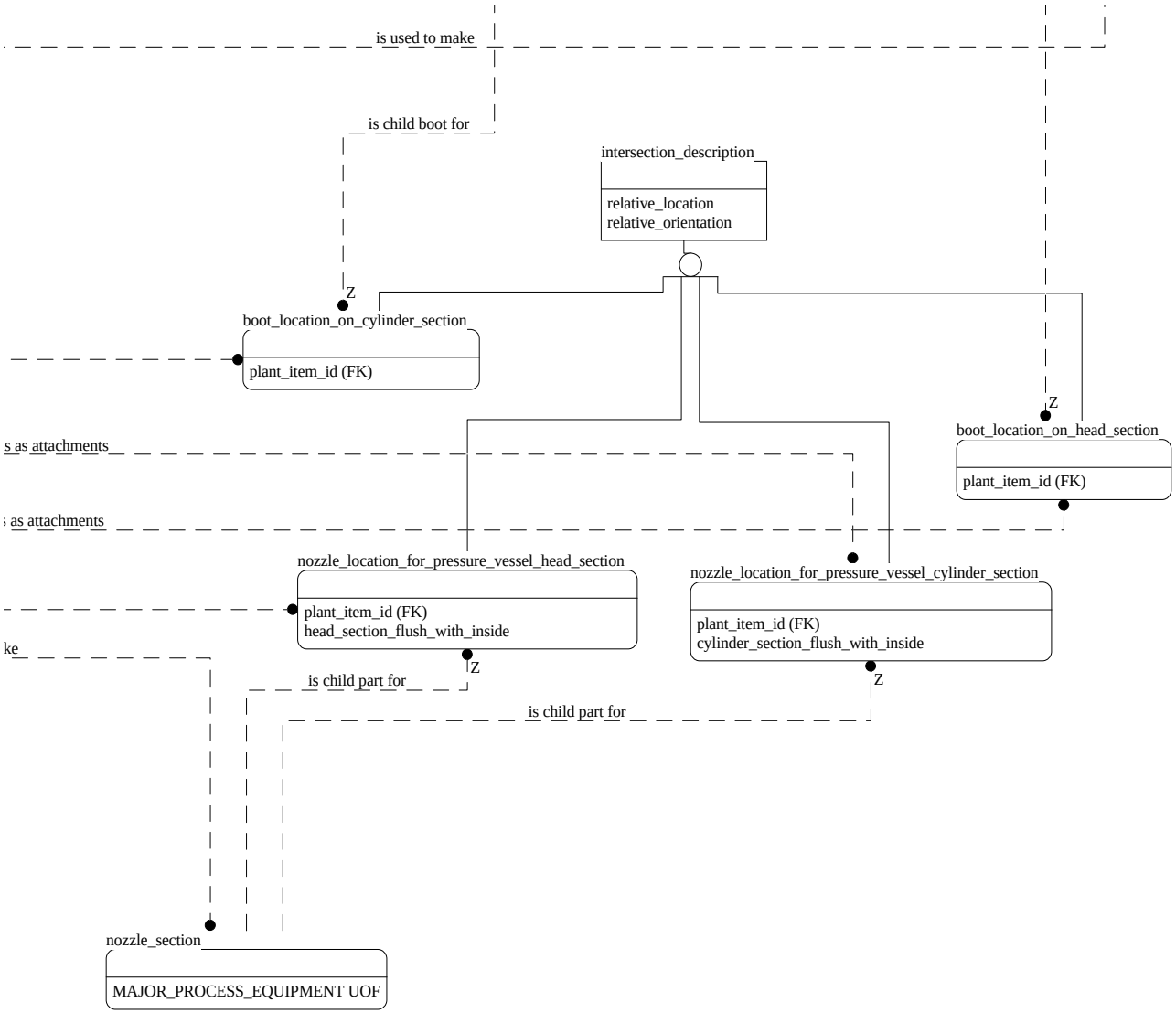


Figure G.42 - ARM Process_vessel_equipment_data UoF diagram 4 of 4

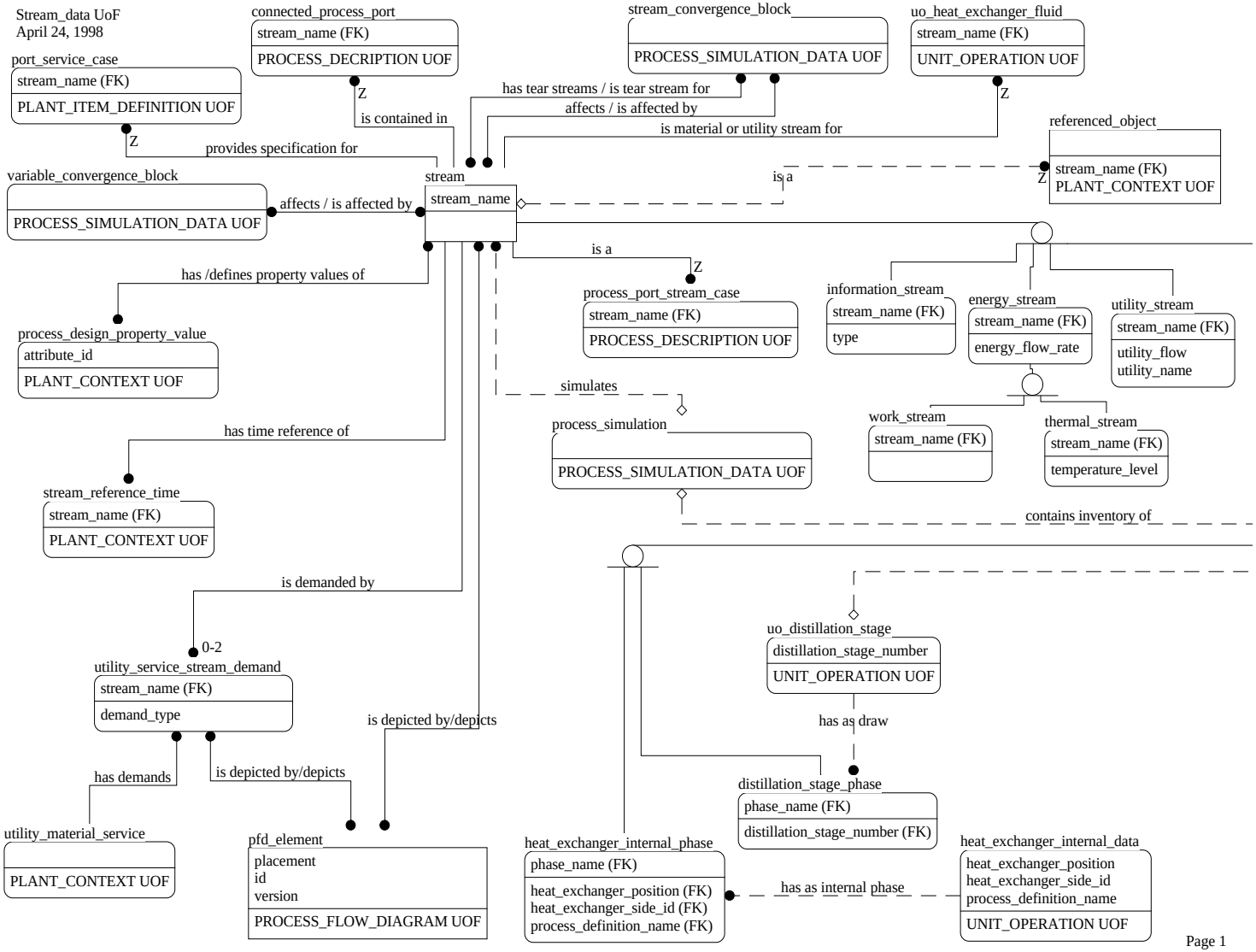


Figure G.43 - ARM Stream_data UoF diagram 1 of 3

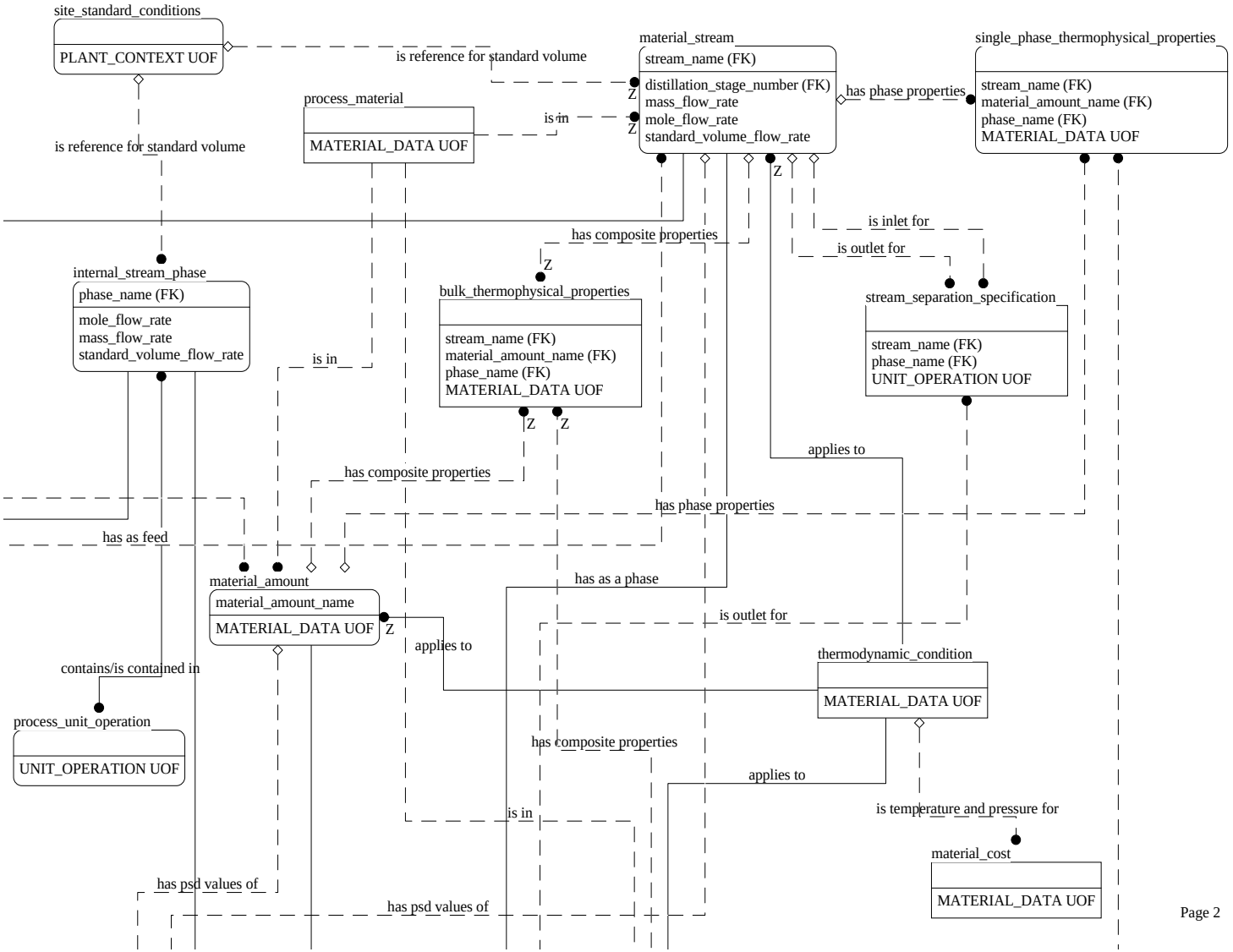


Figure G.44 - ARM Stream_data UoF diagram 2 of 3

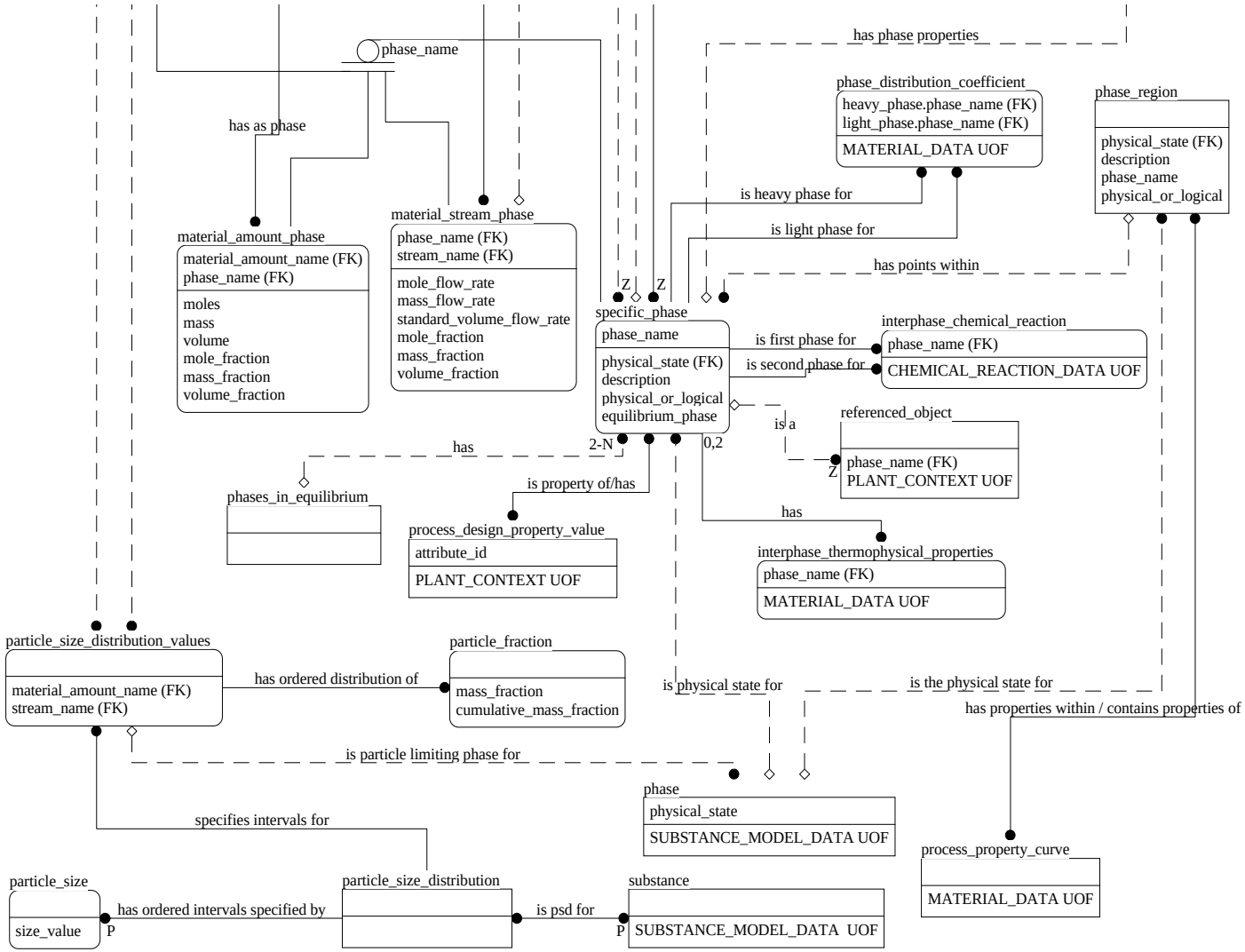


Figure G.45 - ARM Stream_data UoF diagram 3 of 3

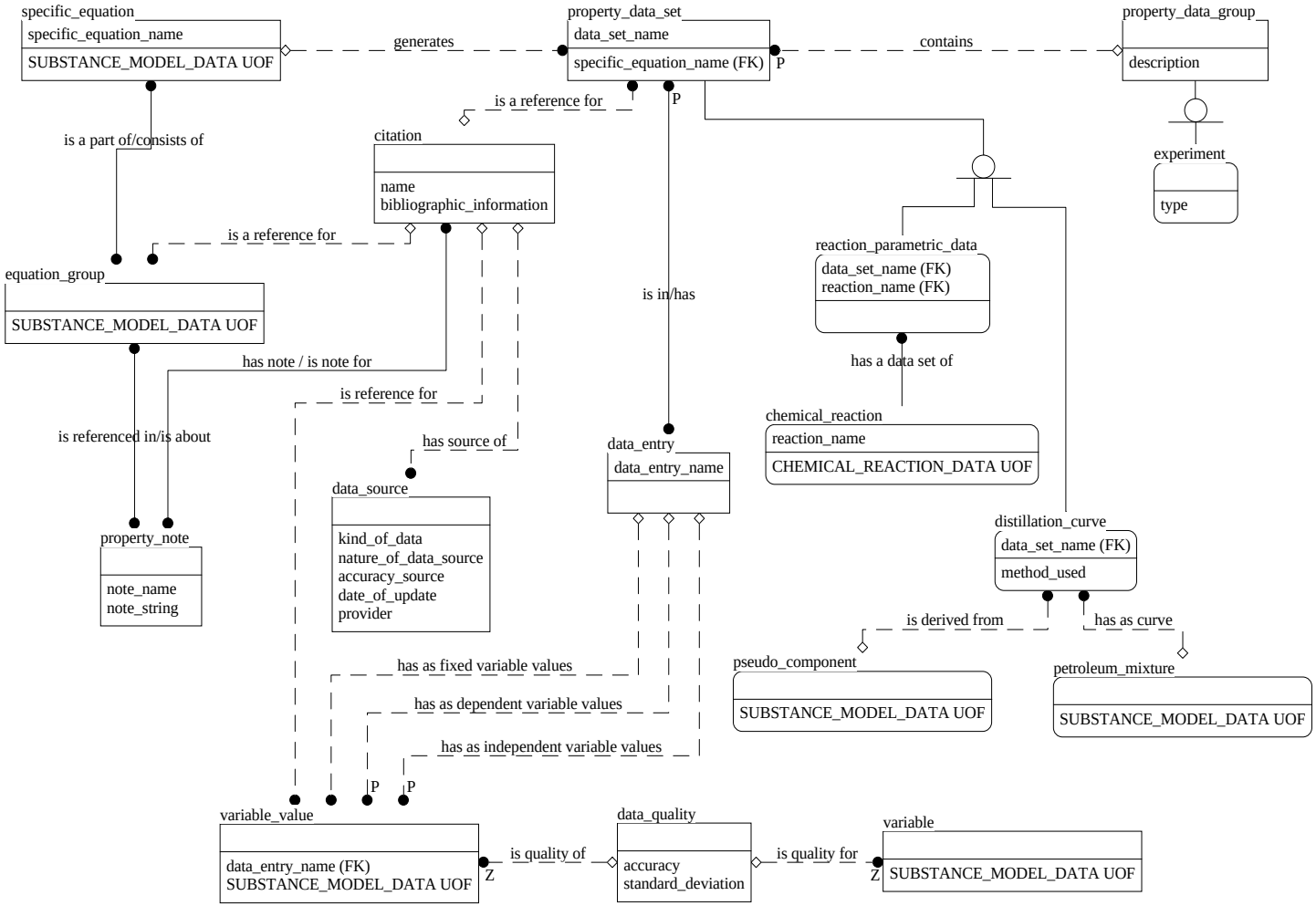


Figure G.46 - ARM Substance_experimental_data UoF diagram 1 of 1

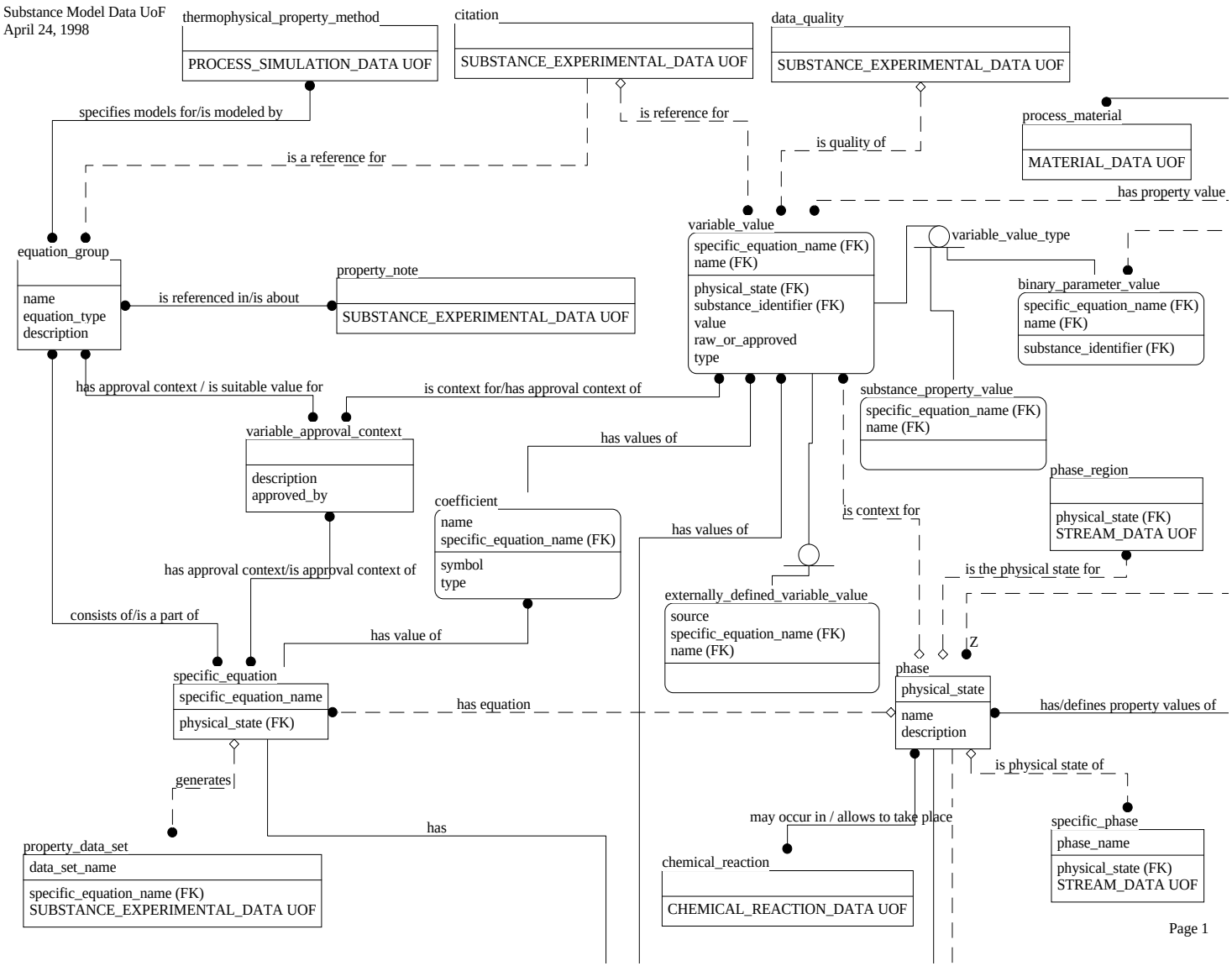


Figure G.47 - ARM Substance_model_data UoF diagram 1 of 3

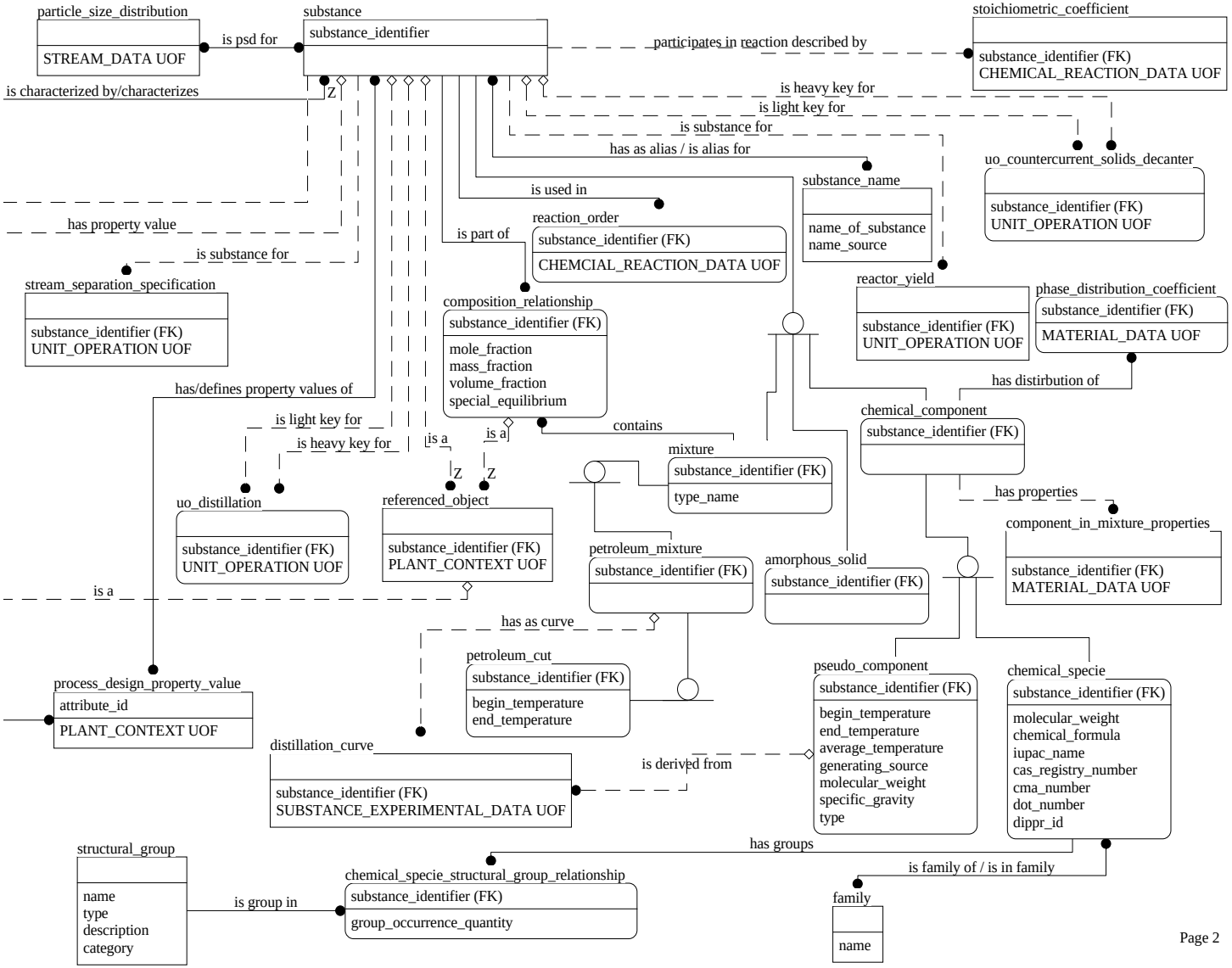
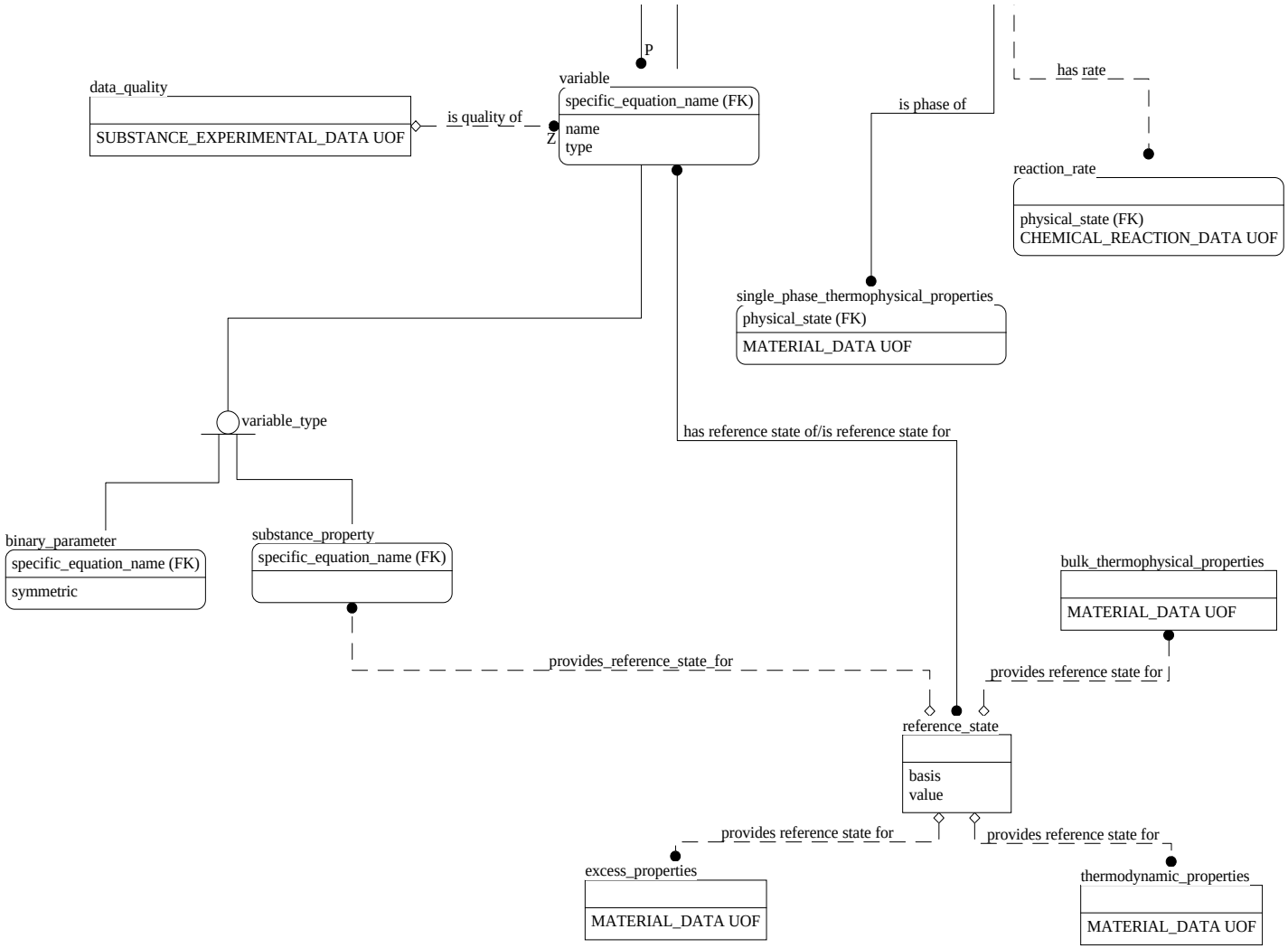


Figure G.48 - ARM Substance_model_data UoF diagram 2 of 3



Page 3

Figure G.49 - ARM Substance_model_data UoF diagram 3 of 3

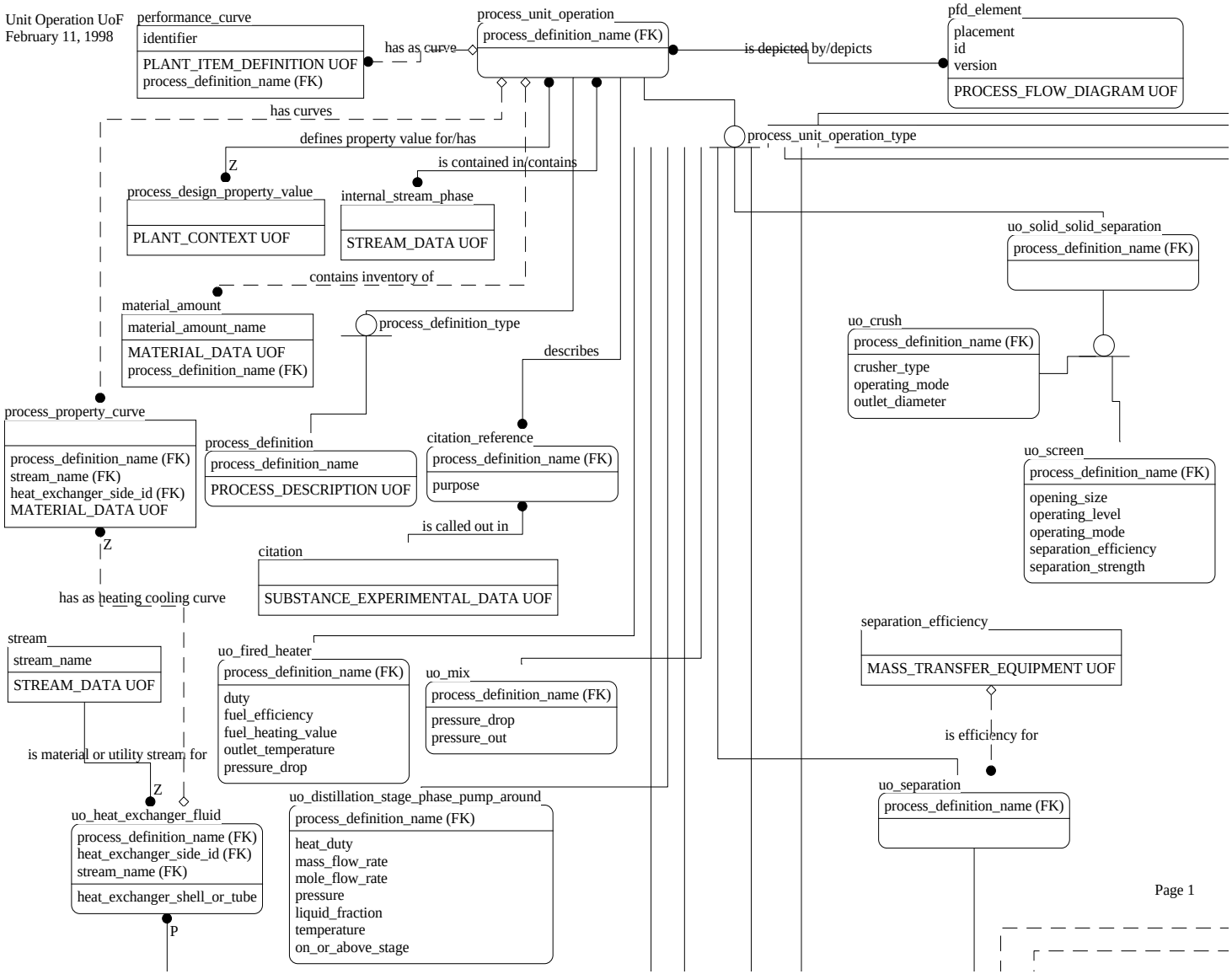


Figure G.50 - ARM Unit_operation UoF diagram 1 of 6

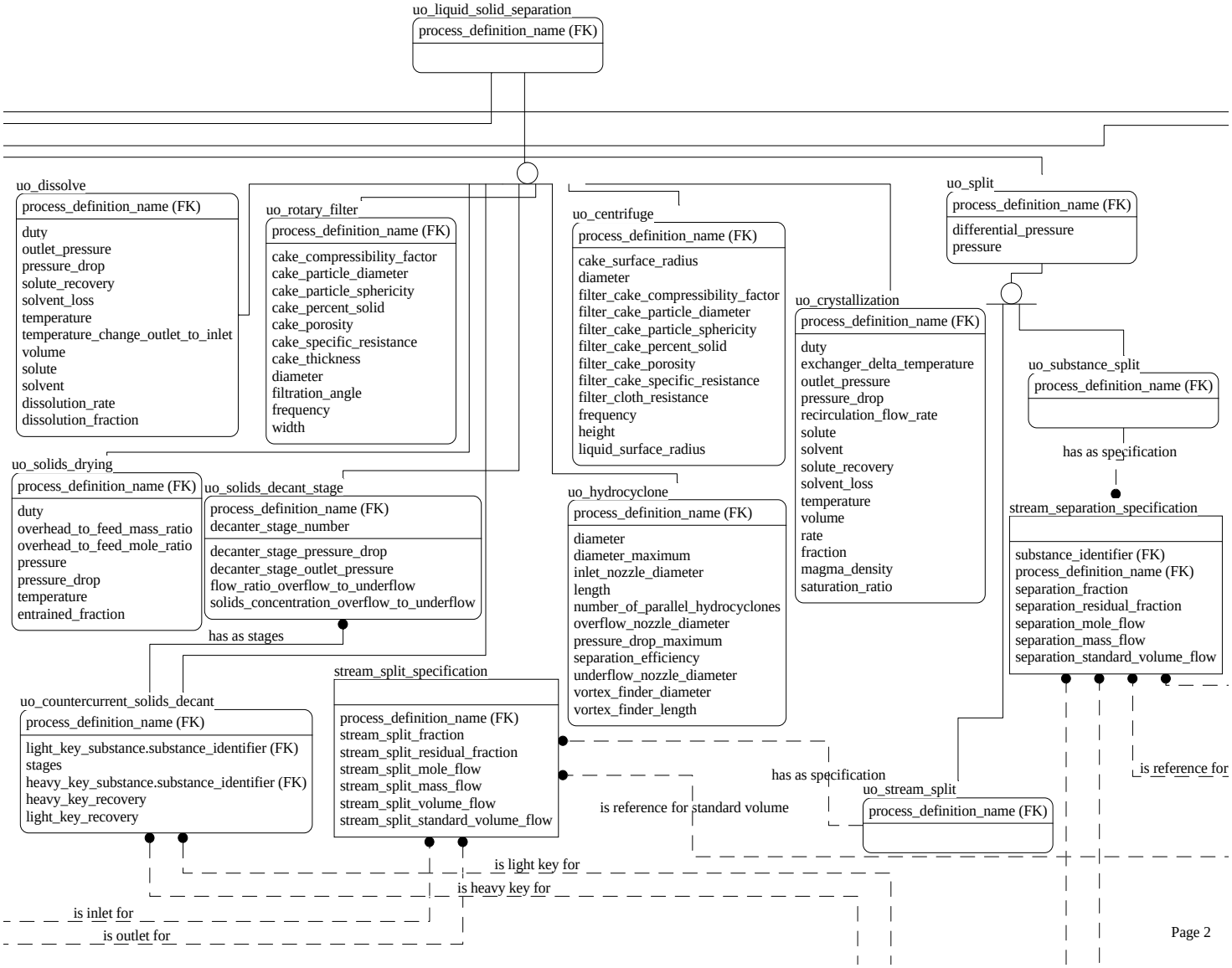


Figure G.51 - ARM Unit_operation UoF diagram 2 of 6

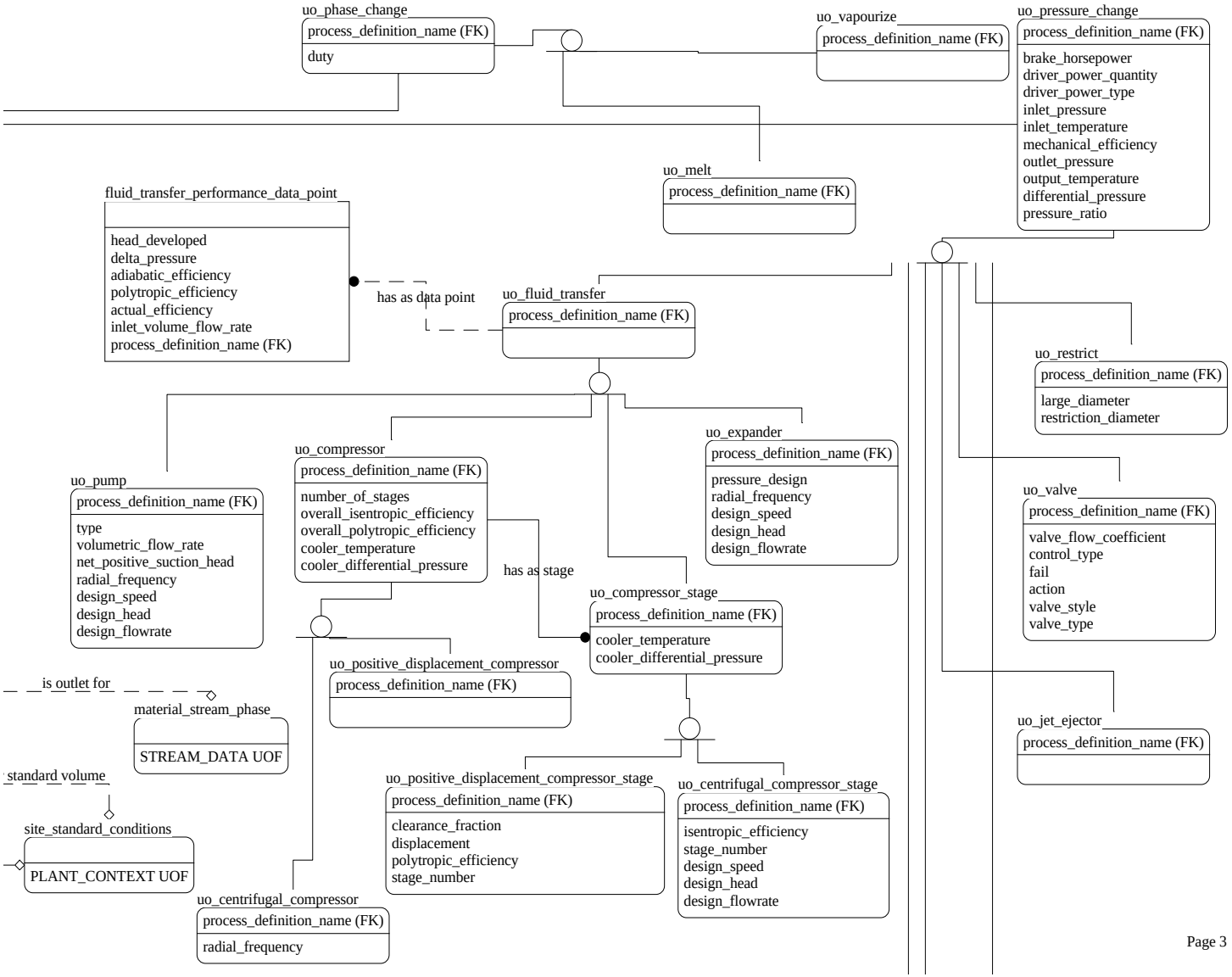


Figure G.52 - ARM Unit_operation UoF diagram 3 of 6

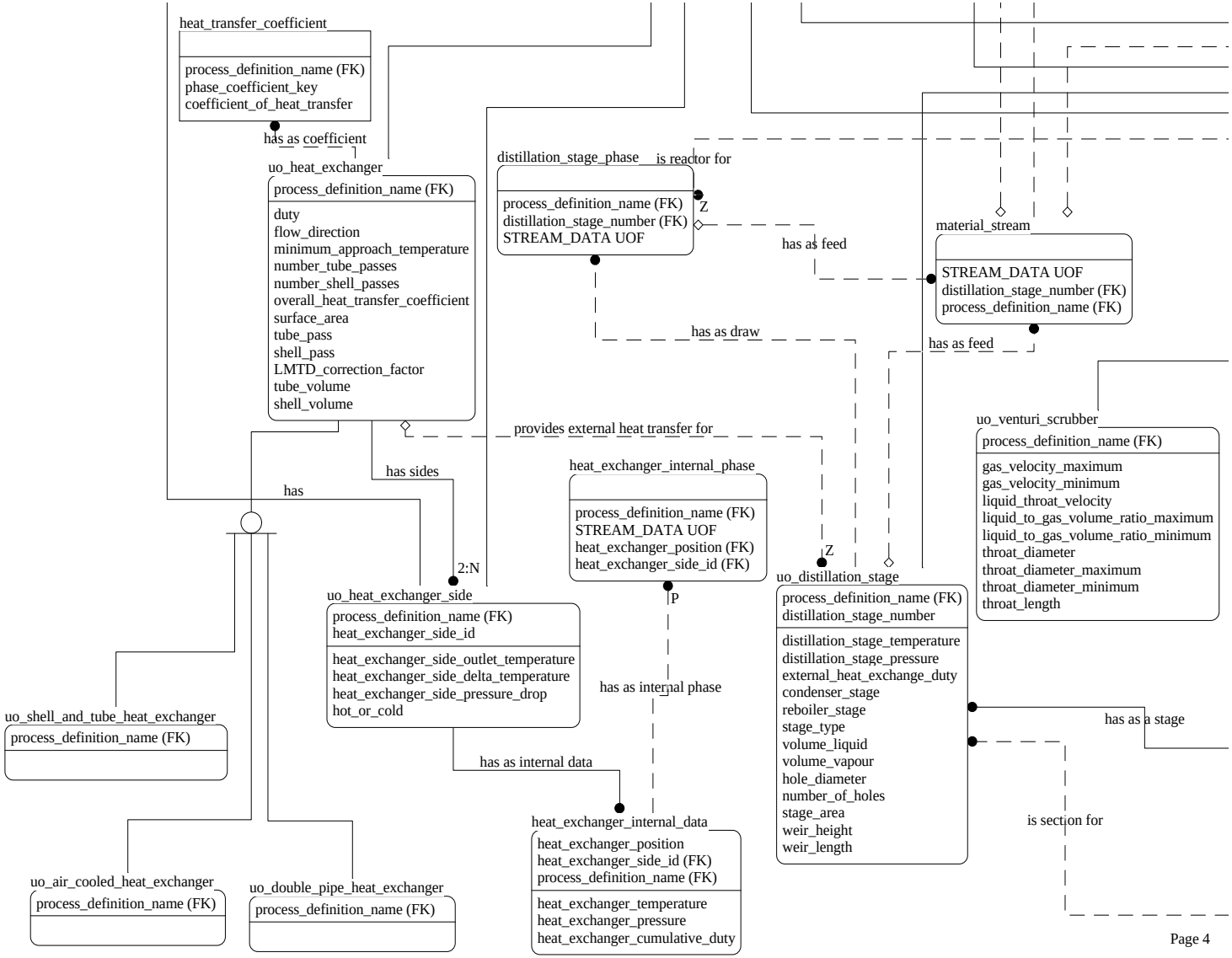


Figure G.53 - ARM Unit_operation UoF diagram 4 of 6

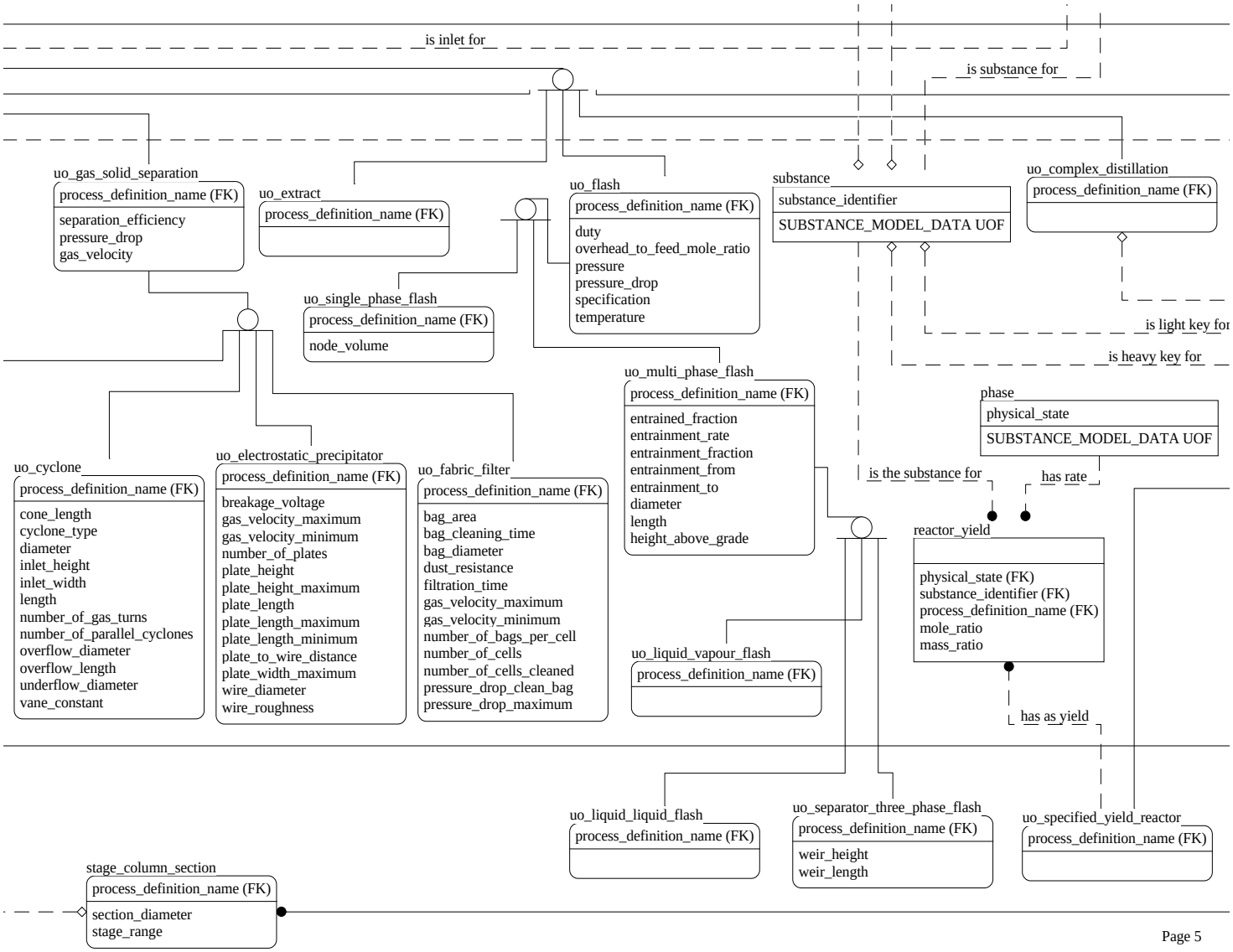
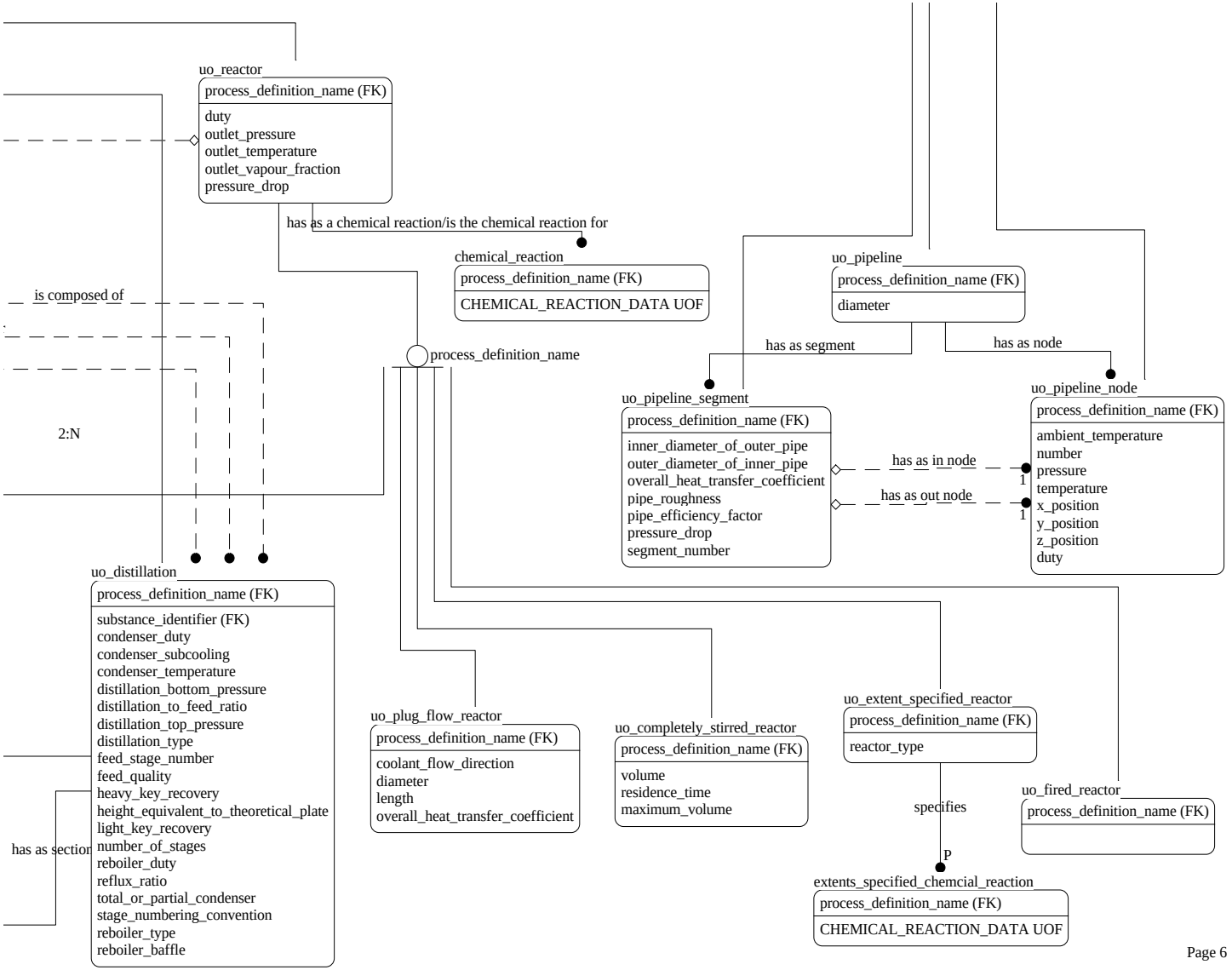


Figure G.54 - ARM Unit_operation UoF diagram 5 of 6



Page 6

Figure G.55 - ARM Unit_operation UoF diagram 6 of 6

Annex H
(informative)

AIM EXPRESS-G

Figures H.1 through H.55 correspond to the AIM EXPRESS expanded listing given in annex A. The diagrams use the EXPRESS-G graphical notation for the EXPRESS language. EXPRESS-G is defined in annex D of ISO 10303-11.

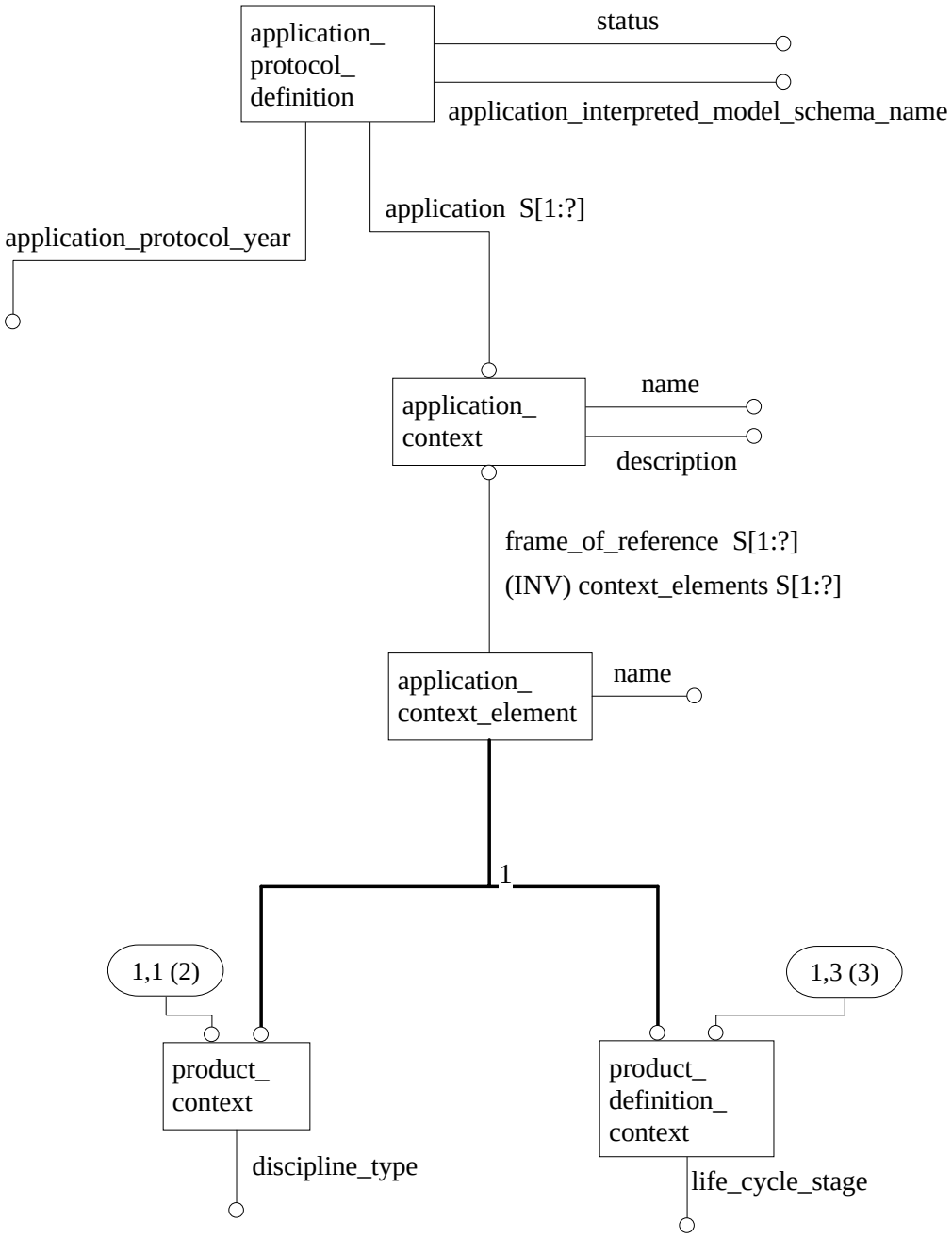


Figure H.1 - AIM EXPRESS-G diagram 1 of 55

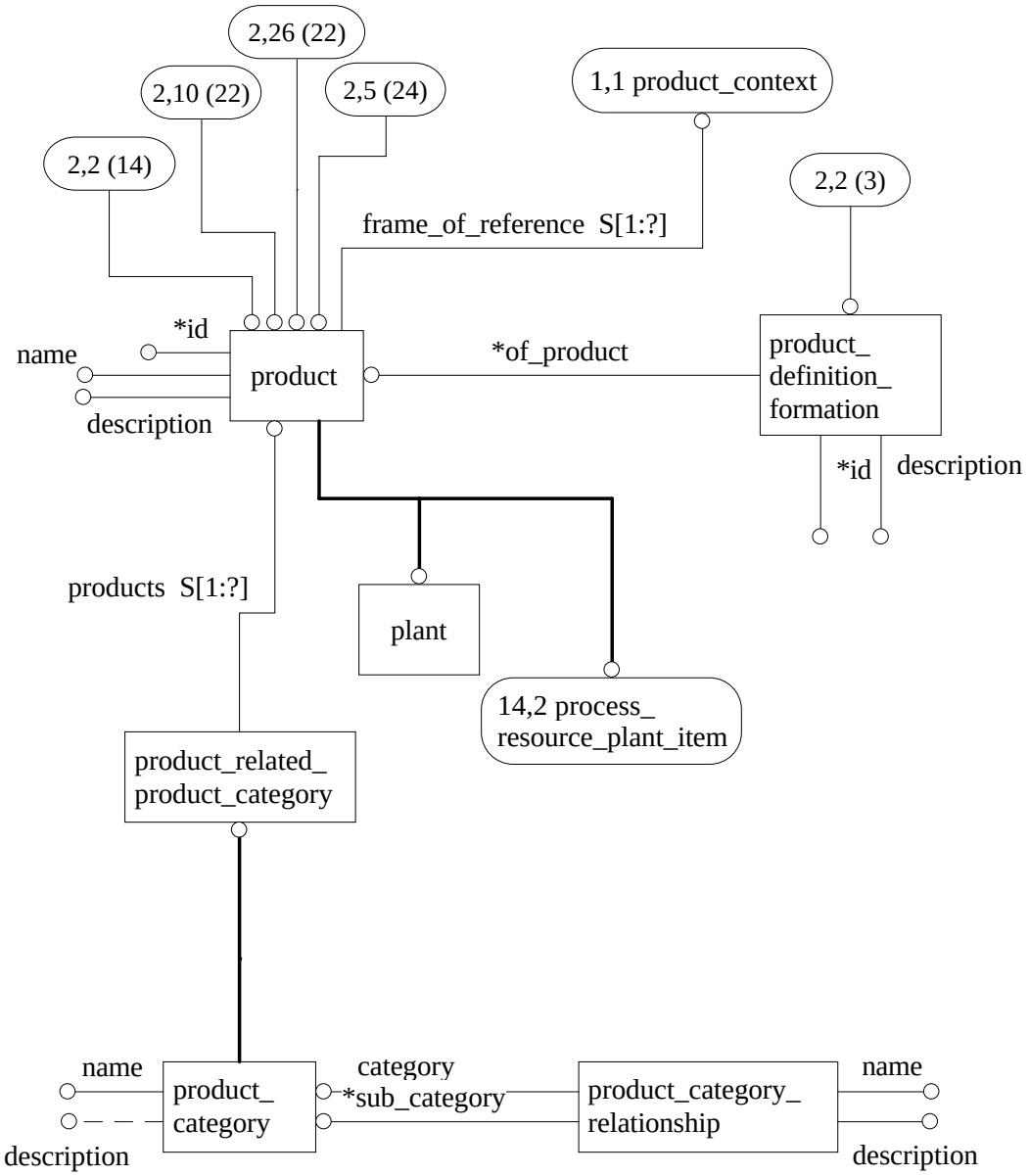


Figure H.2 - AIM EXPRESS-G diagram 2 of 55

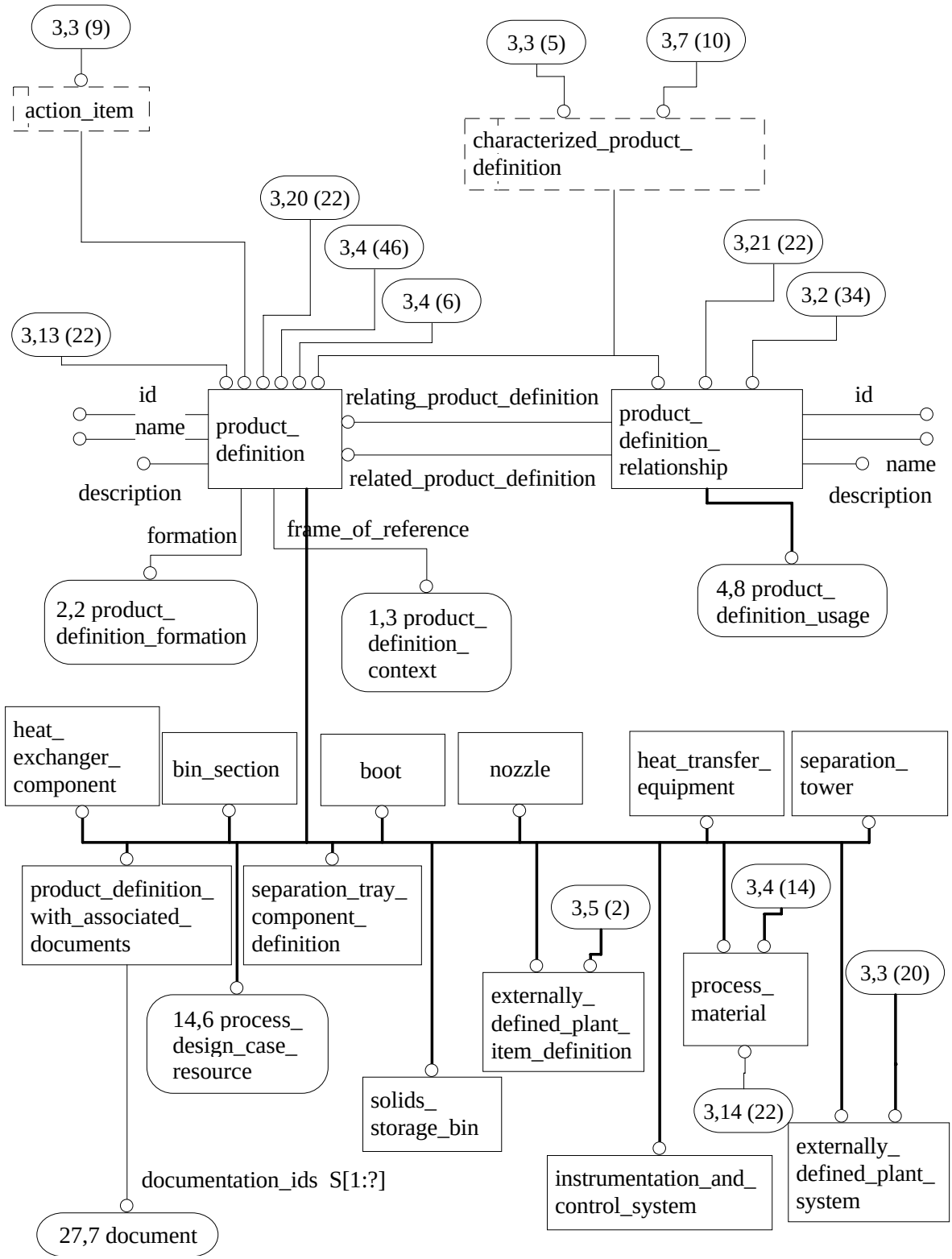


Figure H.3 - AIM EXPRESS-G diagram 3 of 55

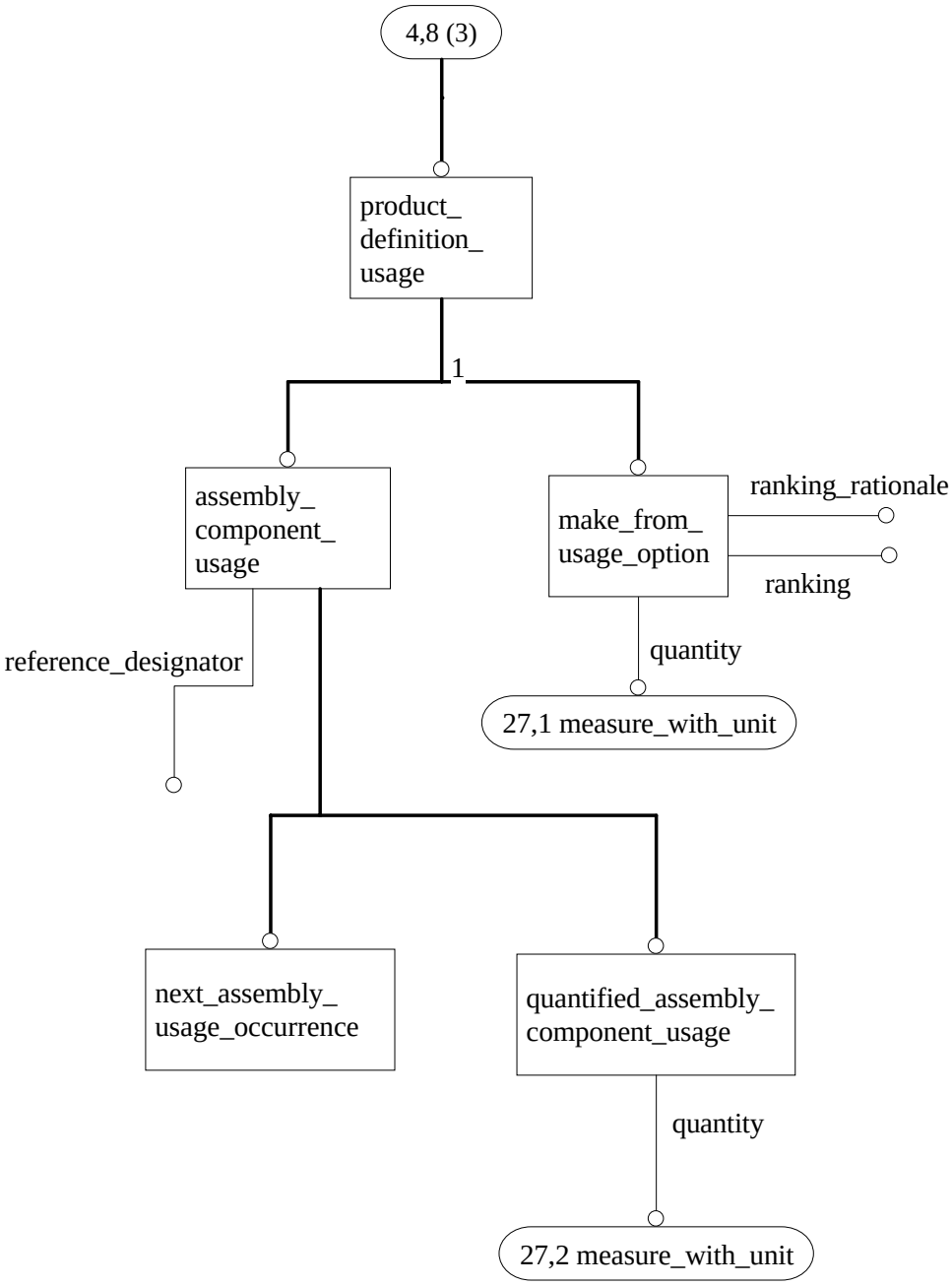


Figure H.4 - AIM EXPRESS-G diagram 4 of 55

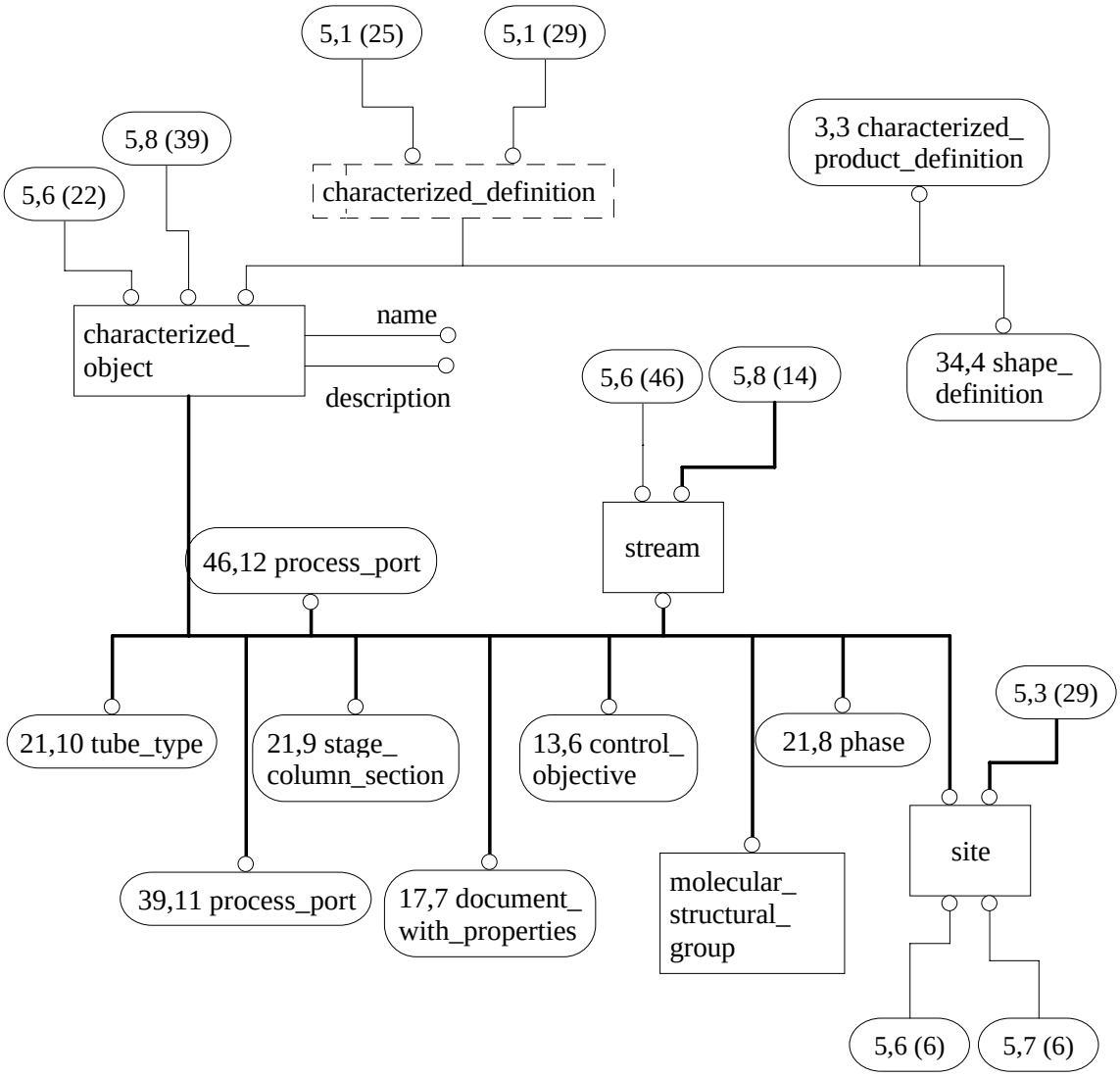


Figure H.5 - AIM EXPRESS-G diagram 5 of 55

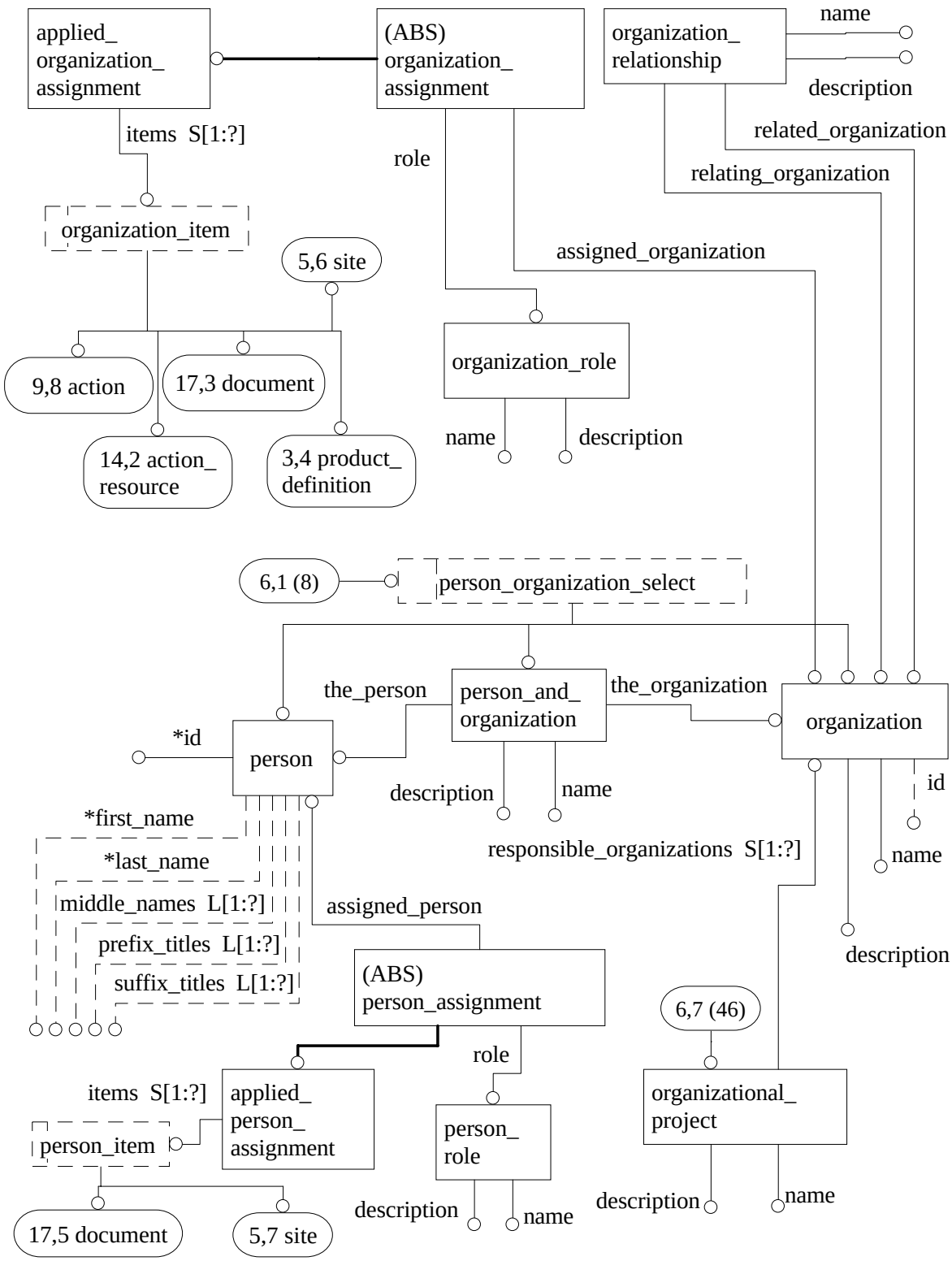


Figure H.6 - AIM EXPRESS-G diagram 6 of 55

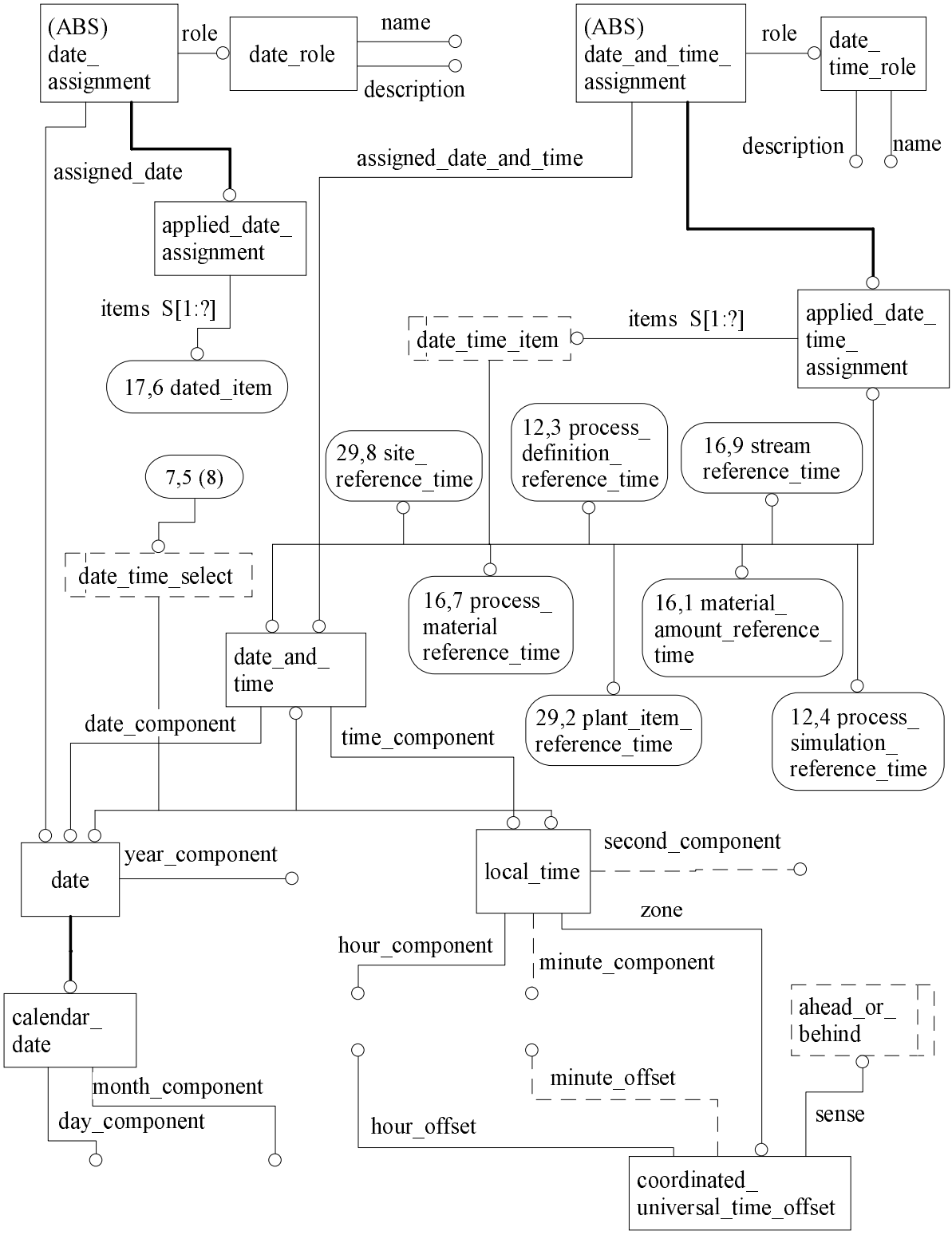


Figure H.7 - AIM EXPRESS-G diagram 7 of 55

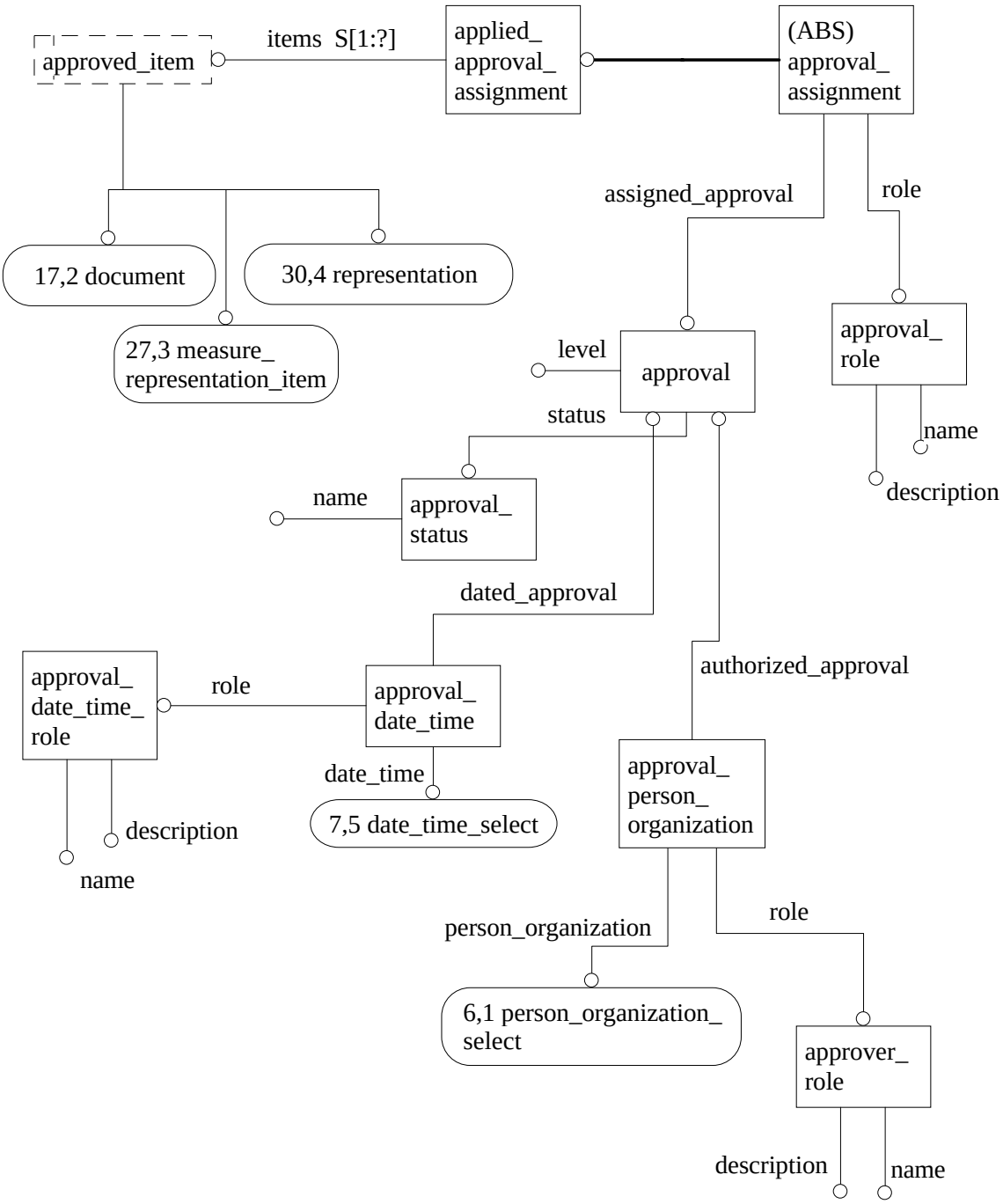


Figure H.8 - AIM EXPRESS-G diagram 8 of 55

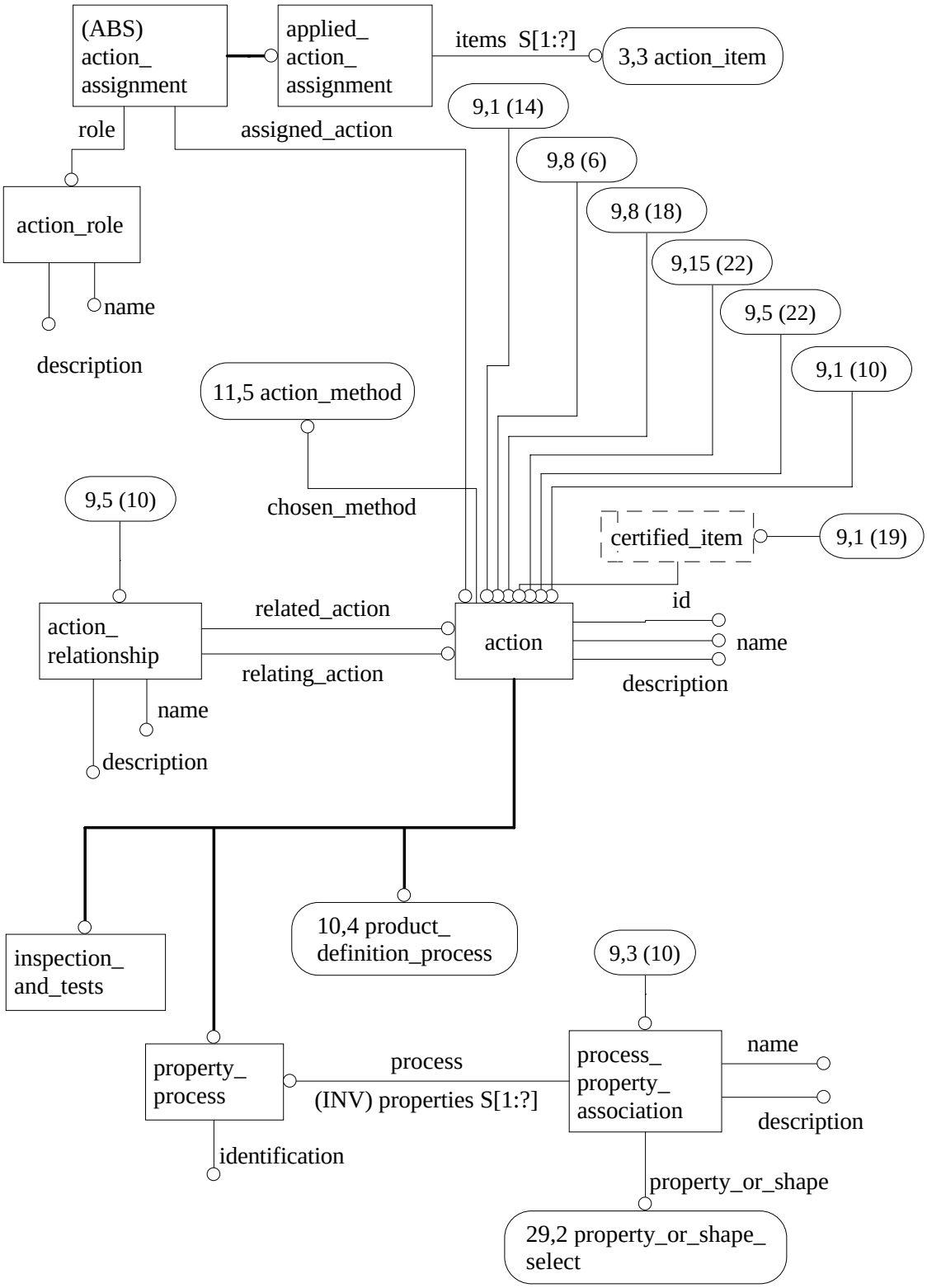


Figure H.9 - AIM EXPRESS-G diagram 9 of 55

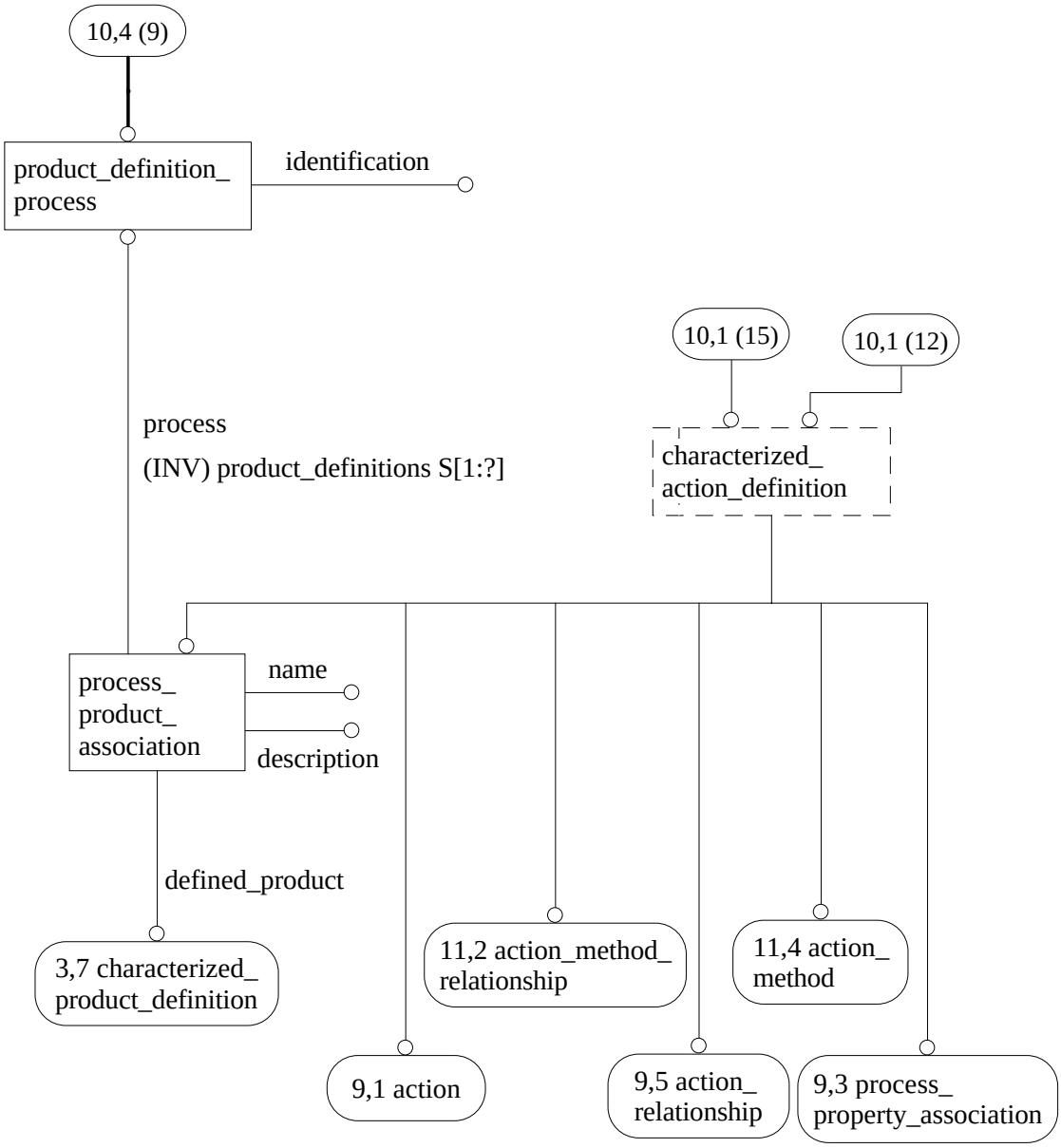


Figure H.10 - AIM EXPRESS-G diagram 10 of 55

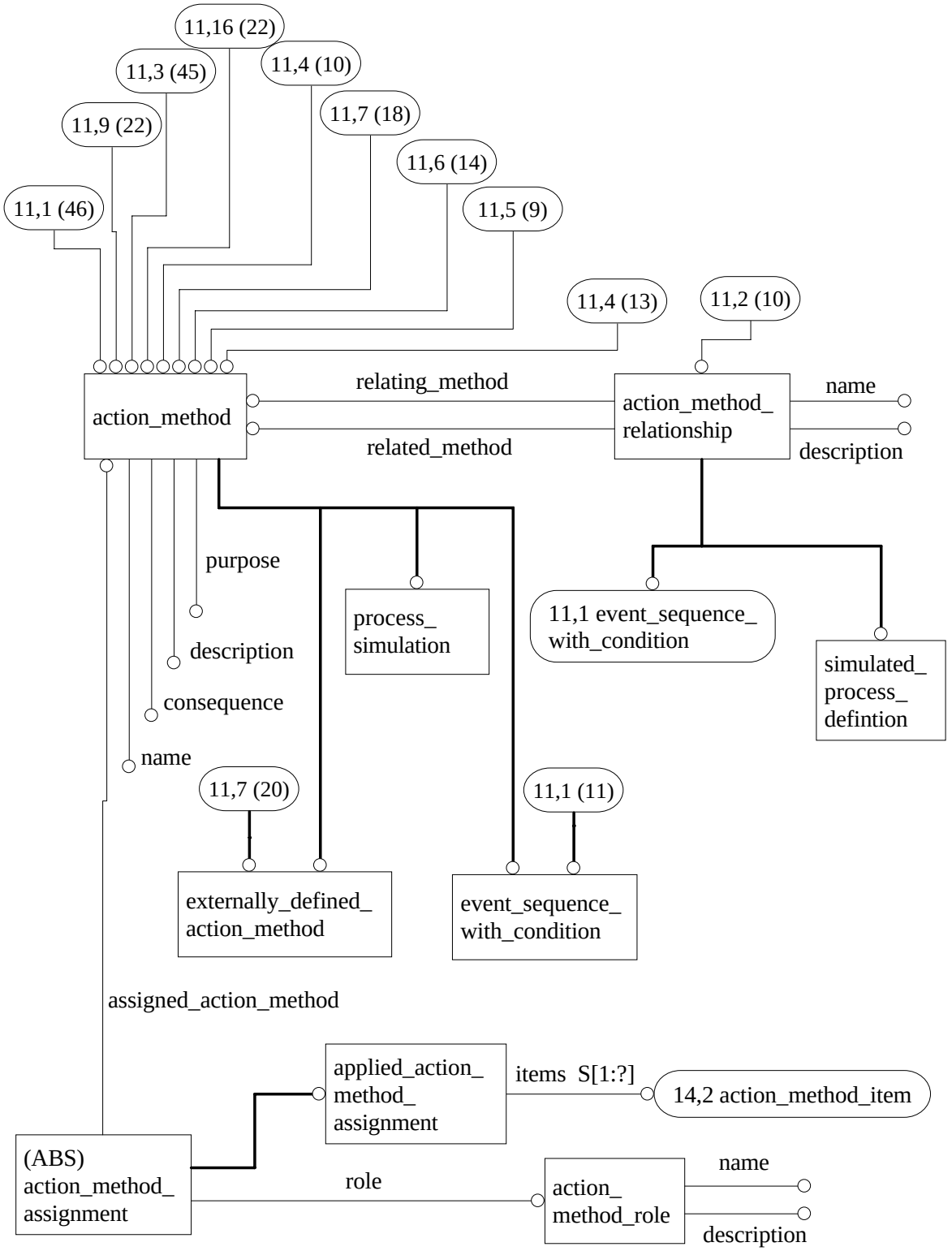


Figure H.11 - AIM EXPRESS-G diagram 11 of 55

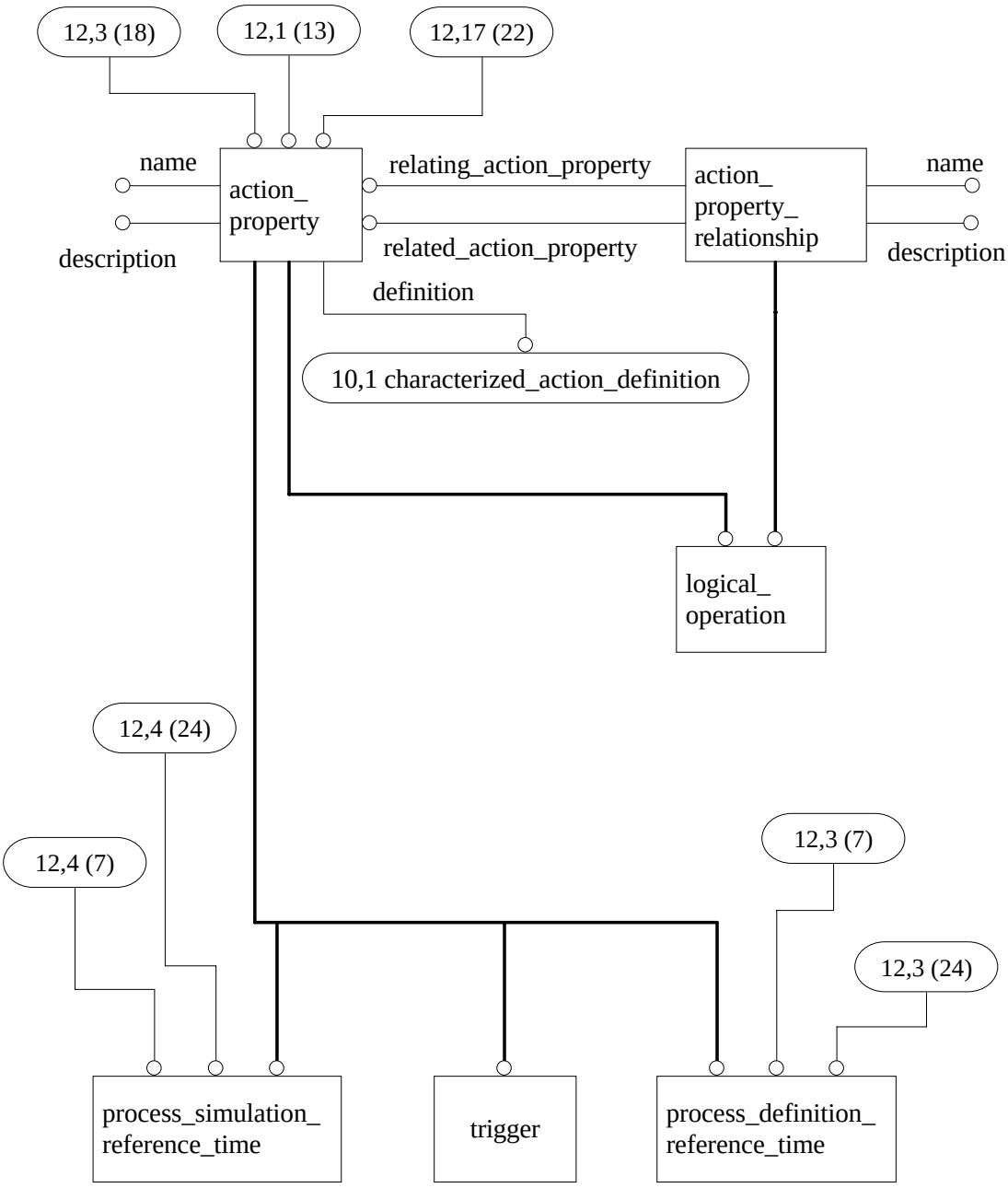


Figure H.12 - AIM EXPRESS-G diagram 12 of 55

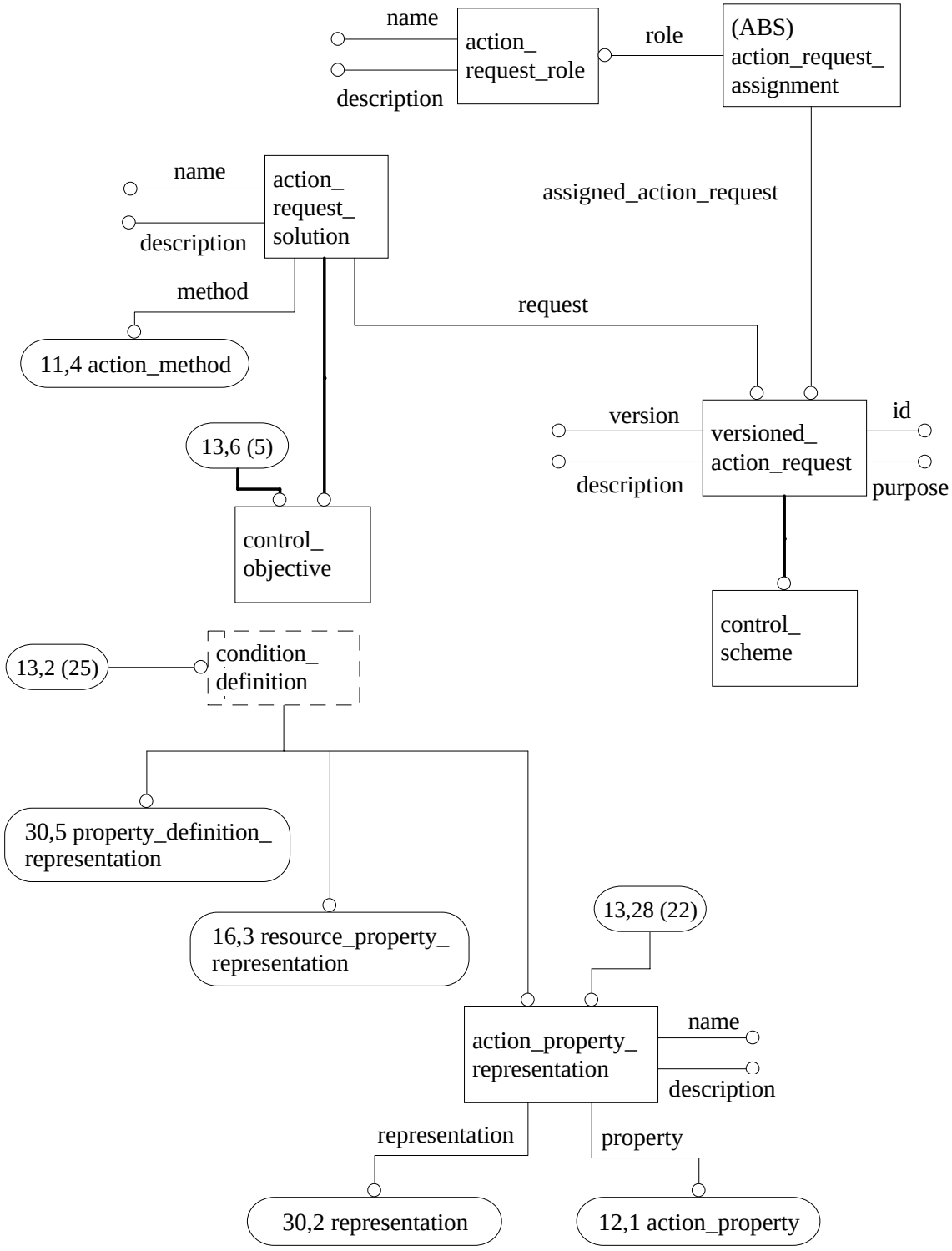


Figure H.13 - AIM EXPRESS-G diagram 13 of 55

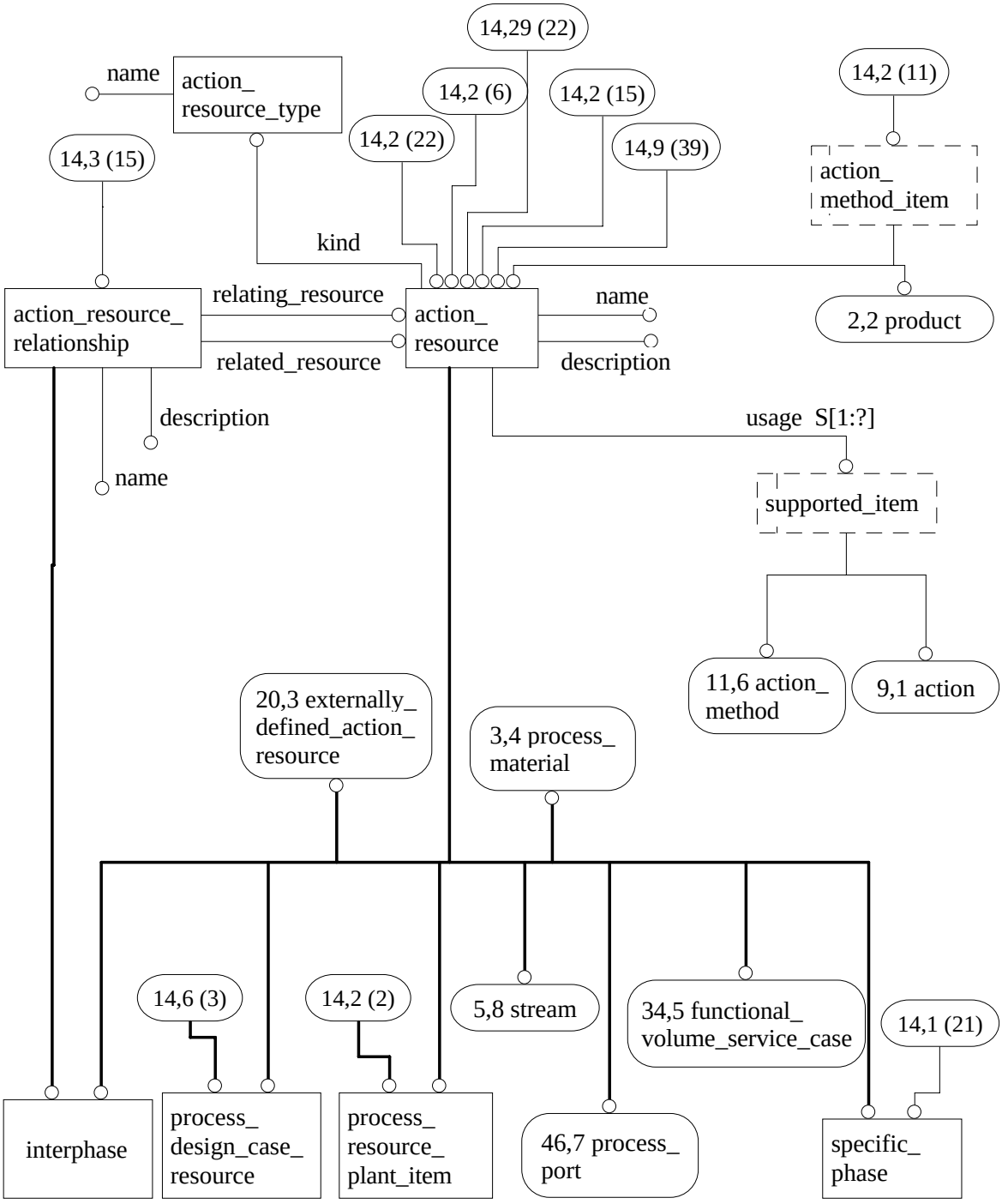


Figure H.14 - AIM EXPRESS-G diagram 14 of 55

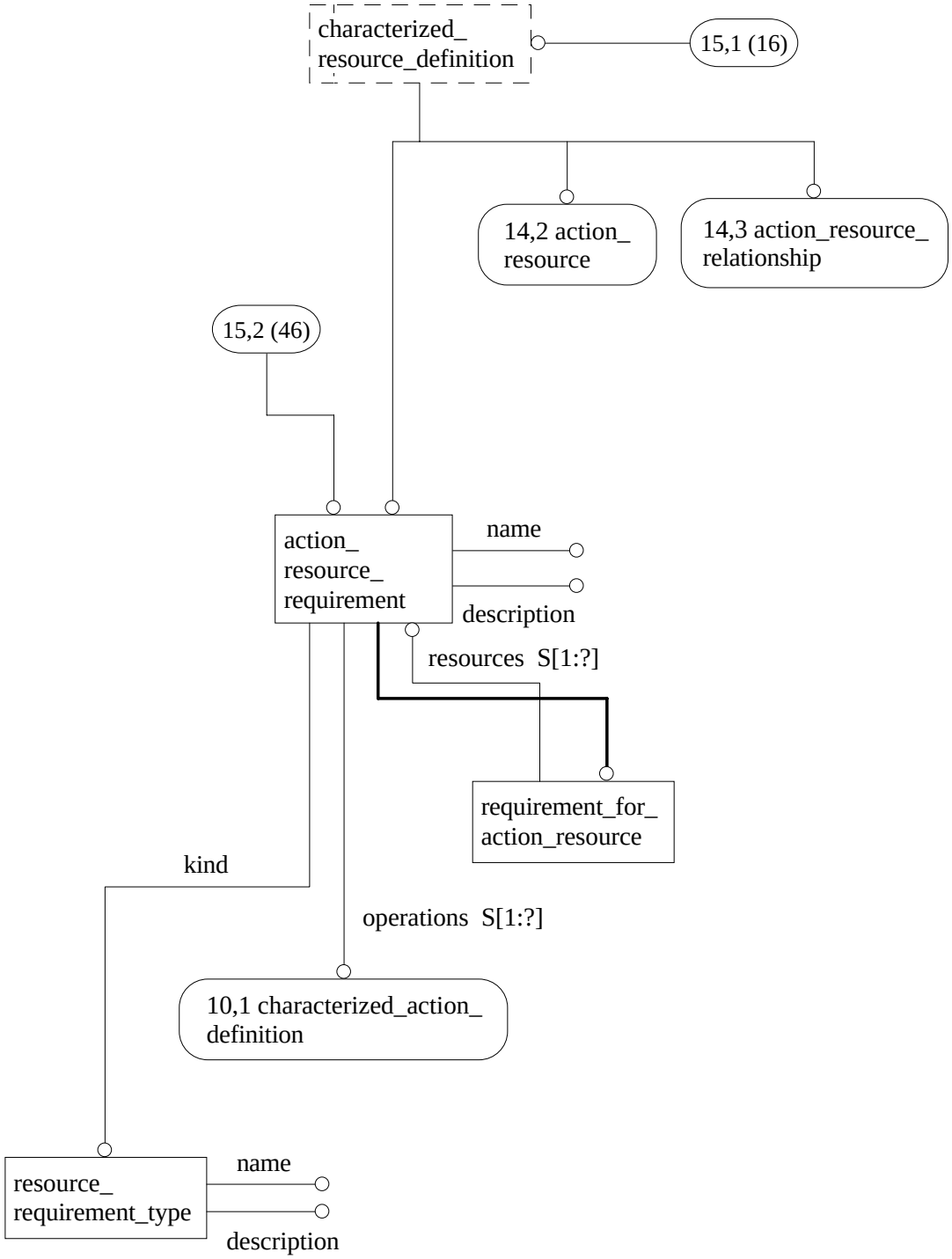


Figure H.15 - AIM EXPRESS-G diagram 15 of 55

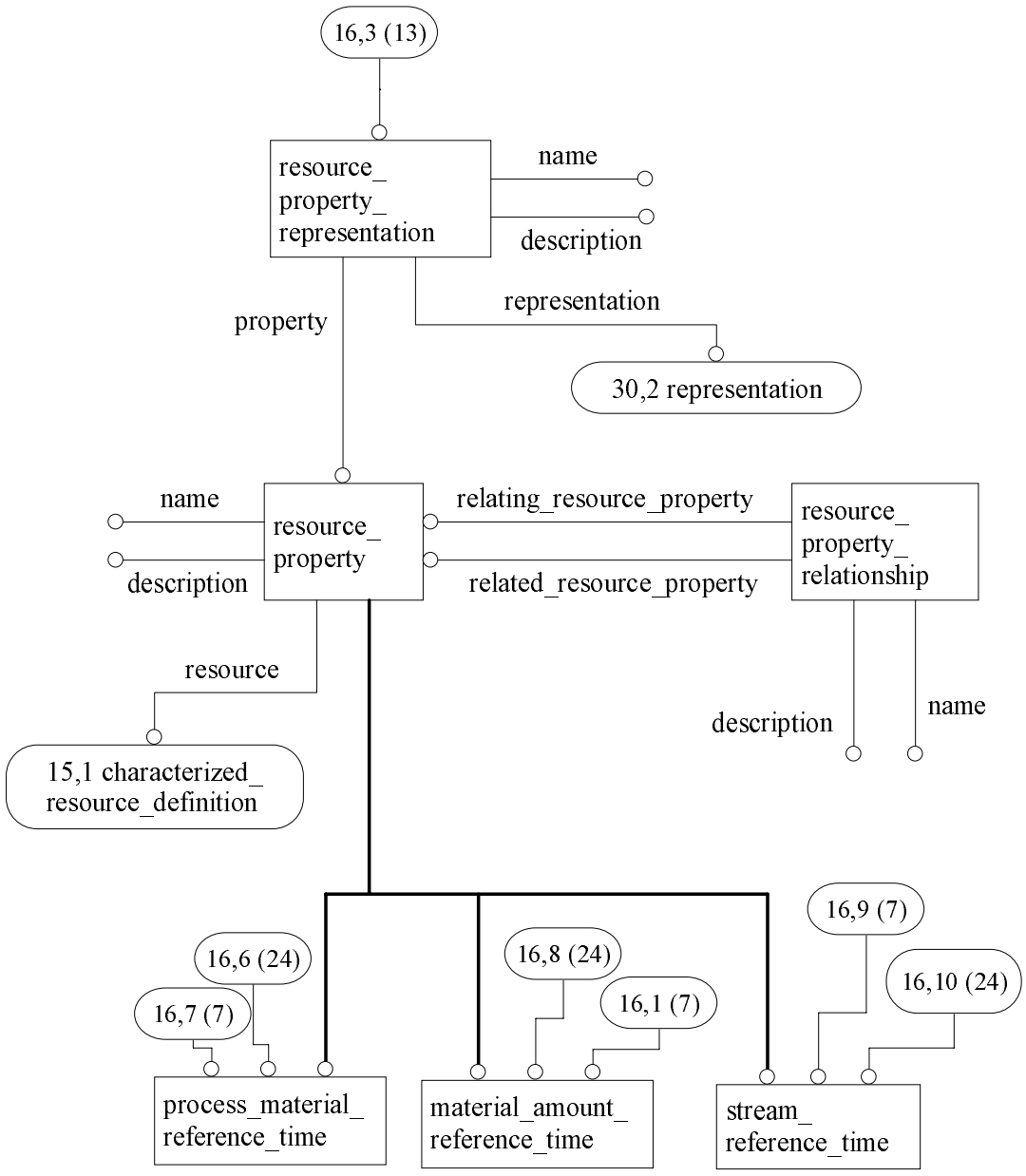


Figure H.16 - AIM EXPRESS-G diagram 16 of 55

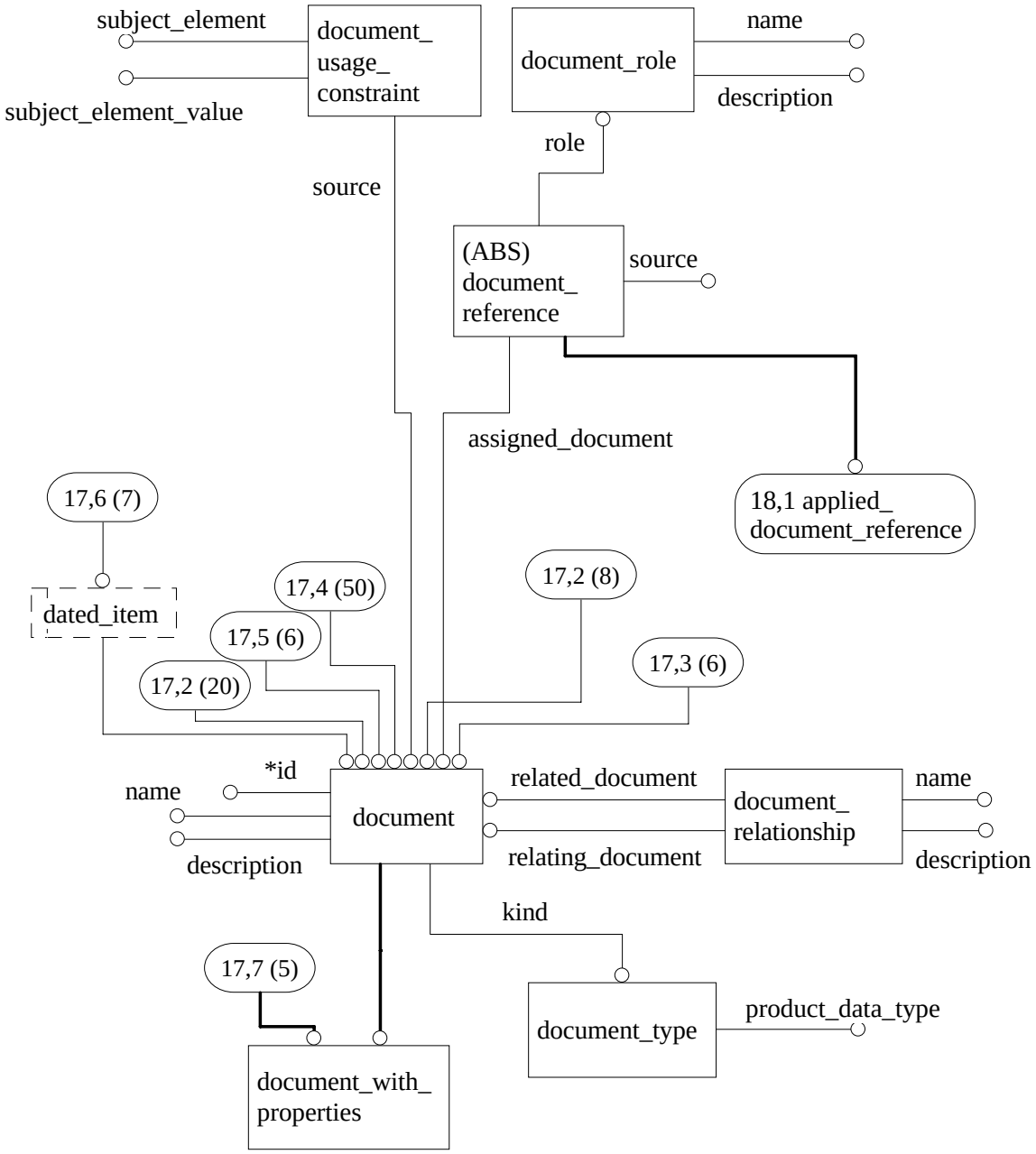


Figure H.17 - AIM EXPRESS-G diagram 17 of 55

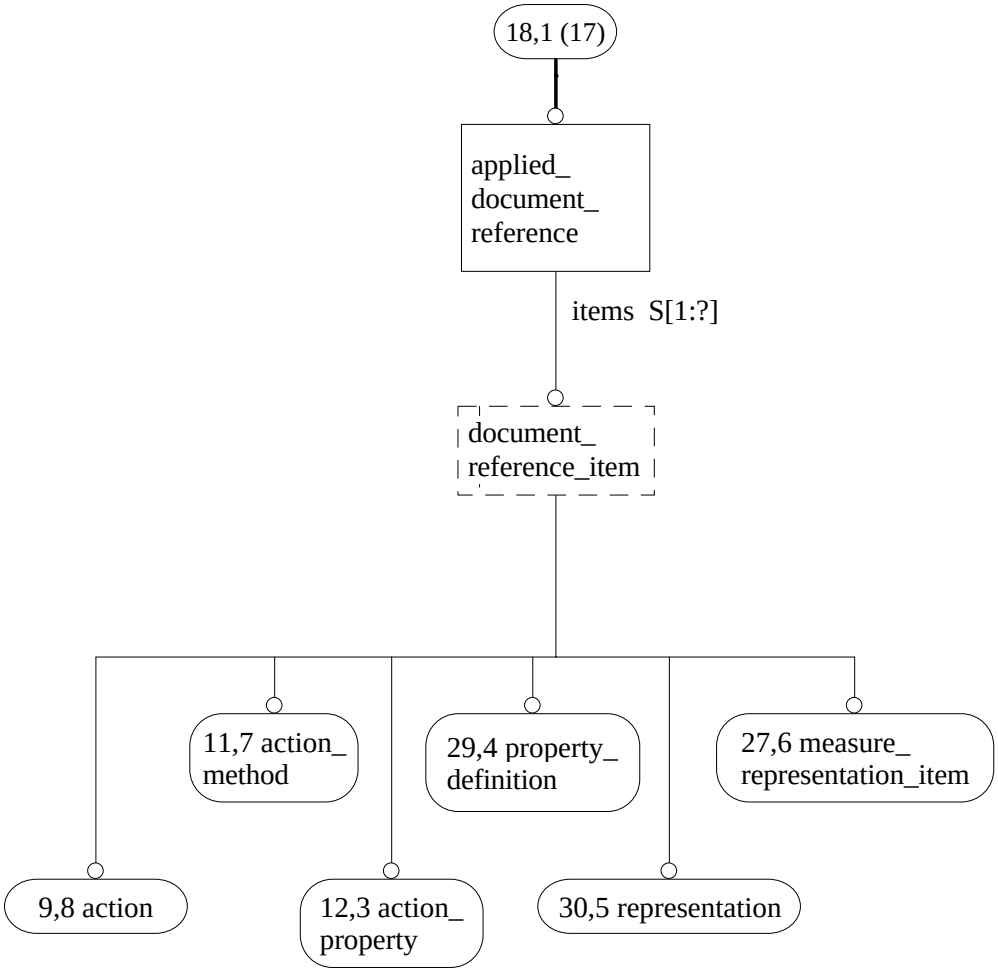


Figure H.18 - AIM EXPRESS-G diagram 18 of 55

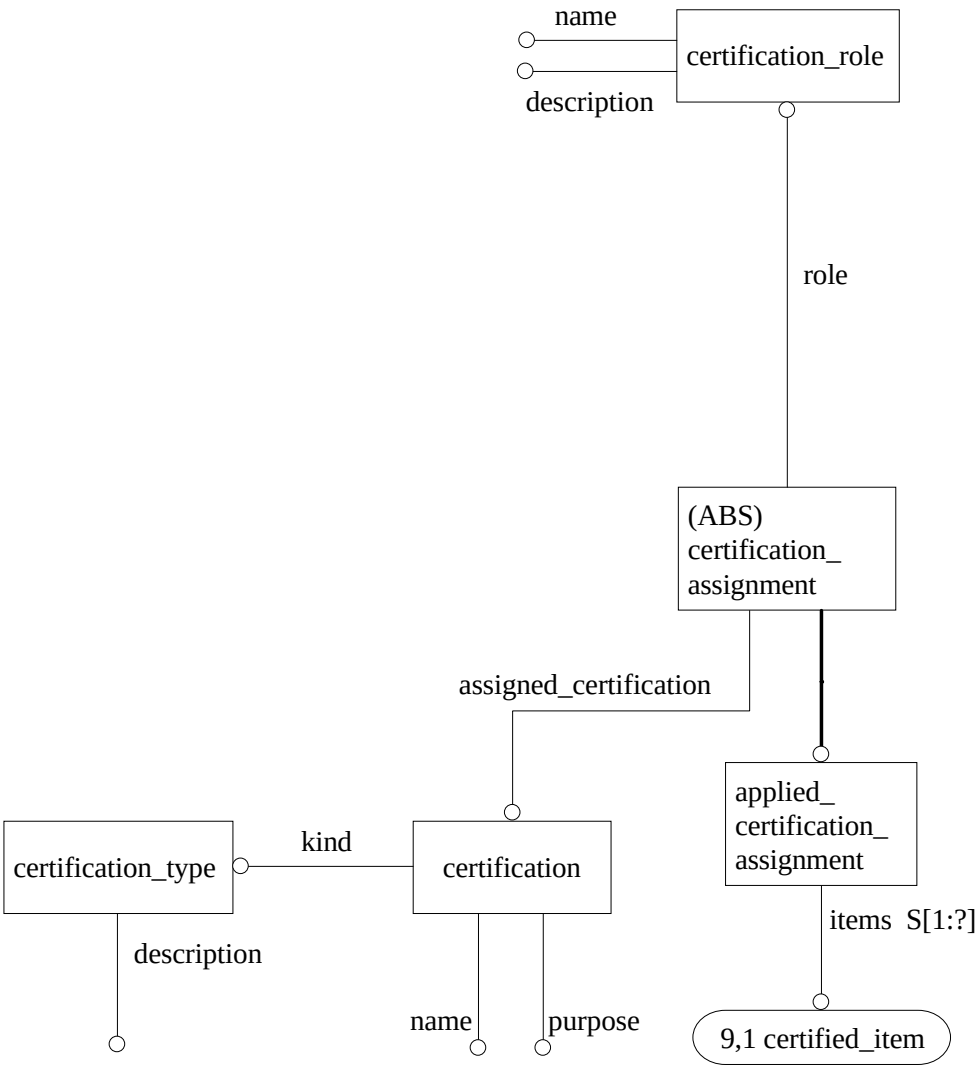


Figure H.19 - AIM EXPRESS-G diagram 19 of 55

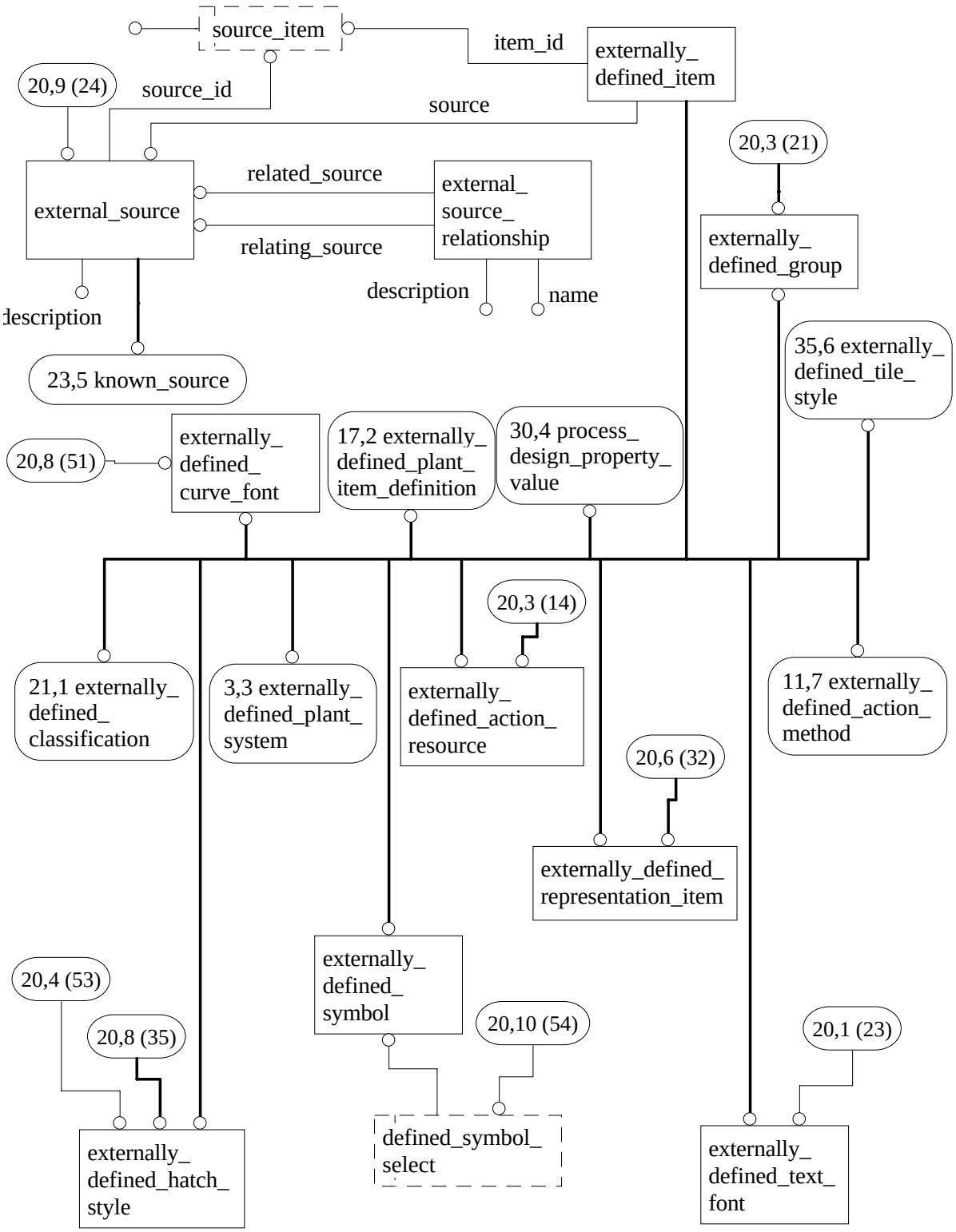


Figure H.20 - AIM EXPRESS-G diagram 20 of 55

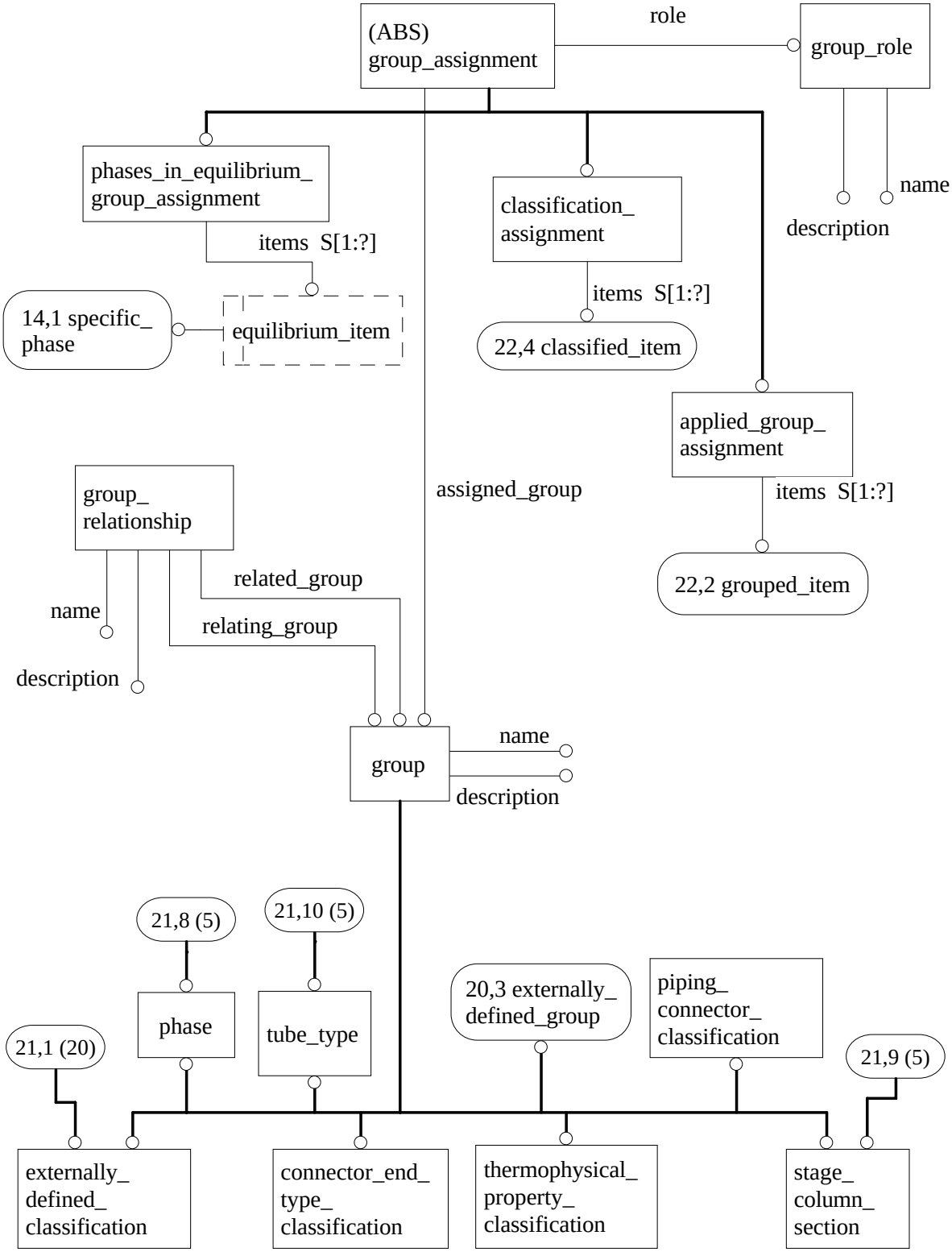


Figure H.21 - AIM EXPRESS-G diagram 21 of 55

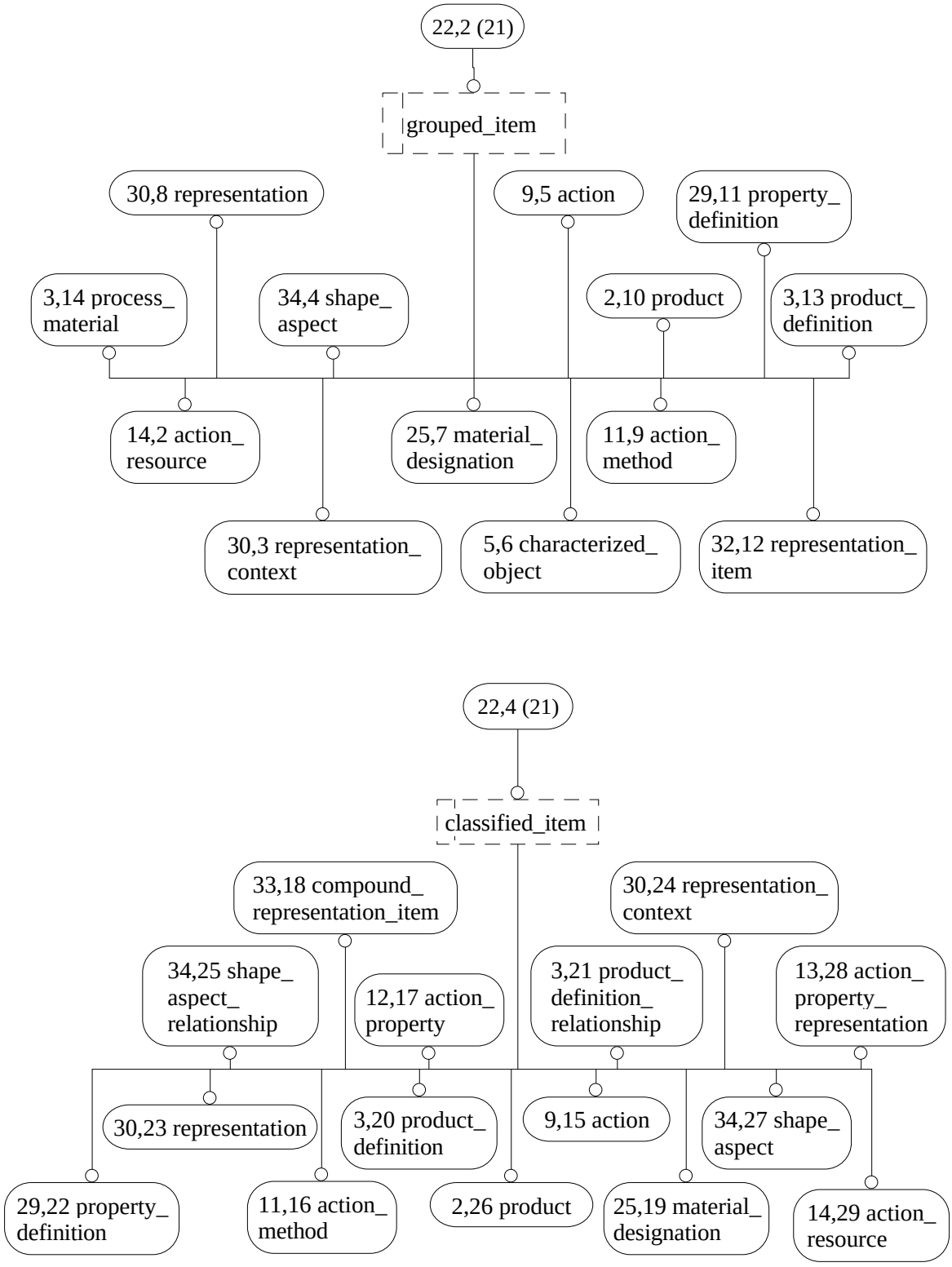


Figure H.22 - AIM EXPRESS-G diagram 22 of 55

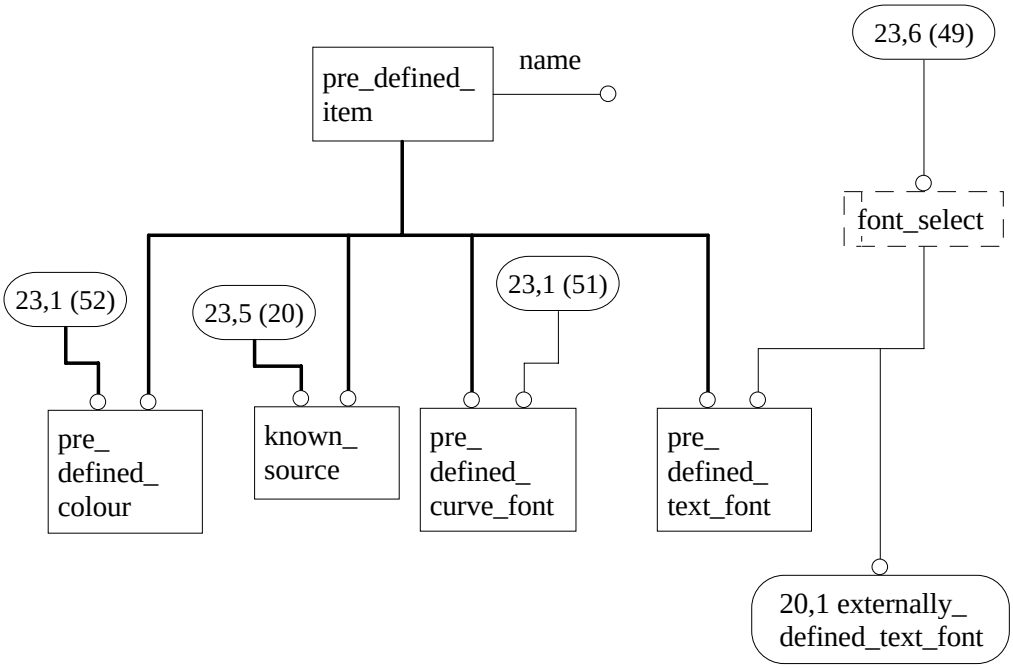


Figure H.23 - AIM EXPRESS-G diagram 23 of 55

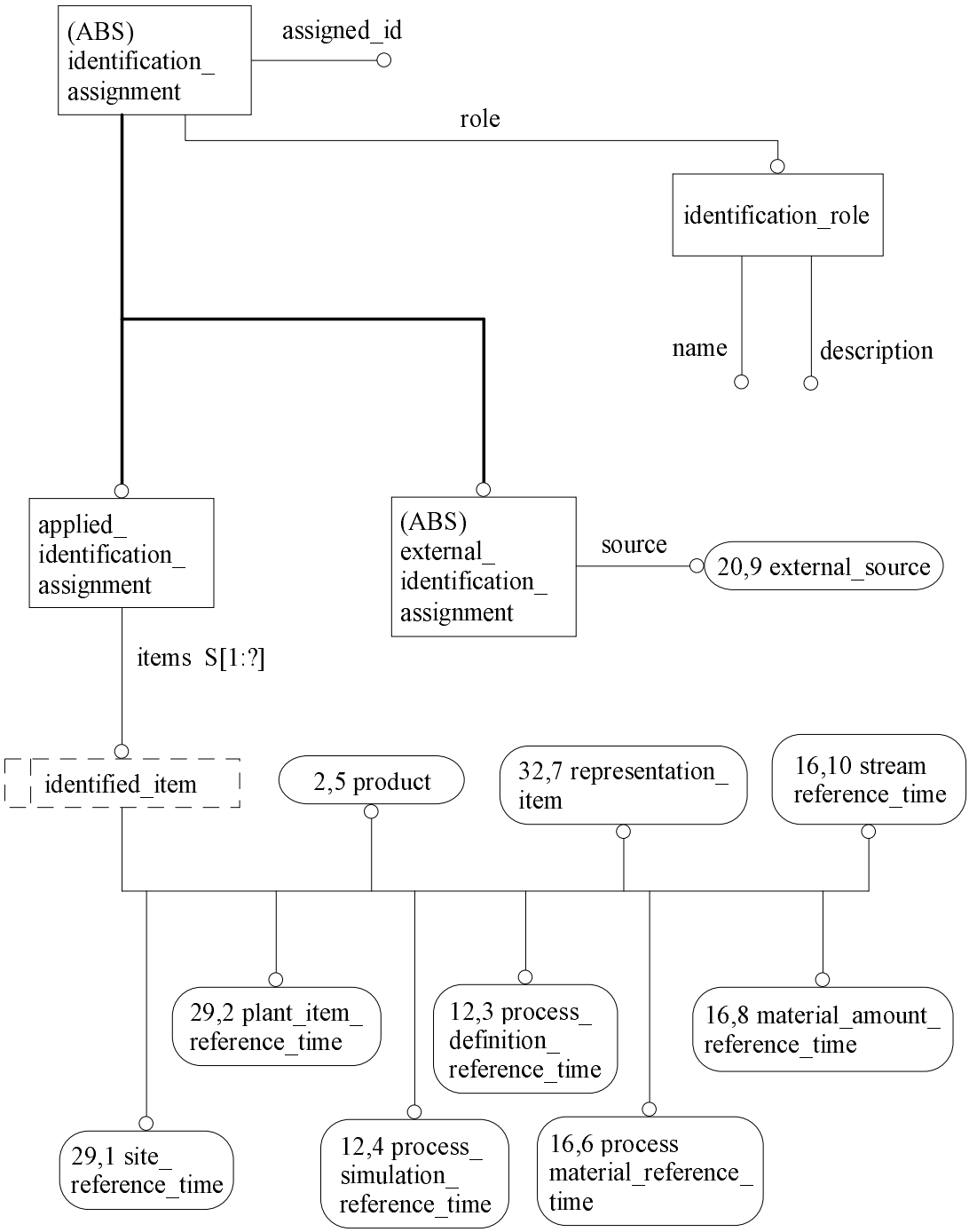


Figure H.24 - AIM EXPRESS-G diagram 24 of 55

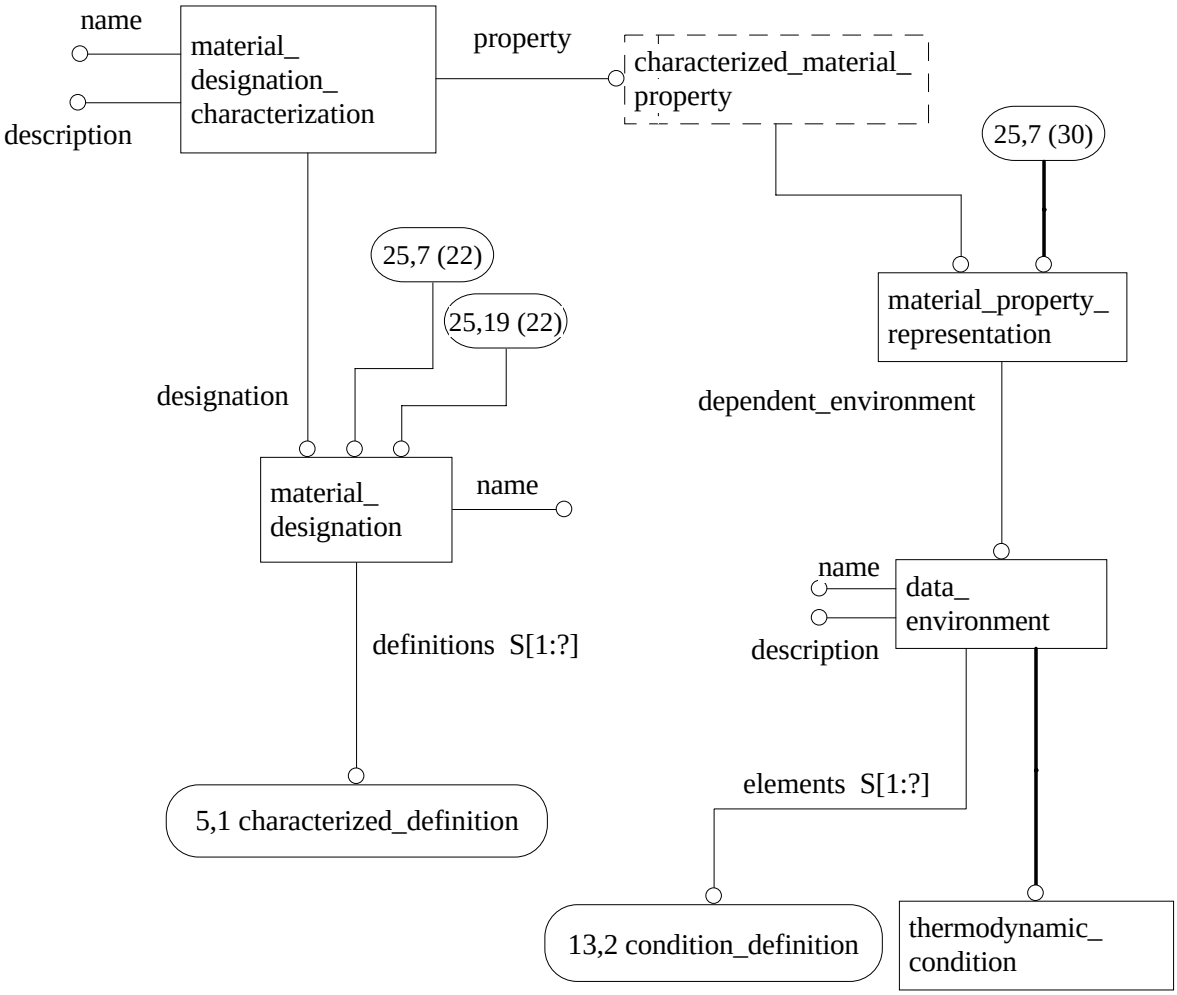


Figure H.25 - AIM EXPRESS-G diagram 25 of 55

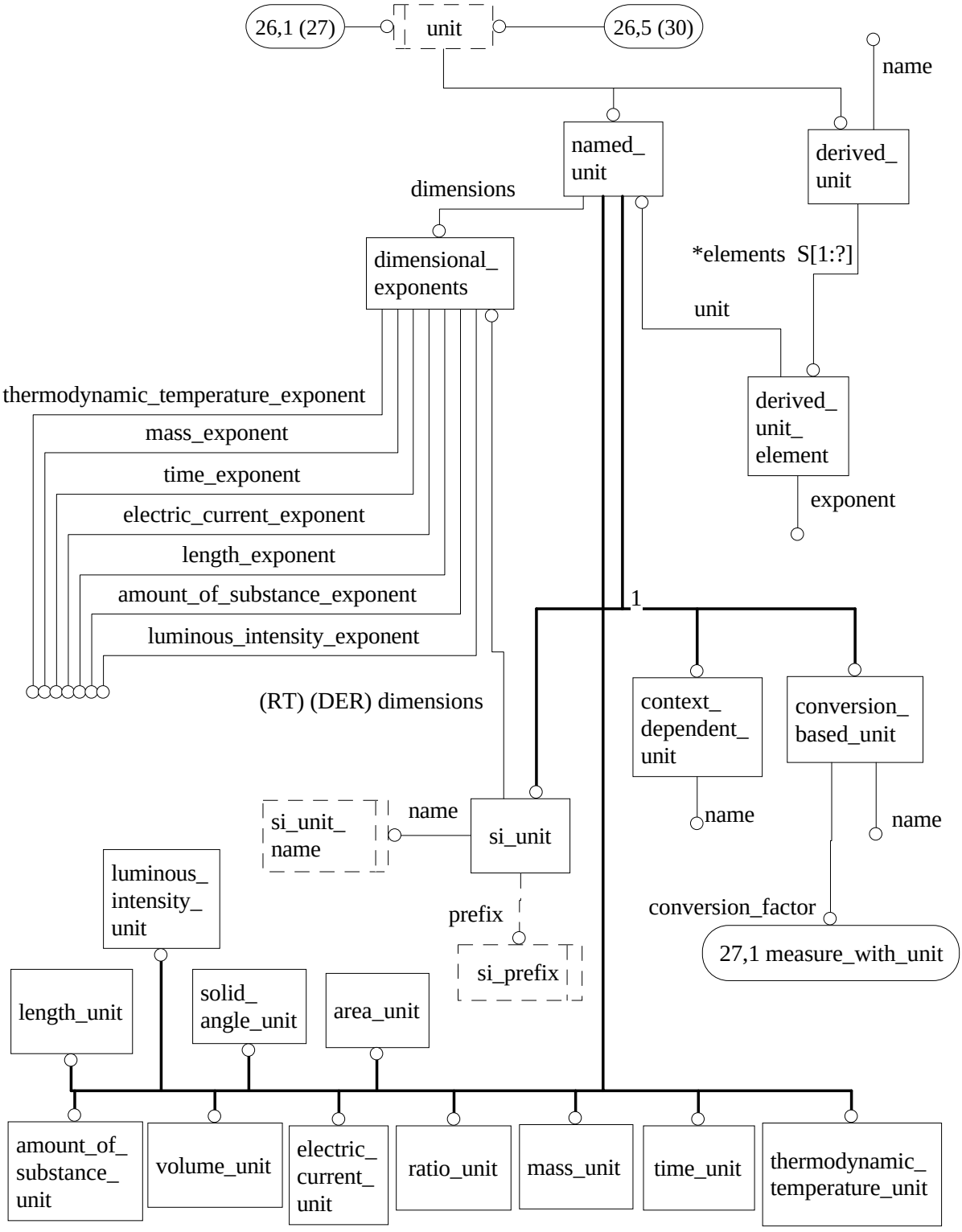


Figure H.26 - AIM EXPRESS-G diagram 26 of 55

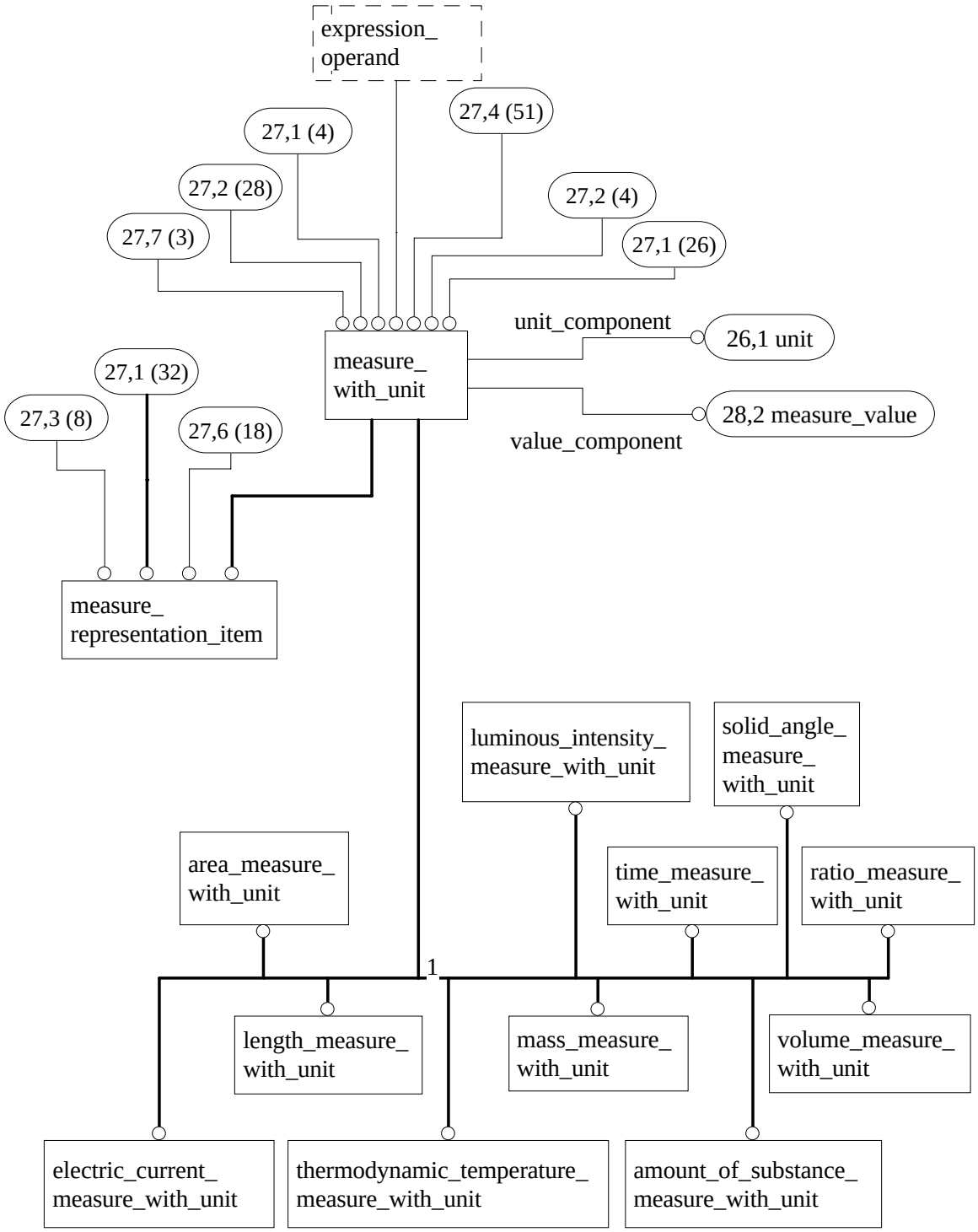


Figure H.27 - AIM EXPRESS-G diagram 27 of 55

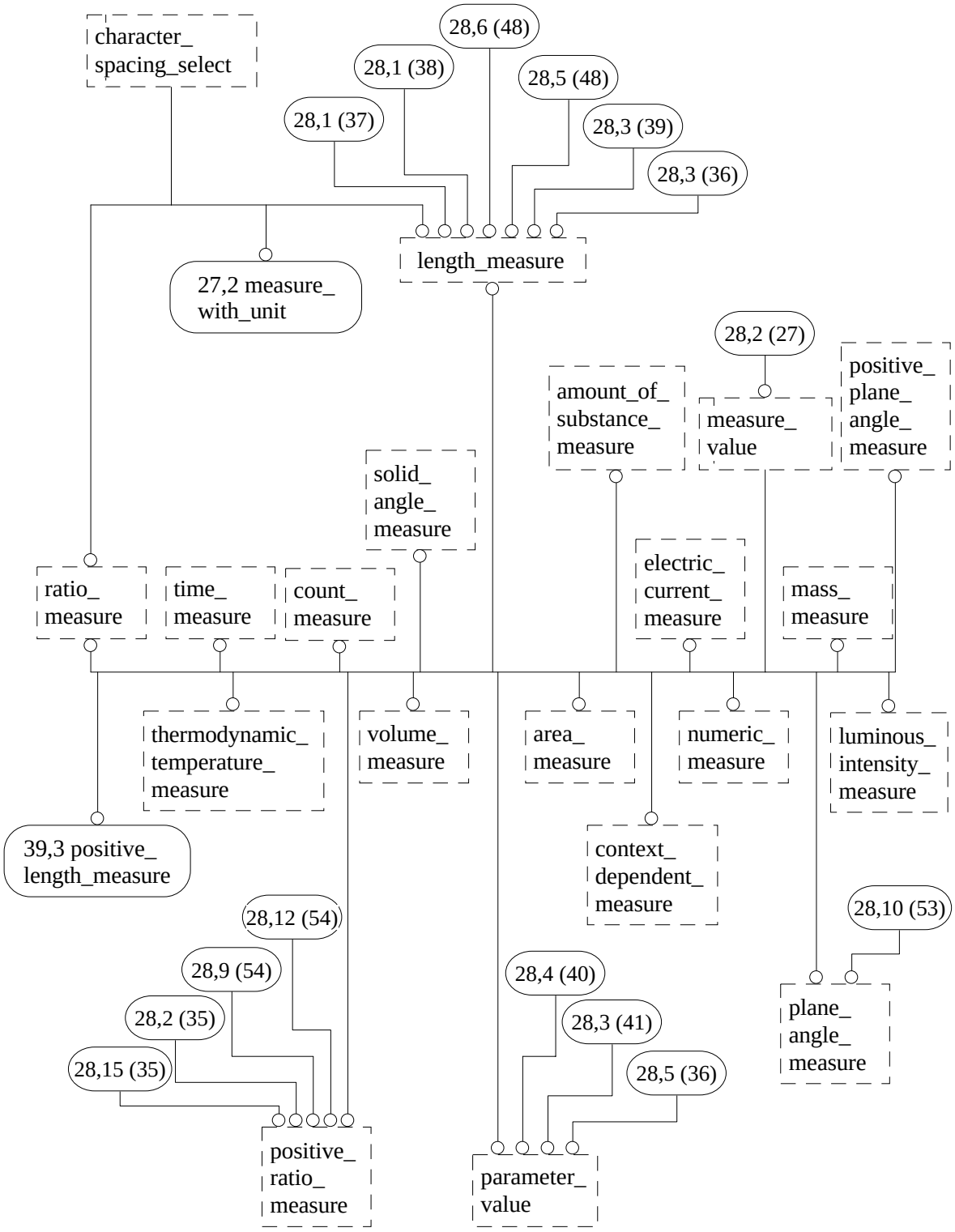


Figure H.28 - AIM EXPRESS-G diagram 28 of 55

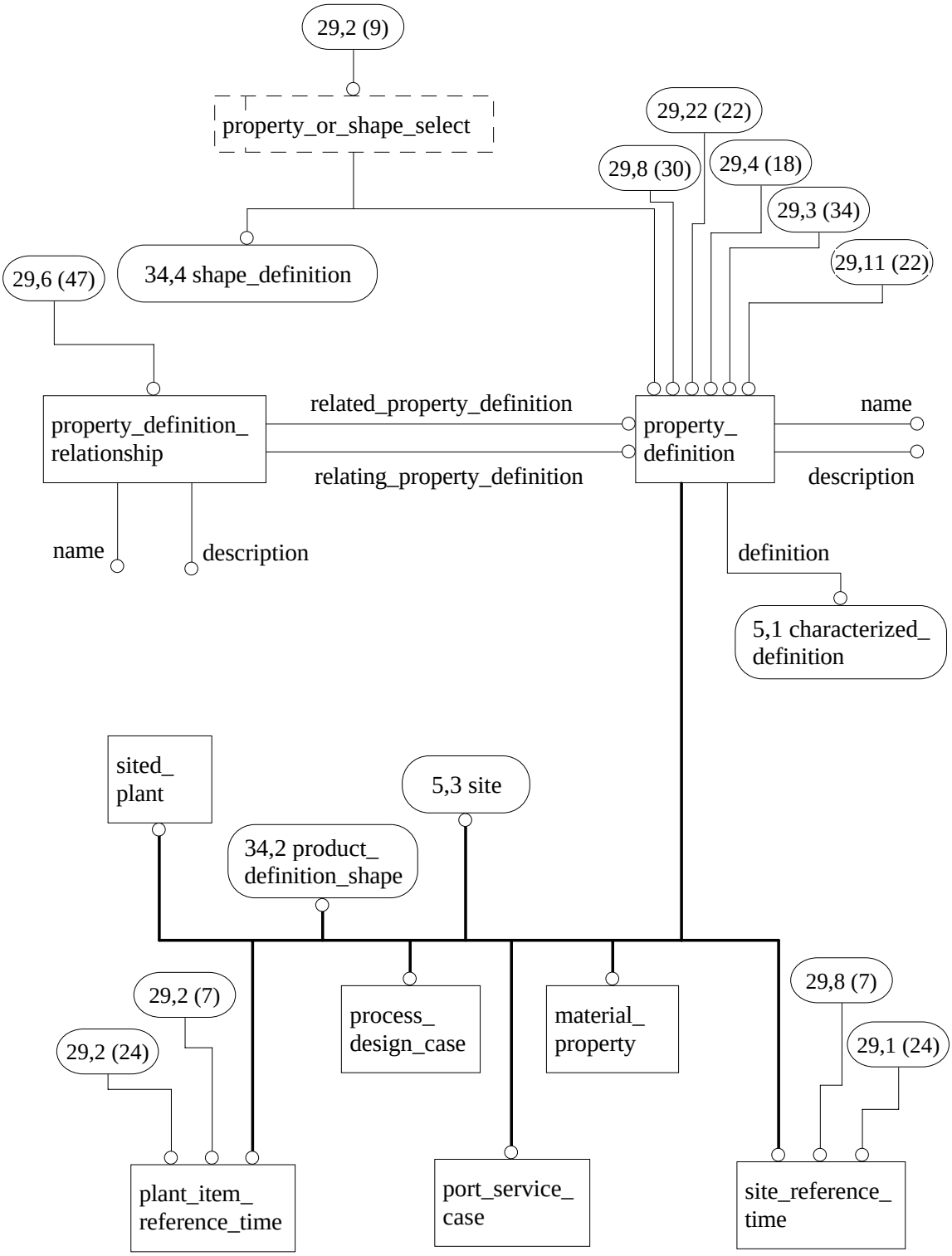


Figure H.29 - AIM EXPRESS-G diagram 29 of 55

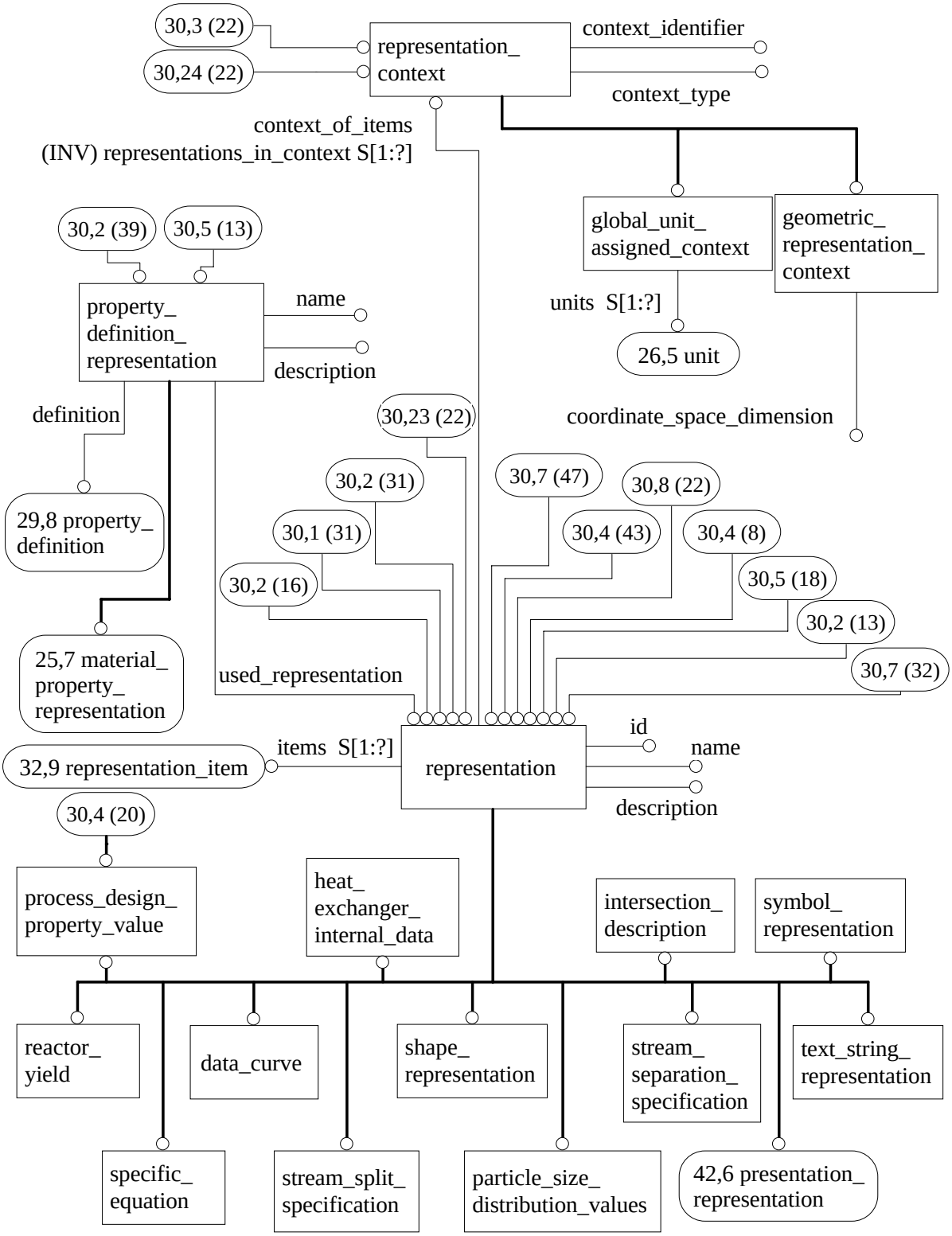


Figure H.30 - AIM EXPRESS-G diagram 30 of 55

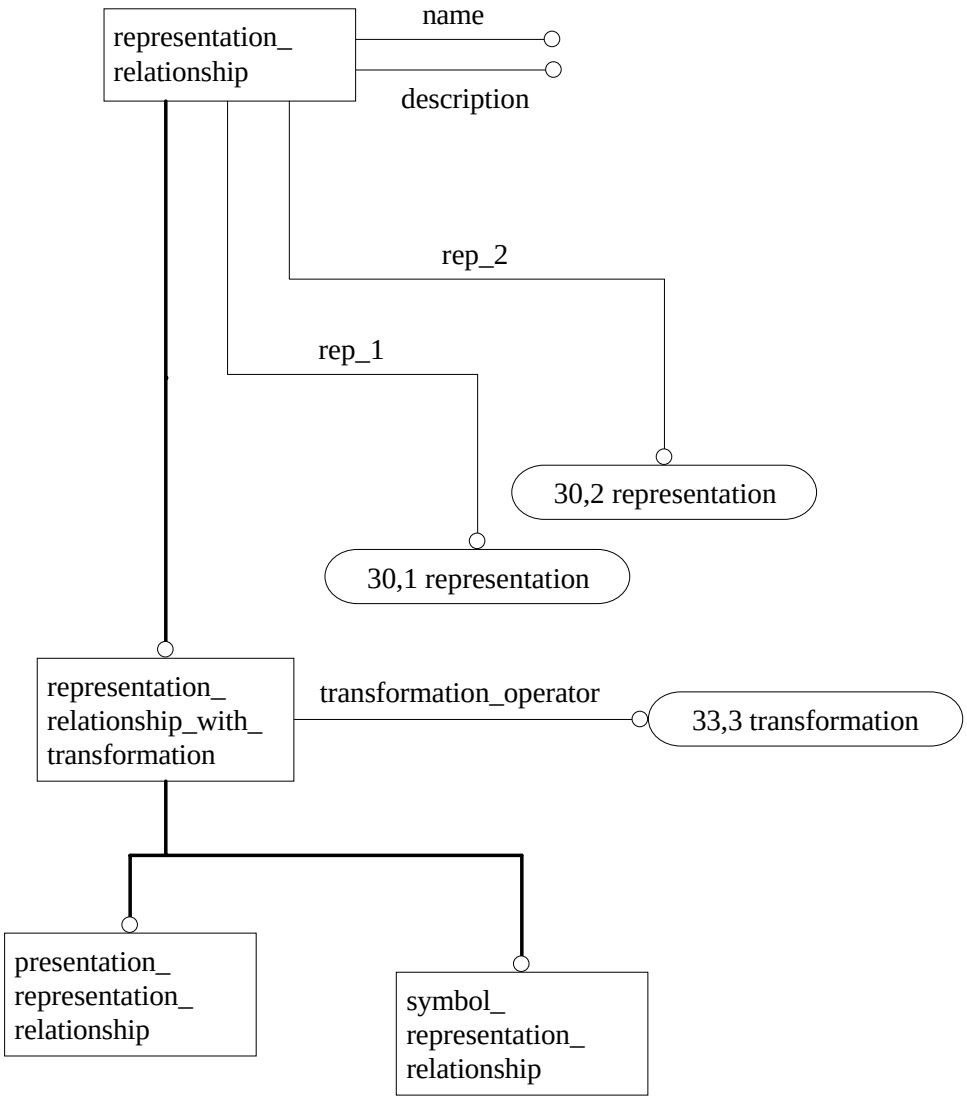


Figure H.31 - AIM EXPRESS-G diagram 31 of 55

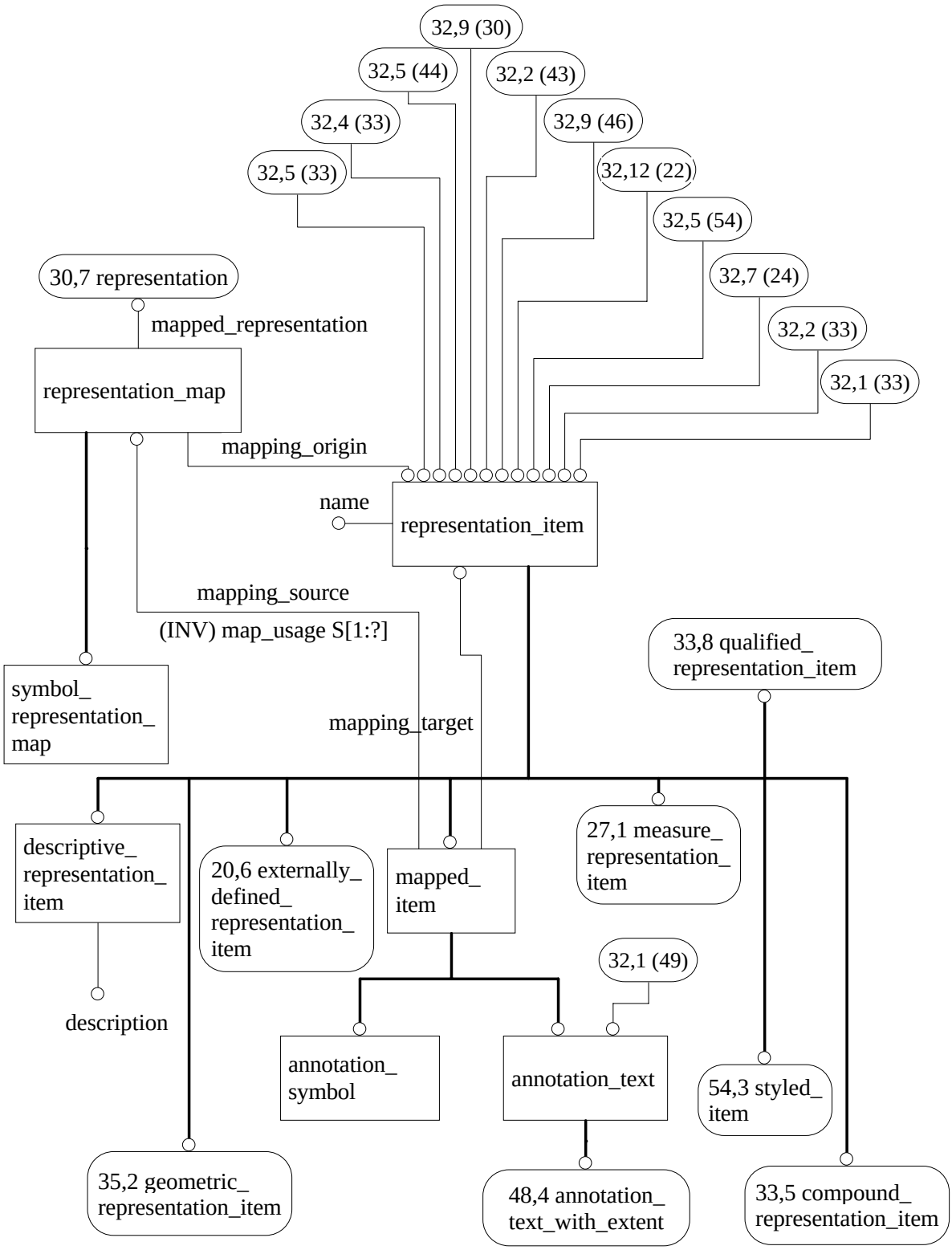


Figure H.32 - AIM EXPRESS-G diagram 32 of 55

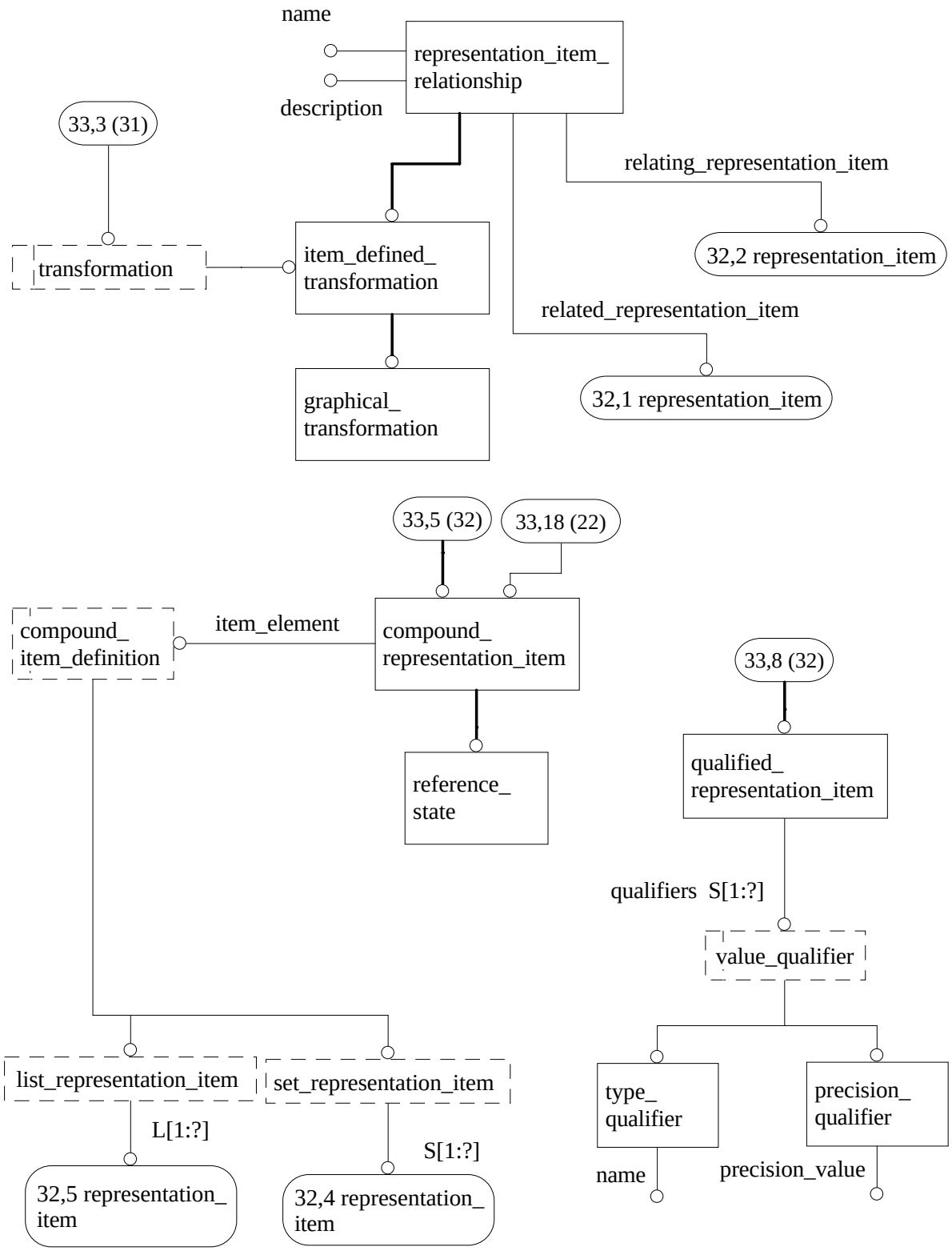


Figure H.33 - AIM EXPRESS-G diagram 33 of 55

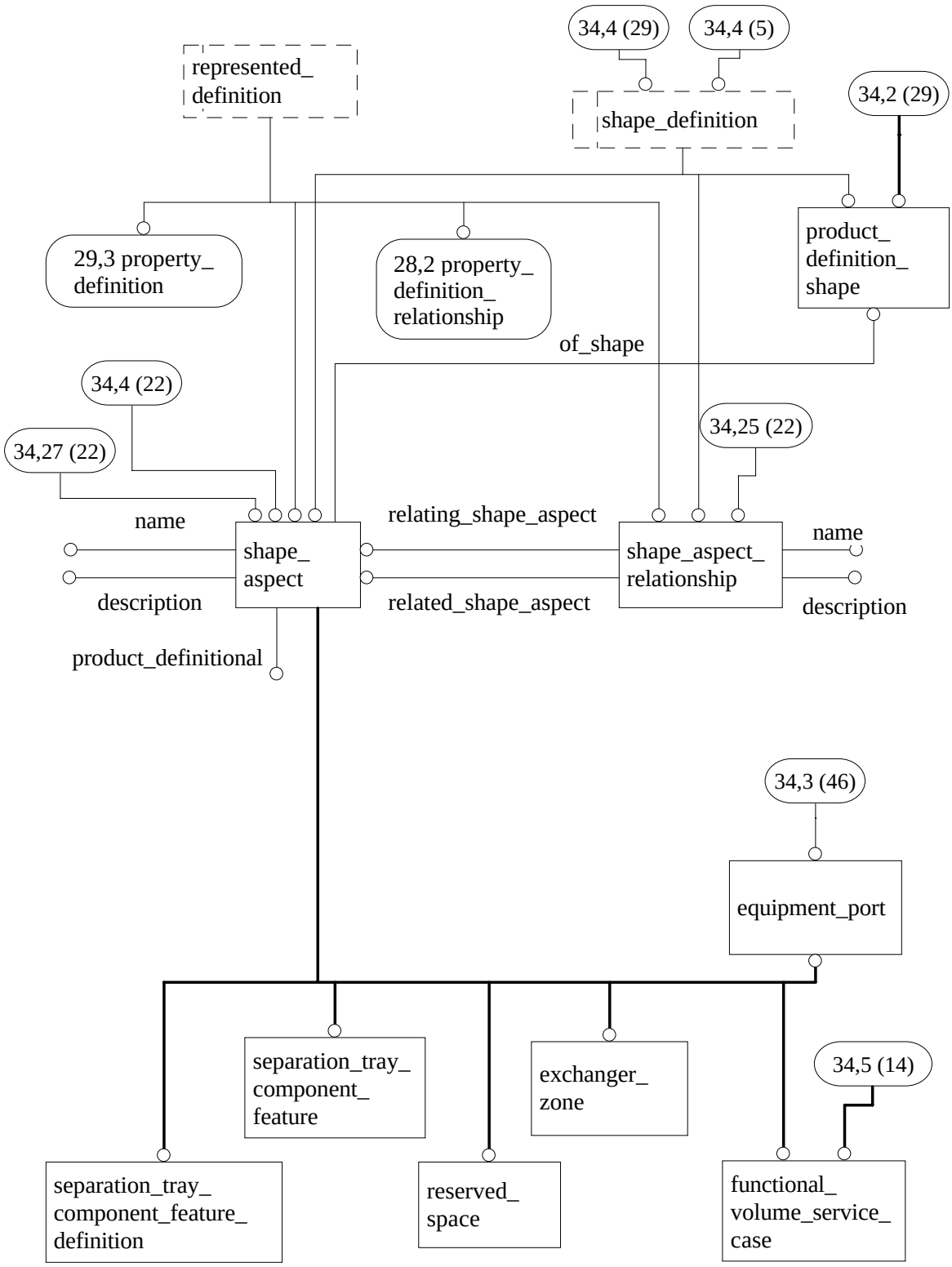


Figure H.34 - AIM EXPRESS-G diagram 34 of 55

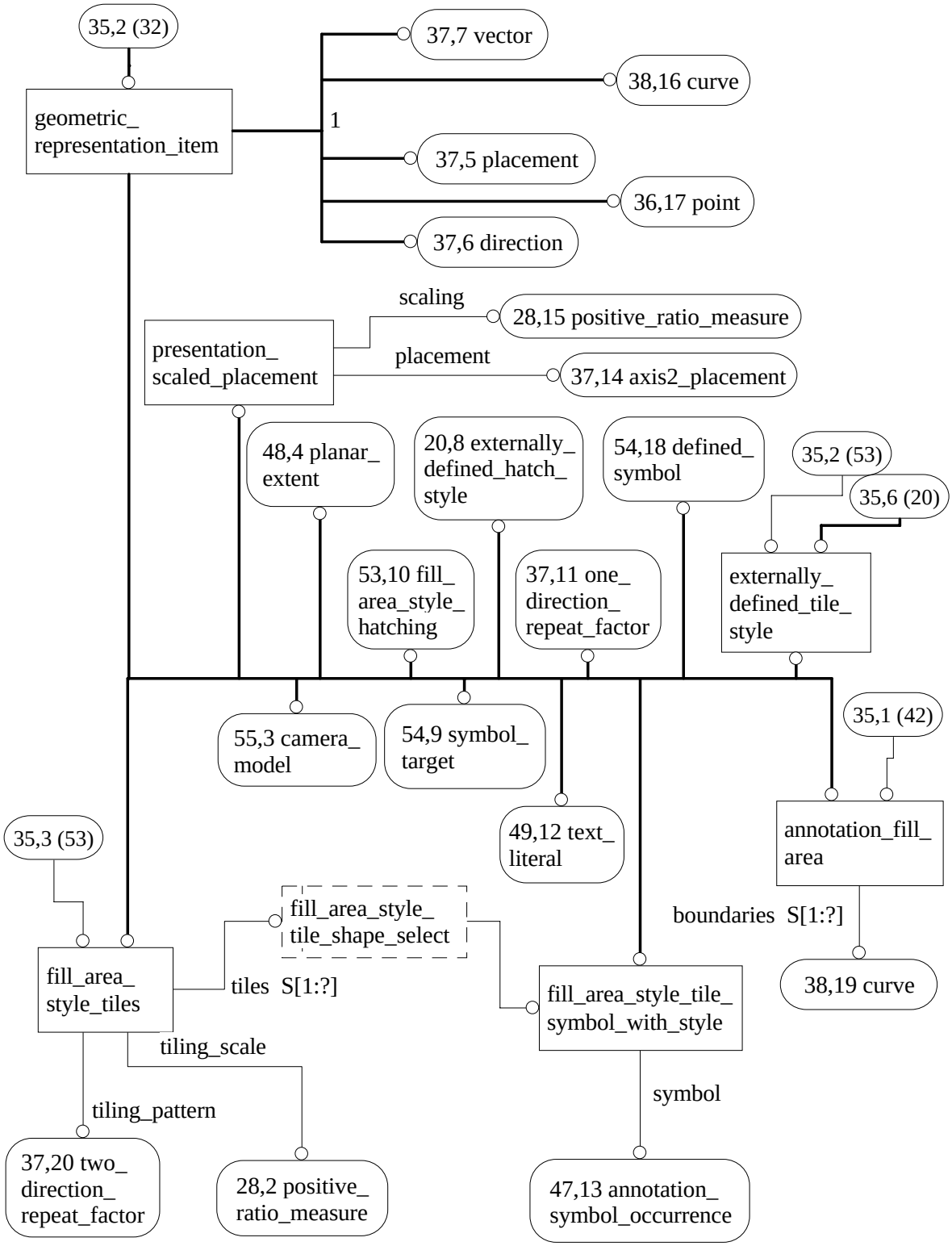


Figure H.35 - AIM EXPRESS-G diagram 35 of 55

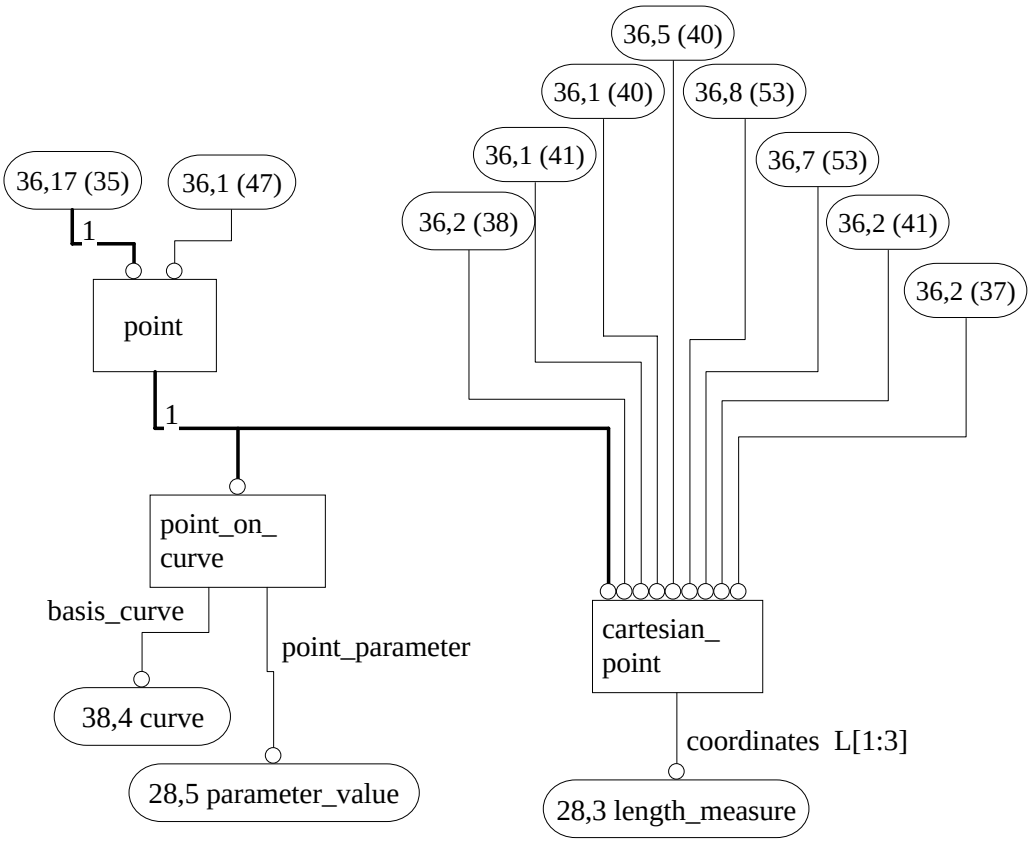


Figure H.36 - AIM EXPRESS-G diagram 36 of 55

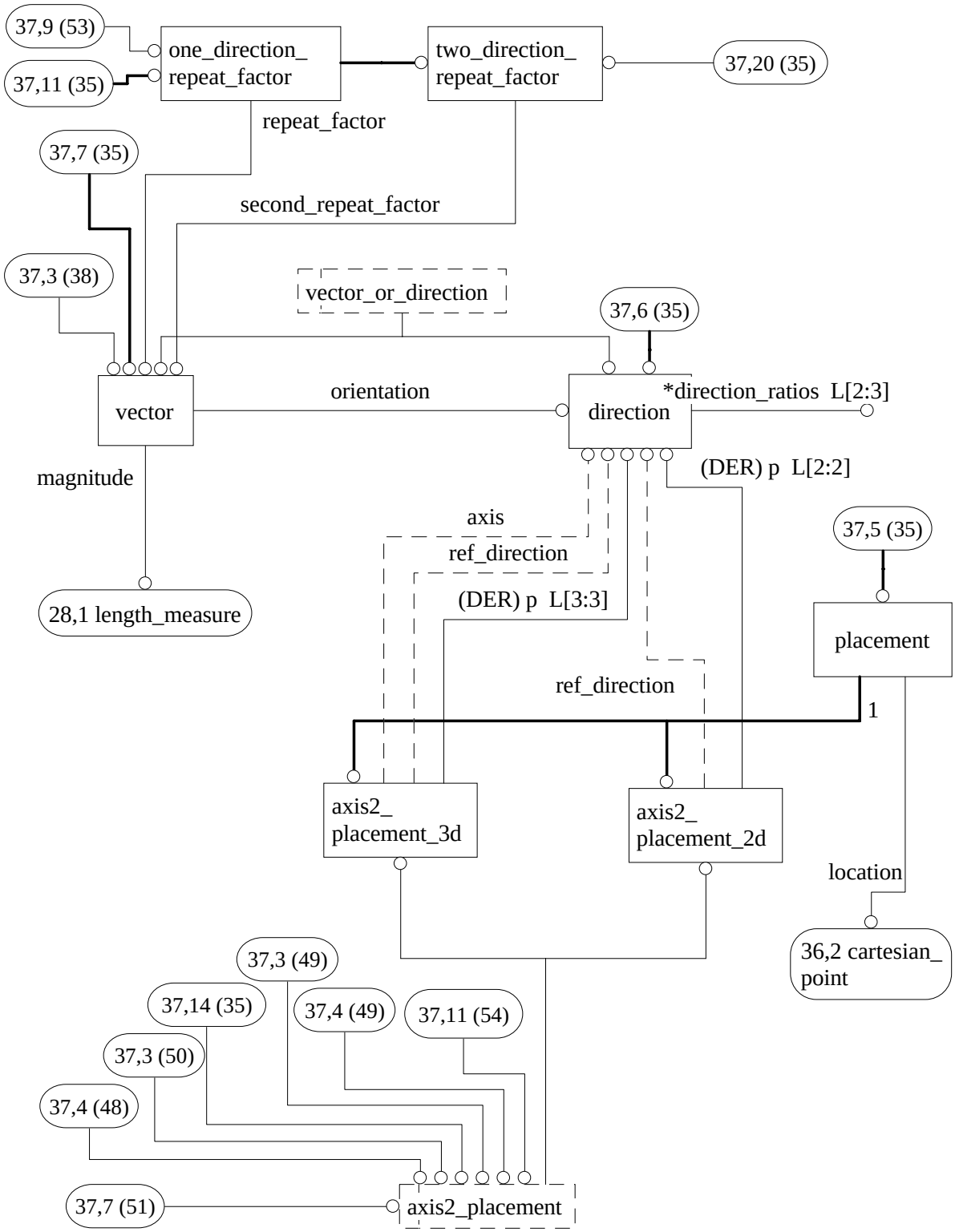


Figure H.37 - AIM EXPRESS-G diagram 37 of 55

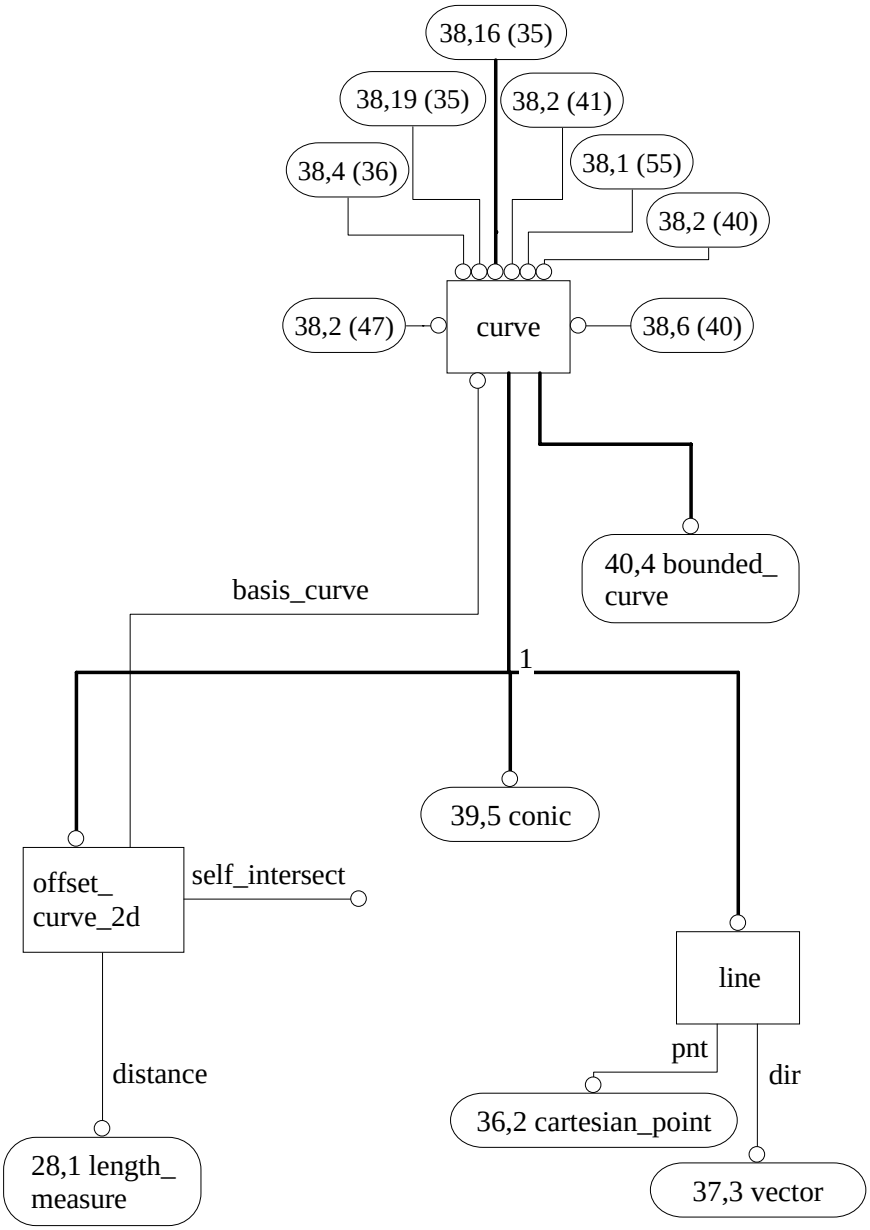


Figure H.38 - AIM EXPRESS-G diagram 38 of 55

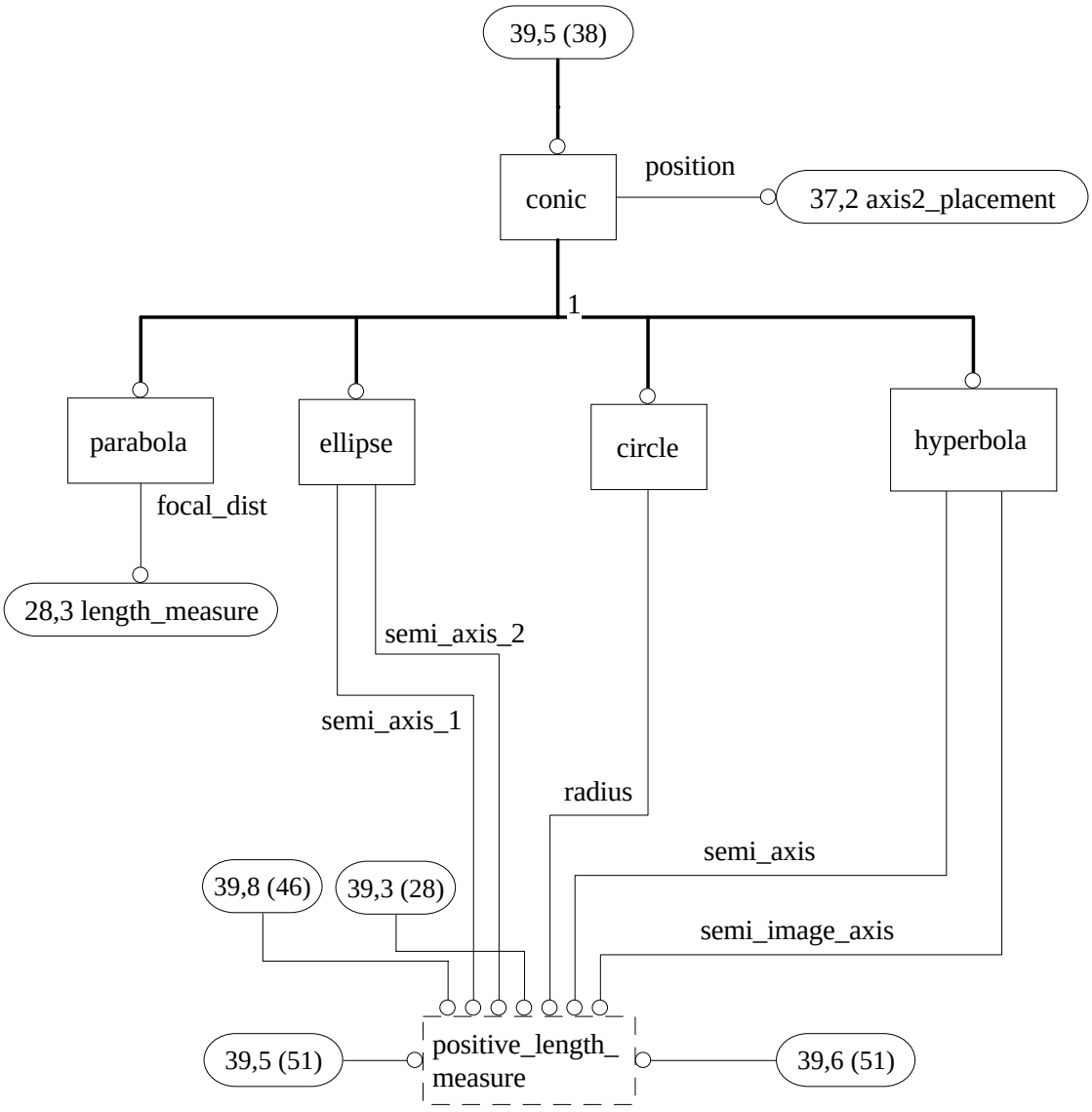


Figure H.39 - AIM EXPRESS-G diagram 39 of 55

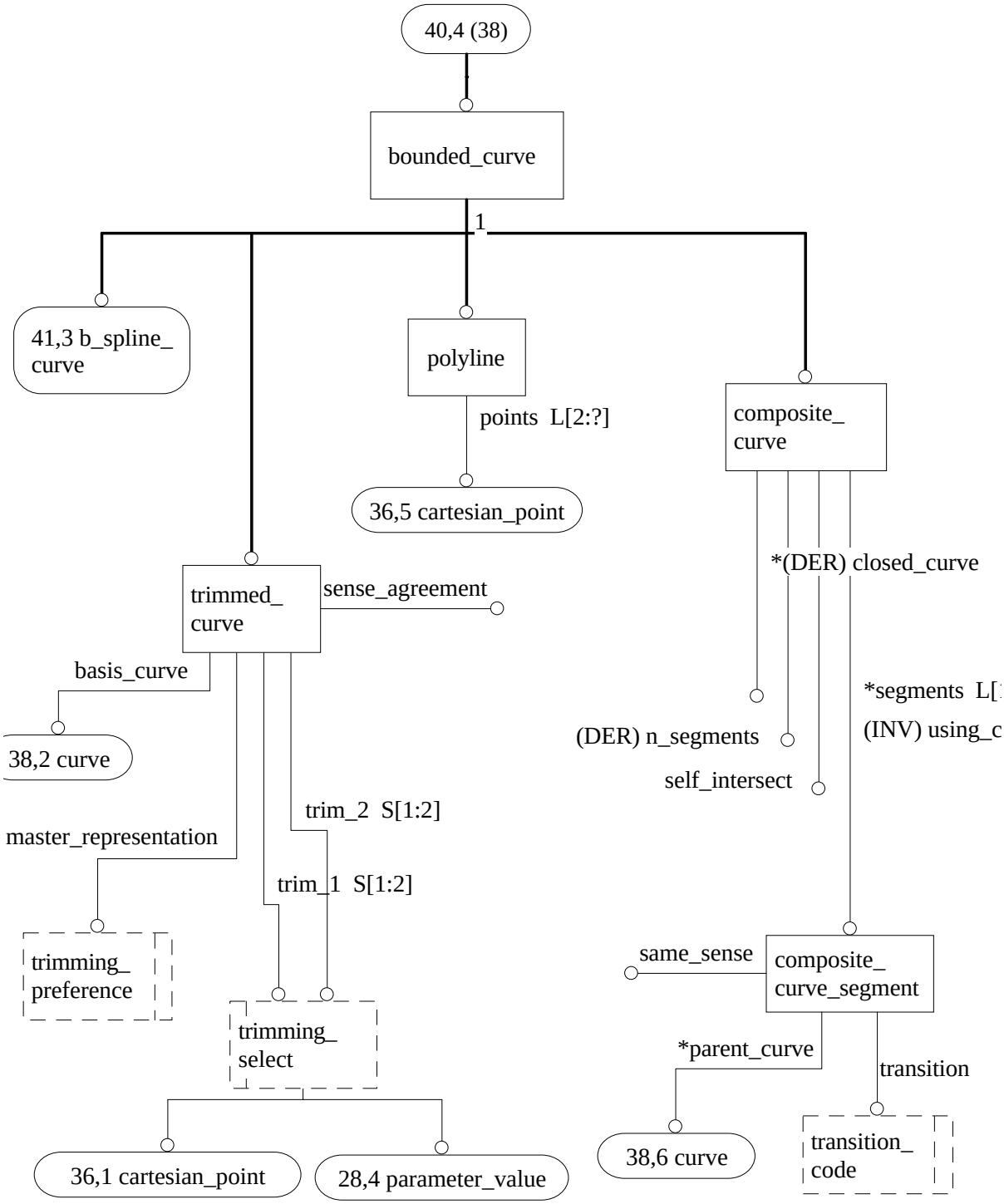


Figure H.40 - AIM EXPRESS-G diagram 40 of 55

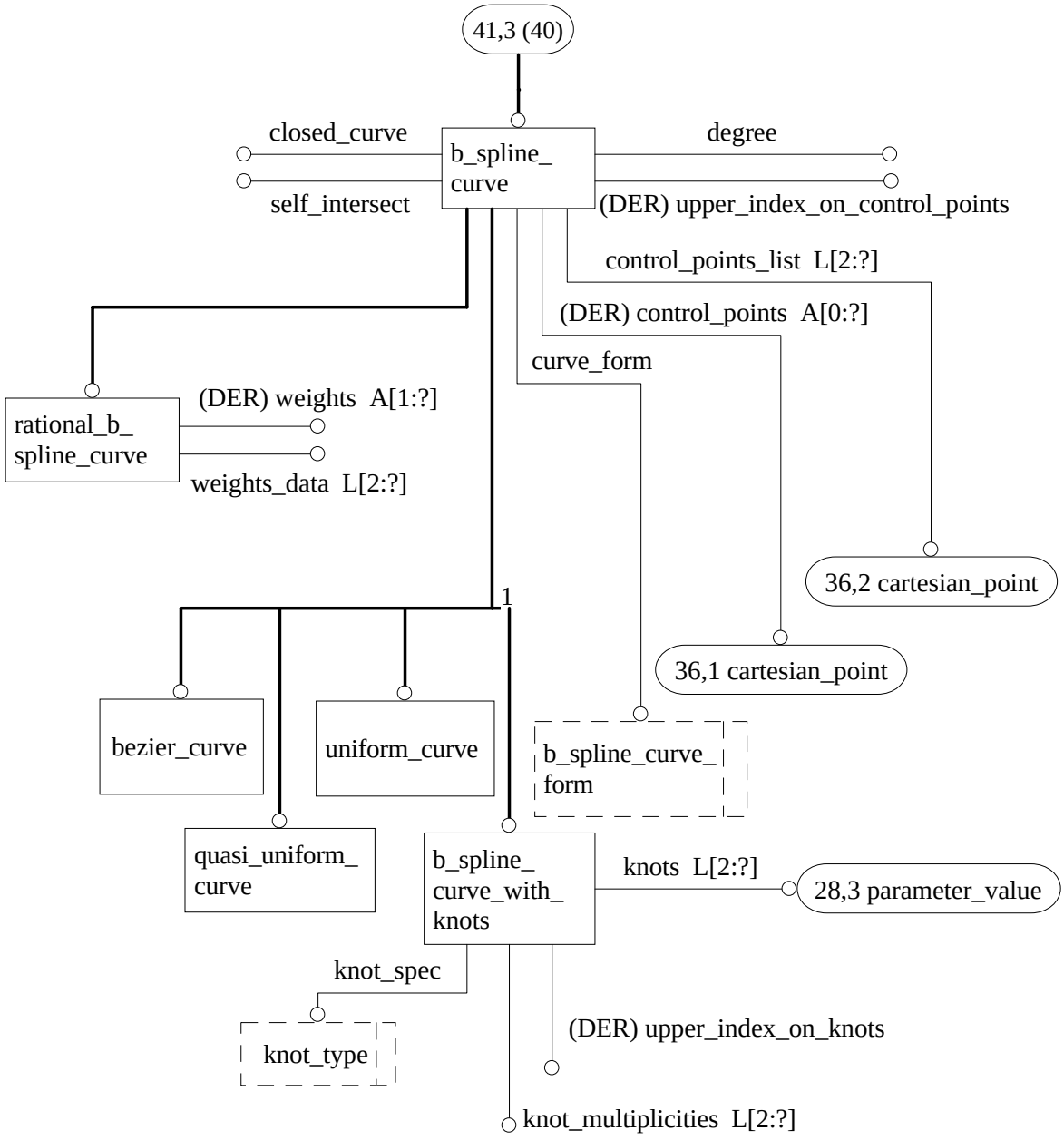


Figure H.41 - AIM EXPRESS-G diagram 41 of 55

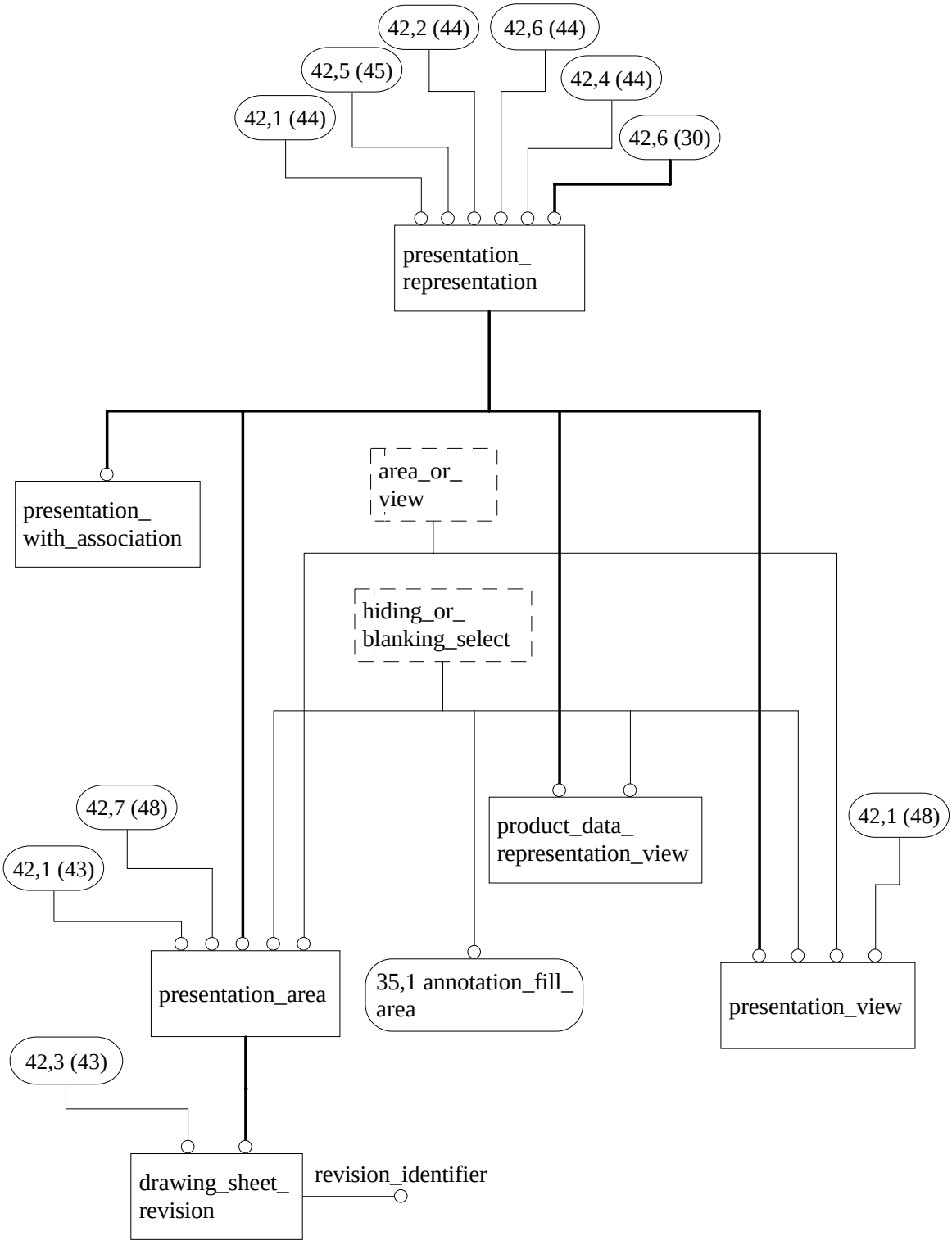


Figure H.42 - AIM EXPRESS-G diagram 42 of 55

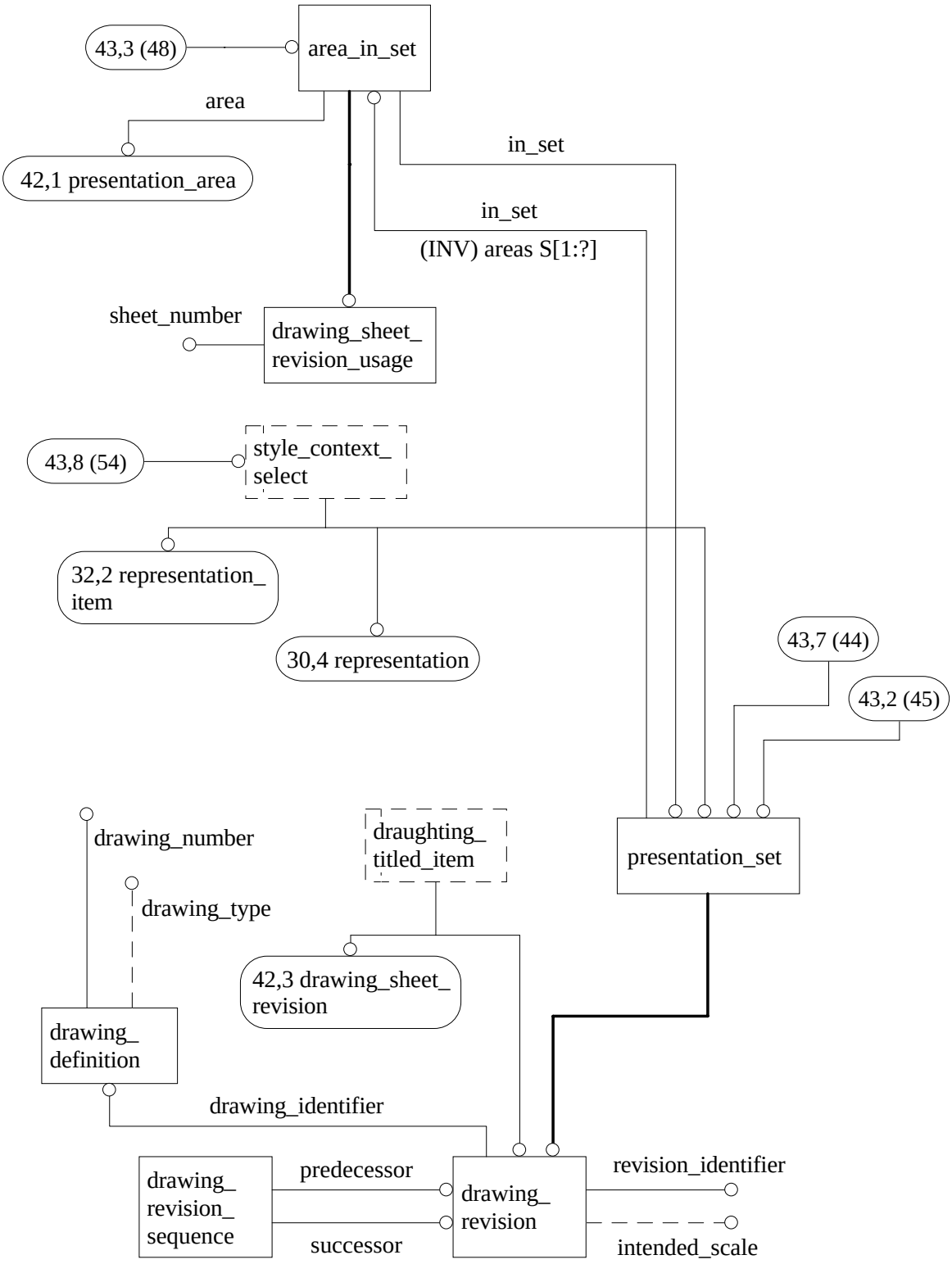


Figure H.43 - AIM EXPRESS-G diagram 43 of 55

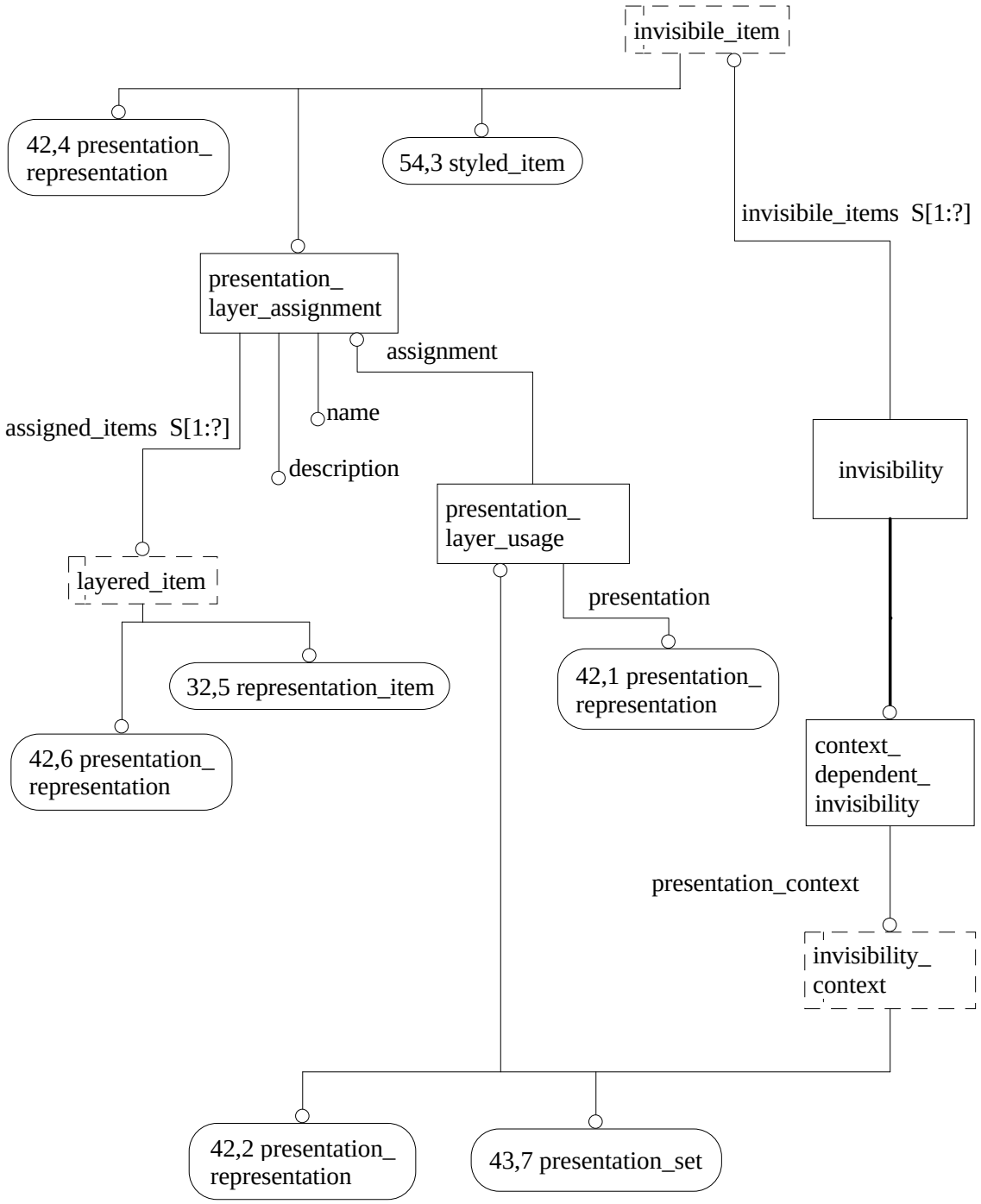


Figure H.44 - AIM EXPRESS-G diagram 44 of 55

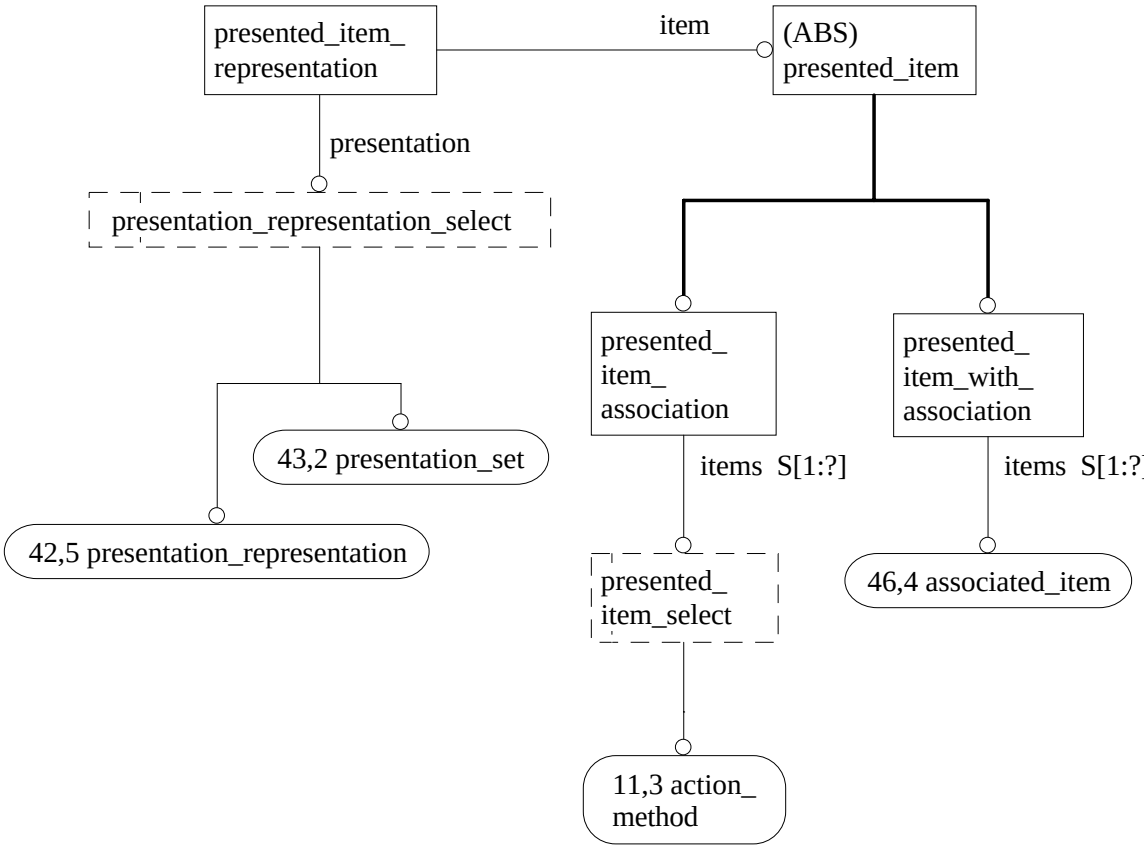


Figure H.45 - AIM EXPRESS-G diagram 45 of 55

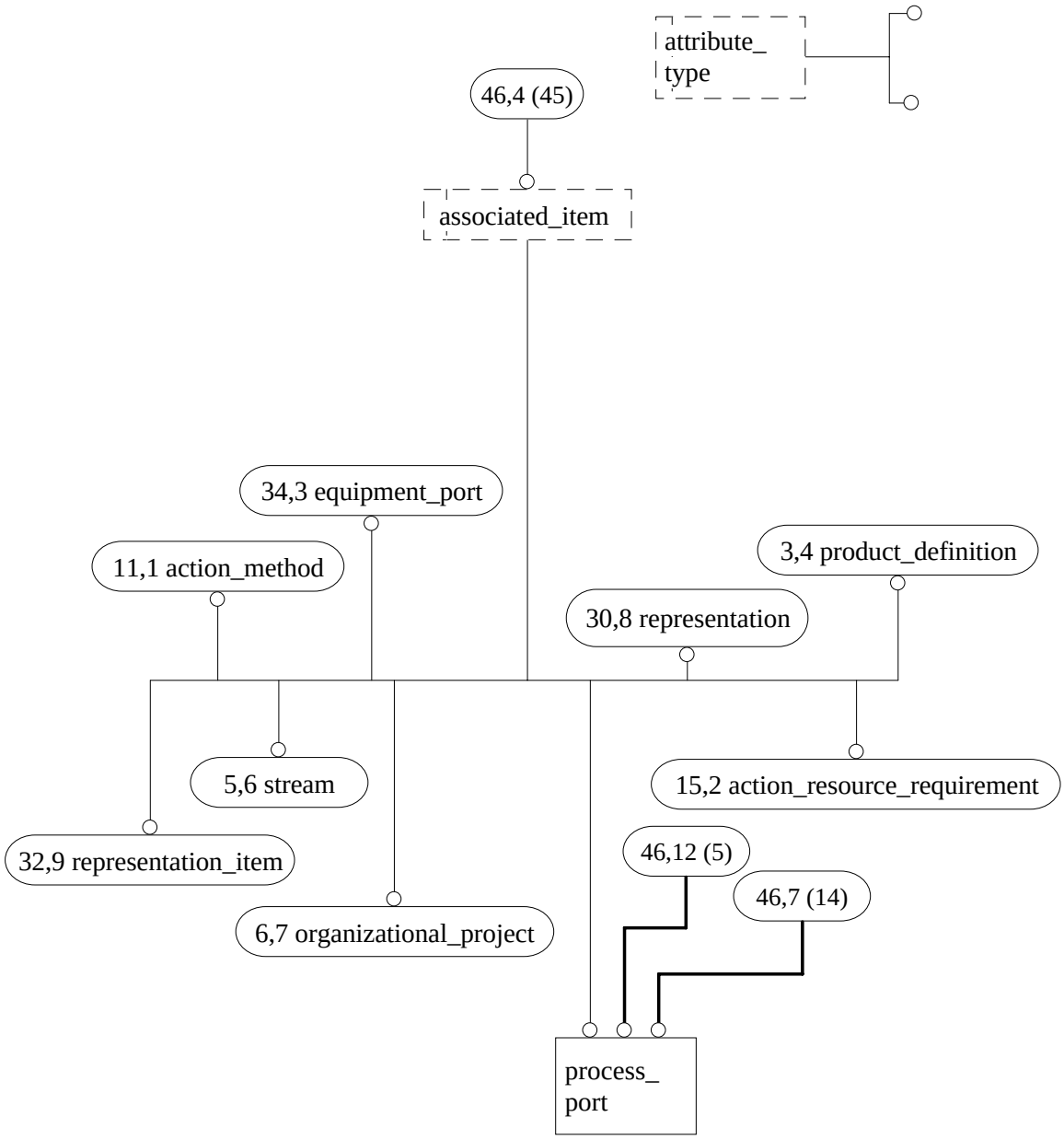


Figure H.46 - AIM EXPRESS-G diagram 46 of 55

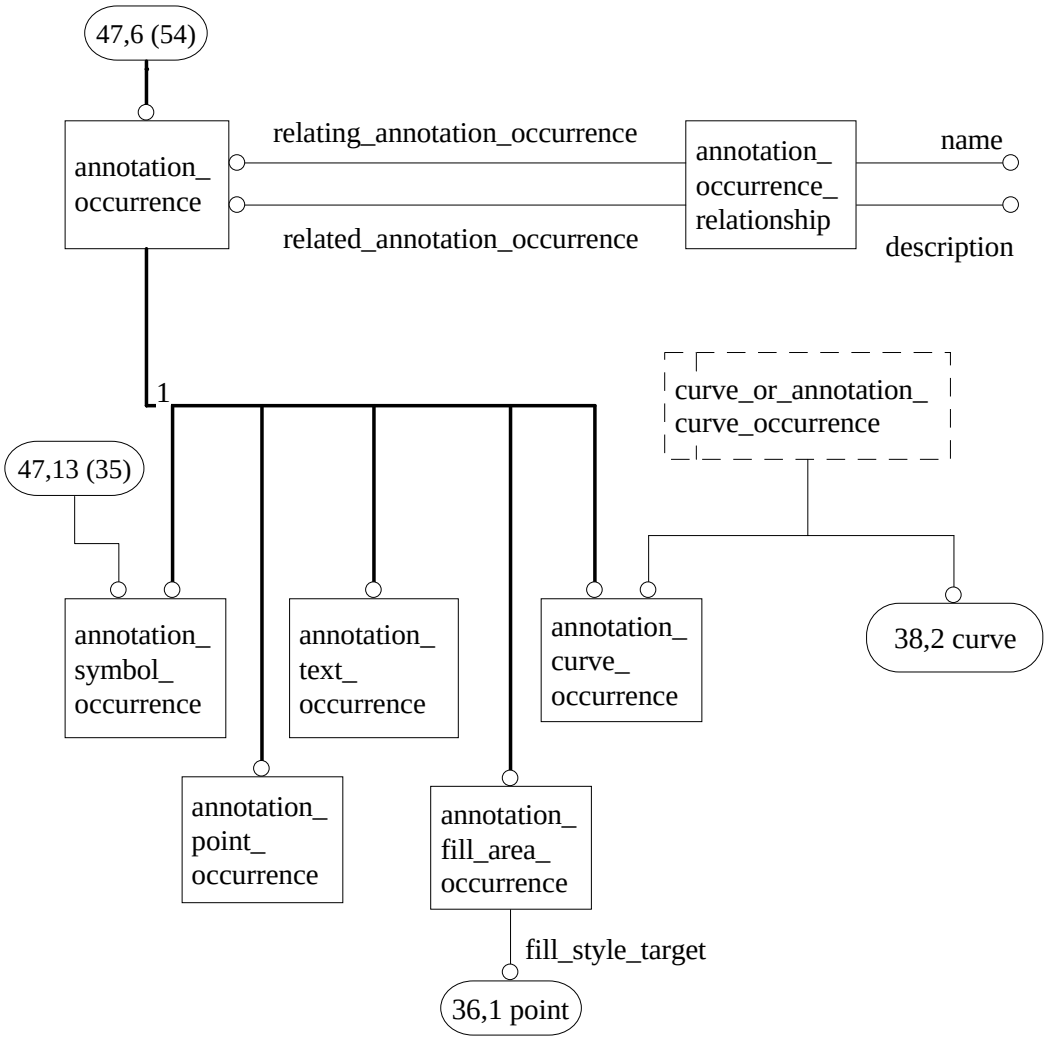


Figure H.47 - AIM EXPRESS-G diagram 47 of 55

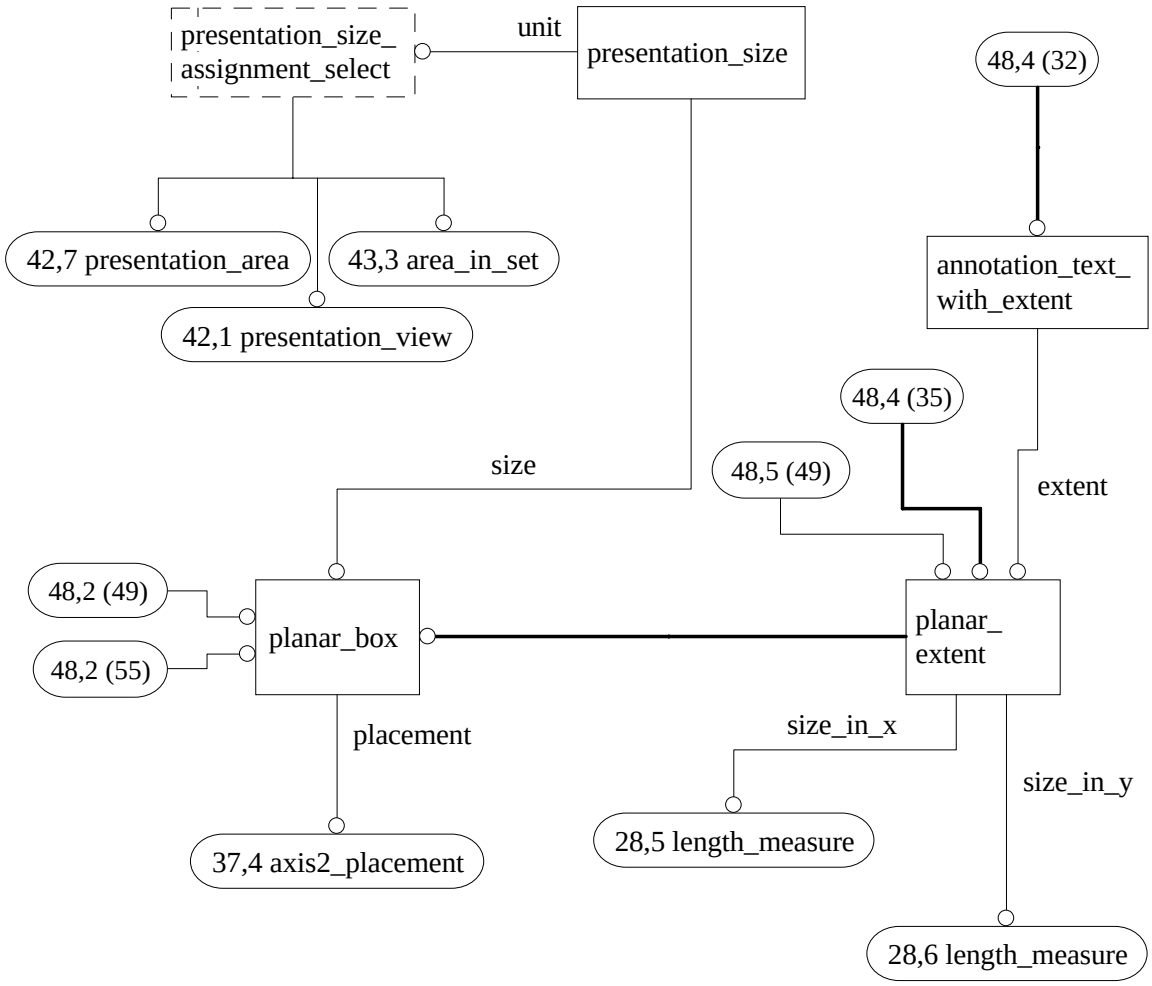


Figure H.48 - AIM EXPRESS-G diagram 48 of 55

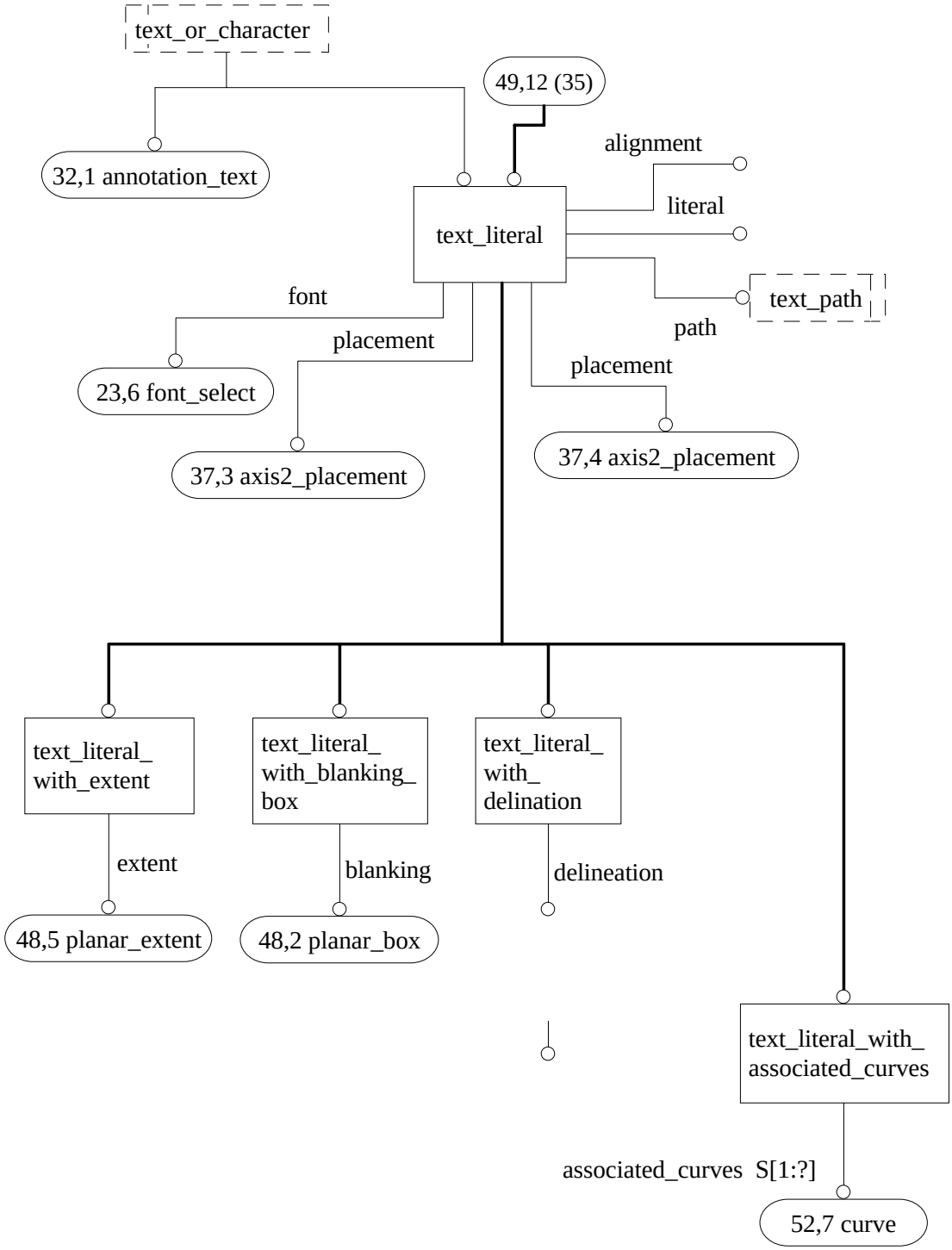


Figure H.49 - AIM EXPRESS-G diagram 49 of 55

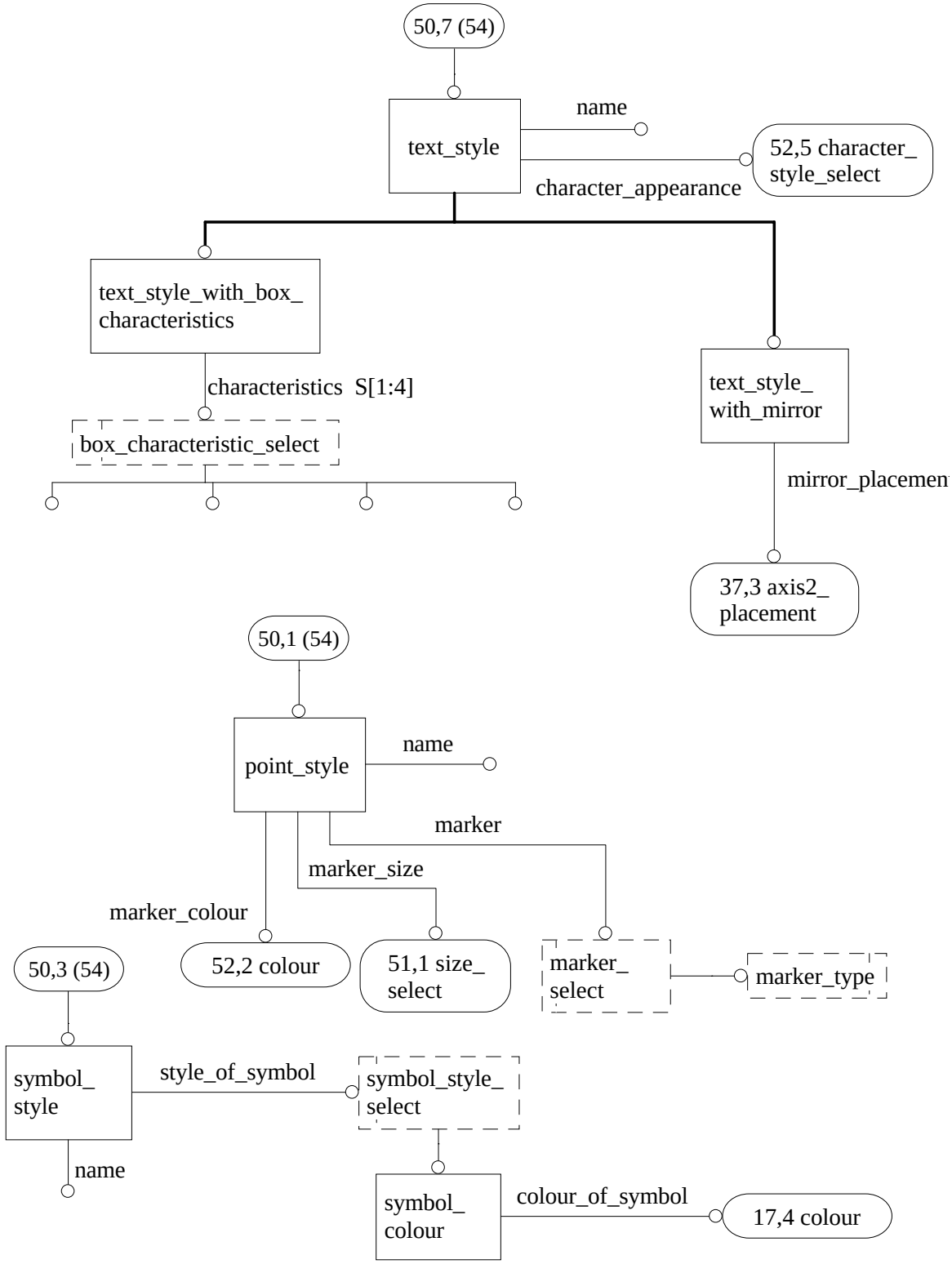


Figure H.50 - AIM EXPRESS-G diagram 50 of 55

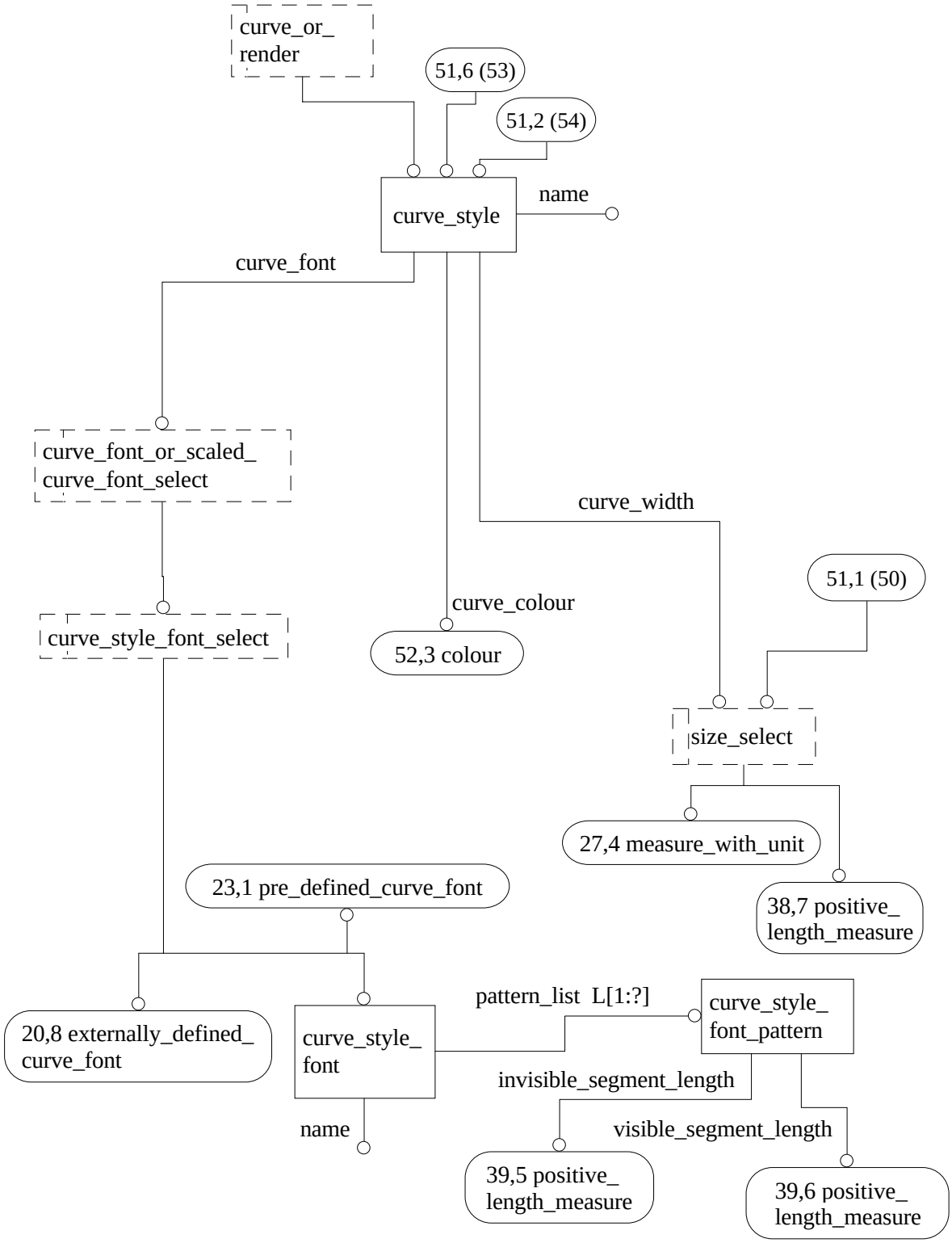


Figure H.51 - AIM EXPRESS-G diagram 51 of 55

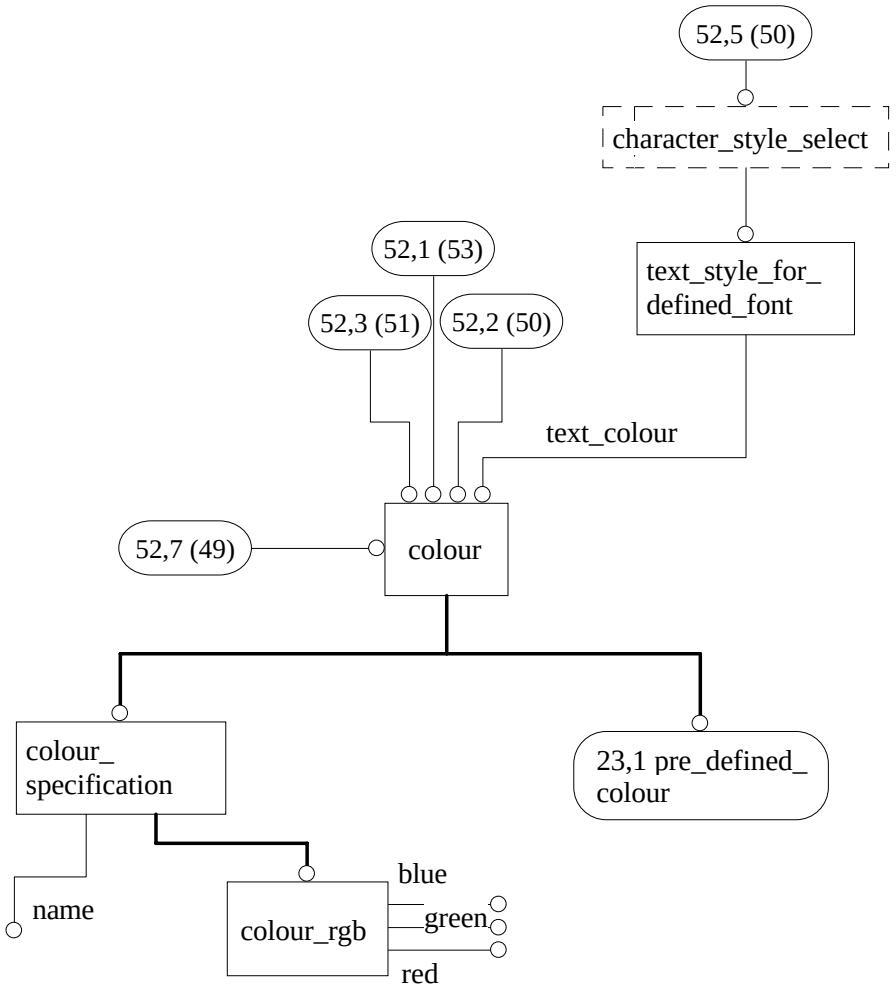


Figure H.52 - AIM EXPRESS-G diagram 52 of 55

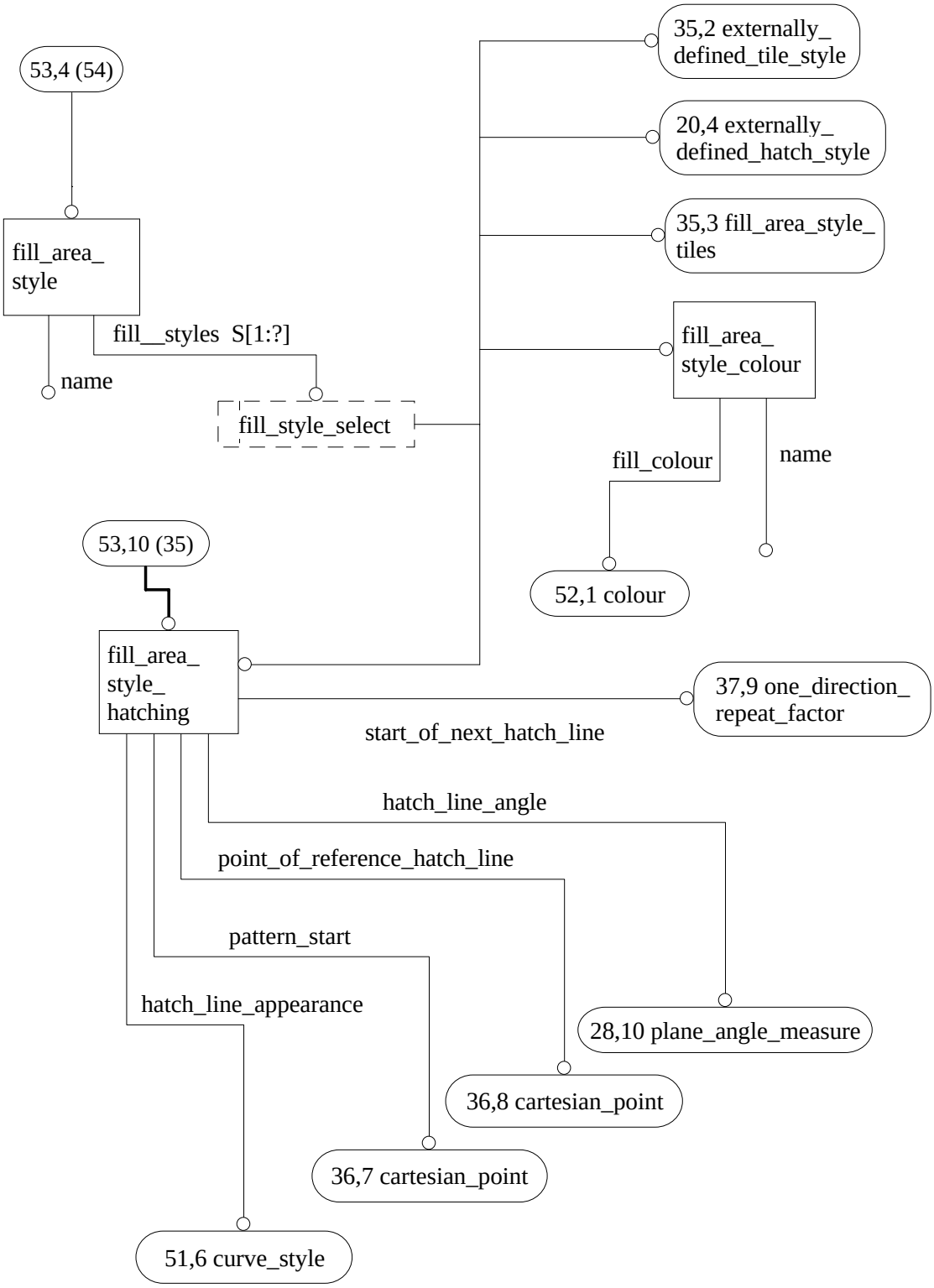


Figure H.53 - AIM EXPRESS-G diagram 53 of 55

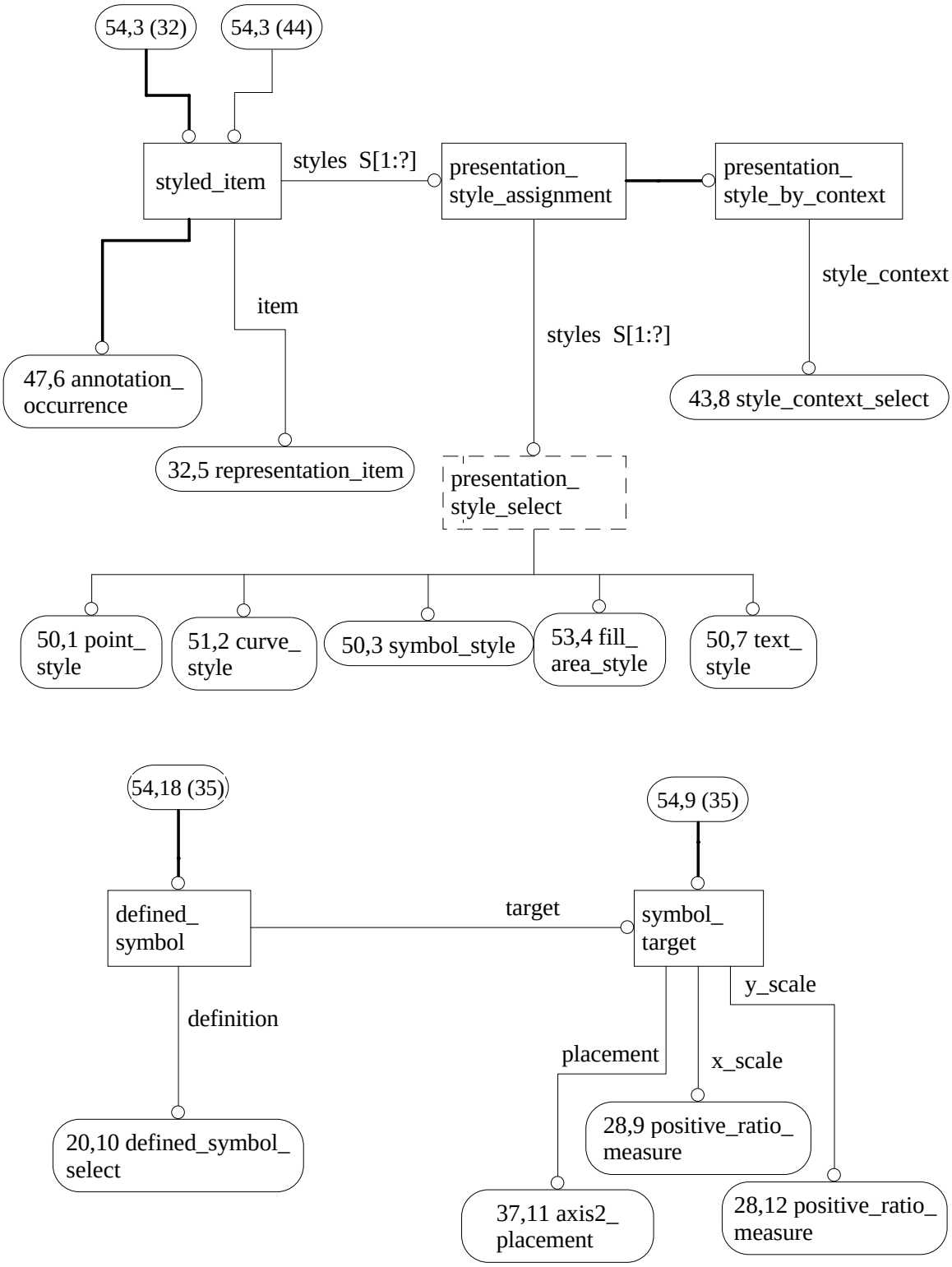


Figure H.54 - AIM EXPRESS-G diagram 54 of 55

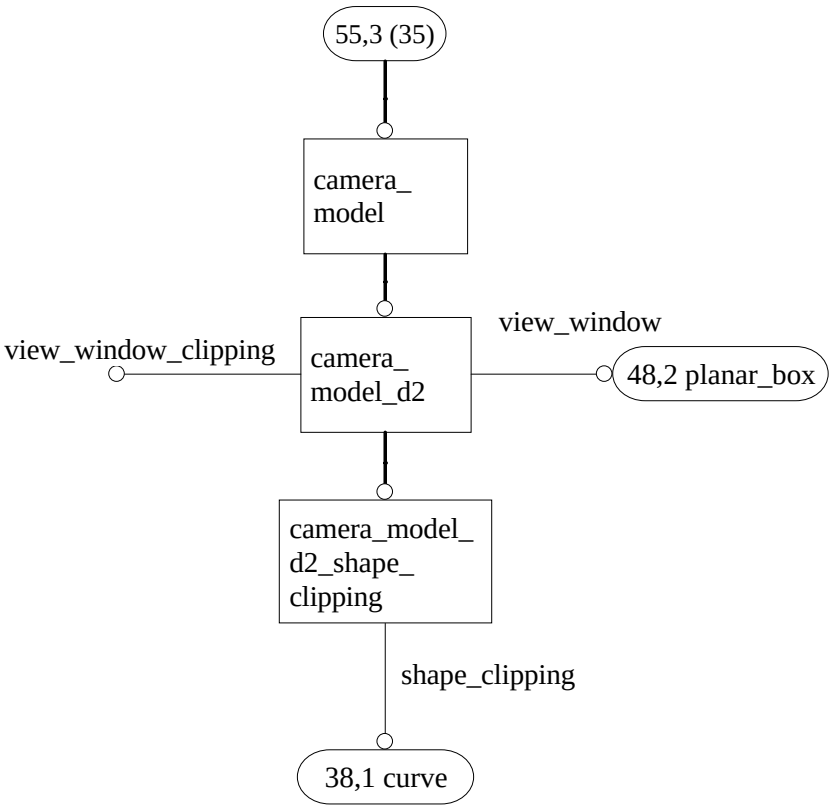


Figure H.55 - AIM EXPRESS-G diagram 55 of 55

Annex J
(informative)

AIM EXPRESS listing

This annex provides a listing of the table of short names and a listing of the EXPRESS specified in the AIM of this part of ISO 10303. No text or annotation is included. This annex is provided only in computer-interpretable form.

NOTE - The information provided on this diskette is informative; the normative text is that contained in the body of this part of ISO 10303.

Annex K
(informative)

Bibliography

[1] *Batch Control, Part 1: Models and Terminology*, ISA-S88.01-1995, The International Society for Measurement and Control, 28 February 1995.

[2] *IDEF0 Federal Information Processing Standards Publication 183, Integration Definition for Function Modeling (IDEF0)*, FIPS PUB 183, National Institute of Standards and Technology, December 1993.

[3] *IDEF1X Federal Information Processing Standards Publication 184, Integration Definition for Information Modeling (IDEF1X)*, FIPS PUB 184, National Institute of Standards and Technology, December 1993.

[4] Ludwig, Ernest E., *Applied Process Design for Chemical and Petrochemical Plants*, 2nd Edition, Gulf Publishing Company, February 1993.

[5] Smith, J.M., Van Ness, H.C., Abbott, M.M., *Introduction to Chemical Engineering Thermodynamics*, 5th Edition, McGraw-Hill, 1996.

[6] Perry, R.H., Green, D.W., Maloney, J.O., Chemical Engineers' Handbook, 6th Edition, McGraw-Hill, 1984.

[7] ISO 10303-221, *Functional Data and their Schematic Representation for Process Plant*, TC184/SC4/WG3/N559, 23 February 1997.

[8] ISO 10303-227. *Plant Spatial Configuration*, TC184/SC4/WG3/N580, 31 March 1997.

Index

AACE 14
AAM 14
Absolute_time_reference
application assertion 475
application object 45
ARM diagrams 2465
mapping table 1399
Abstract test suite 6
Action
AIM diagrams 2503
AIM EXPRESS listing entities 2294
Action_assignment
AIM diagrams 2503
AIM EXPRESS listing entities 2295
Action_item
AIM diagrams 2497
AIM EXPRESS listing types 2285
AIM EXPRESS short listing types 2136
mapping table 1508
Action_method
AIM diagrams 2505
AIM EXPRESS listing entities 2295
AIM EXPRESS short listing imported entity modifications 2212
Action_method_assignment
AIM diagrams 2505
AIM EXPRESS listing entities 2295
Action_method_item
AIM diagrams 2508
AIM EXPRESS listing types 2285
AIM EXPRESS short listing types 2136
Action_method_relationship
AIM diagrams 2505
AIM EXPRESS listing entities 2295
AIM EXPRESS short listing imported entity modifications 2213
Action_method_role
AIM diagrams 2505
AIM EXPRESS listing entities 2295
Action_property
AIM diagrams 2506
AIM EXPRESS listing entities 2295
AIM EXPRESS short listing imported entity modifications 2213
Action_property_relationship
AIM diagrams 2506
AIM EXPRESS listing entities 2295
Action_property_representation
AIM diagrams 2507
AIM EXPRESS listing entities 2295
Action_relationship

AIM diagrams 2503
AIM EXPRESS listing entities 2295
Action_request_assignment
AIM diagrams 2507
AIM EXPRESS listing entities 2296
Action_request_role
AIM diagrams 2507
AIM EXPRESS listing entities 2296
Action_request_solution
AIM diagrams 2507
AIM EXPRESS listing entities 2296
Action_resource
AIM diagrams 2508
AIM EXPRESS listing entities 2296
AIM EXPRESS short listing imported entity modifications 2213
Action_resource_relationship
AIM diagrams 2508
AIM EXPRESS listing entities 2296
Action_resource_requirement
AIM diagrams 2509
AIM EXPRESS listing entities 2296
Action_resource_type
AIM diagrams 2508
AIM EXPRESS listing entities 2296
Action_role
AIM diagrams 2503
AIM EXPRESS listing entities 2296
Active_area_shape
application assertion 427, 456, 457
application object 354
ARM diagrams 2452
mapping table 986
Actual
definition 7
acyclic_mapped_representation
AIM EXPRESS listing functions 2359
acyclic_presentation_representation_relationship
AIM EXPRESS listing functions 2360
acyclic_product_category_relationship
AIM EXPRESS listing functions 2360
acyclic_product_definition_relationship
AIM EXPRESS listing functions 2361
acyclic_symbol_representation_relationship
AIM EXPRESS listing functions 2361
AFD 14
AFNOR 14
Aggregation_relationship
application object 97
ARM diagrams 2473
mapping table 1598

Ahead_or_behind
AIM diagrams . . . 2501
AIM EXPRESS listing types . . . 2285
AIC . . . 14
AIM . . . 14
Air_cooled_heat_exchanger_unit
application object . . . 264
ARM diagrams . . . 2442
mapping table . . . 516
Algorithm_type_parameter
application assertion . . . 471
application object . . . 174
ARM diagrams . . . 2475
mapping table . . . 1622
Alternate_relationship
application object . . . 97
ARM diagrams . . . 2473
mapping table . . . 1598
Alternating_current_port
application object . . . 210
ARM diagrams . . . 2469
mapping table . . . 1448
Amorphous_solid
application object . . . 66
ARM diagrams . . . 2486
mapping table . . . 1821
Amount_of_substance_measure
AIM diagrams . . . 2522
AIM EXPRESS listing types . . . 2285
Amount_of_substance_measure_with_unit
AIM diagrams . . . 2521
AIM EXPRESS listing entities . . . 2296
Amount_of_substance_unit
AIM diagrams . . . 2520
AIM EXPRESS listing entities . . . 2296
Angular_offset_of_small_si de
mapping table . . . 1723
Annotation_curve_occurrence
AIM diagrams . . . 2541
AIM EXPRESS listing entities . . . 2297
Annotation_fill_area
AIM diagrams . . . 2529
AIM EXPRESS listing entities . . . 2297
Annotation_fill_area_occurrence
AIM diagrams . . . 2541
AIM EXPRESS listing entities . . . 2297
Annotation_occurrence
AIM diagrams . . . 2541
AIM EXPRESS listing entities . . . 2297
Annotation_occurrence_relationship

AIM diagrams . . . 2541
AIM EXPRESS listing entities . . . 2297
Annotation_point_occurrence
AIM diagrams . . . 2541
AIM EXPRESS listing entities . . . 2297
Annotation_symbol
AIM diagrams . . . 2526
AIM EXPRESS listing entities . . . 2297
Annotation_symbol_occurrence
AIM diagrams . . . 2541
AIM EXPRESS listing entities . . . 2297
Annotation_text
AIM diagrams . . . 2526
AIM EXPRESS listing entities . . . 2298
Annotation_text_occurrence
AIM diagrams . . . 2541
AIM EXPRESS listing entities . . . 2298
Annotation_text_with_extent
AIM diagrams . . . 2542
AIM EXPRESS listing entities . . . 2298
ANSI . . . 14
AP . . . 14
API . . . 14
Application . . . 6
Application activity model . . . 6
Application interpreted model . . . 6
Application protocol . . . 6
Application reference model . . . 6
Application_context
AIM diagrams . . . 2495
AIM EXPRESS listing entities . . . 2298
AIM EXPRESS short listing imported entity modifications . . . 2213
Application_context_element
AIM diagrams . . . 2495
AIM EXPRESS listing entities . . . 2298
application_context_requires_ap_definition
AIM EXPRESS listing rules . . . 2353
AIM EXPRESS short listing rules . . . 2219
Application_protocol_definition
AIM diagrams . . . 2495
AIM EXPRESS listing entities . . . 2298
AIM EXPRESS short listing imported entity modifications . . . 2213
Applied_action_assignment
AIM diagrams . . . 2503
AIM EXPRESS listing entities . . . 2298
AIM EXPRESS short listing entities . . . 2140
mapping table . . . 1508
Applied_action_method_assignment
AIM diagrams . . . 2505
AIM EXPRESS listing entities . . . 2298

AIM EXPRESS short listing entities 2141
mapping table 1915, 1916, 1959
Applied_approval_assignment
AIM diagrams 2502
AIM EXPRESS listing entities 2298
AIM EXPRESS short listing entities 2141
mapping table 1620, 1814, 1840, 1857, 1867
Applied_certification_assignment
AIM diagrams 2513
AIM EXPRESS listing entities 2299
AIM EXPRESS short listing entities 2141
mapping table 1505
Applied_date_assignment
AIM diagrams 2501
AIM EXPRESS listing entities 2299
AIM EXPRESS short listing entities 2142
mapping table 1814
Applied_date_time_assignment
AIM diagrams 2501
AIM EXPRESS listing entities 2299
AIM EXPRESS short listing entities 2142
Applied_document_reference
AIM diagrams 2512
AIM EXPRESS listing entities 2299
AIM EXPRESS short listing entities 2143
mapping table 958, 969, 1431, 1505, 1811, 1819, 1839, 1864, 1865, 1868, 1876
Applied_group_assignment
AIM diagrams 2515
AIM EXPRESS listing entities 2299
AIM EXPRESS short listing entities 2144
mapping table 496, 505, 508-510, 512, 615, 956, 957, 959, 960, 963, 977, 980, 1223-1229, 1231-1250, 1261, 1262, 1267, 1270-1281, 1410, 1417-1419, 1450-1456, 1461, 1464, 1472, 1473, 1475, 1484, 1506, 1507, 1515, 1517, 1551-1554, 1564-1569, 1596, 1597, 1625, 1654, 1655, 1662, 1665, 1667, 1677, 1688, 1691, 1692, 1731, 1750, 1803-1805, 1812, 1813, 1822, 1828, 1833, 1847, 1857, 1861, 1863, 1877, 1881, 1971
Applied_identification_assignment
AIM diagrams 2518
AIM EXPRESS listing entities 2299
AIM EXPRESS short listing entities 2144
mapping table 962, 1400, 1427, 1616, 1627, 1676, 1825-1827, 1832, 1860, 1861
Applied_organization_assignment
AIM diagrams 2500
AIM EXPRESS listing entities 2299
AIM EXPRESS short listing entities 2145
mapping table 1095, 1433, 1474, 1477, 1511, 1535, 1580, 1620, 1627, 1815, 2121
Applied_person_assignment
AIM diagrams 2500
AIM EXPRESS listing entities 2299
AIM EXPRESS short listing entities 2145
mapping table 1433, 1813, 1815

Approval
AIM diagrams . . . 2502
AIM EXPRESS listing entities . . . 2299
Approval_assignment
AIM diagrams . . . 2502
AIM EXPRESS listing entities . . . 2299
AIM EXPRESS short listing imported entity modifications . . . 2214
Approval_date_time
AIM diagrams . . . 2502
AIM EXPRESS listing entities . . . 2299
Approval_date_time_role
AIM diagrams . . . 2502
AIM EXPRESS listing entities . . . 2299
Approval_person_organization
AIM diagrams . . . 2502
AIM EXPRESS listing entities . . . 2300
Approval_role
AIM diagrams . . . 2502
AIM EXPRESS listing entities . . . 2300
Approval_status
AIM diagrams . . . 2502
AIM EXPRESS listing entities . . . 2300
Approved_item
AIM diagrams . . . 2502
AIM EXPRESS listing types . . . 2285
AIM EXPRESS short listing types . . . 2136
mapping table . . . 1620, 1814, 1840, 1857, 1867
Approver_role
AIM diagrams . . . 2502
AIM EXPRESS listing entities . . . 2300
Area_in_set
AIM diagrams . . . 2537
AIM EXPRESS listing entities . . . 2300
Area_measure
AIM diagrams . . . 2522
AIM EXPRESS listing types . . . 2285
Area_measure_with_unit
AIM diagrams . . . 2521
AIM EXPRESS listing entities . . . 2300
Area_or_view
AIM diagrams . . . 2536
AIM EXPRESS listing types . . . 2285
Area_unit
AIM diagrams . . . 2520
AIM EXPRESS listing entities . . . 2300
ARM . . . 14
Arrhenius_reaction
application object . . . 79
ARM diagrams . . . 2439
mapping table . . . 496

ASME 14
ASN 15
Assembly
definition 7
Assembly_component_usage
AIM diagrams 2498
AIM EXPRESS listing entities 2300
Associated_item
AIM diagrams 2540
AIM EXPRESS listing types 2285
AIM EXPRESS short listing types 2136
mapping table 1477, 1605-1613
ASTM 15
Atmospheric_tank
application object 411
ARM diagrams 2477
mapping table 1688
ATS 15
Attribute_type
AIM diagrams 2540
AIM EXPRESS listing types 2285
Axial_position_detector
application assertion 427
ARM diagrams 2458
Axis2_placement
AIM diagrams 2531
AIM EXPRESS listing types 2285
Axis2_placement_2d
AIM diagrams 2531
AIM EXPRESS listing entities 2300
Axis2_placement_3d
AIM diagrams 2531
AIM EXPRESS listing entities 2300
B_spline_curve
AIM diagrams 2535
AIM EXPRESS listing entities 2301
B_spline_curve_form
AIM diagrams 2535
AIM EXPRESS listing types 2286
B_spline_curve_with_knots
AIM diagrams 2535
AIM EXPRESS listing entities 2301
Baffle_and_disengaging_panel_intersection
application assertion 428, 439
application object 354
ARM diagrams 2449
mapping table 986
Baffle_and_seal_pan_intersection
application assertion 428, 439
application object 355

ARM diagrams 2451
mapping table 988
Baffle_and_tray_panel_intersection
application assertion 428, 439
application object 355
ARM diagrams 2449
mapping table 991
bag_to_set
AIM EXPRESS listing functions 2362
Balance
application assertion 428
application object 174
ARM diagrams 2475
mapping table 1622
Baseplates_and_soleplates
application assertion 428
application object 211
ARM diagrams 2458, 2471
mapping table 1450
Bearing
application assertion 429
application object 213
ARM diagrams 2459, 2471
mapping table 1458
Bearing_housing
application assertion 429
application object 215
ARM diagrams 2459, 2471
mapping table 1467
Bezier_curve
AIM diagrams 2535
AIM EXPRESS listing entities 2301
Bin_section
AIM diagrams 2497
AIM EXPRESS listing entities 2301
AIM EXPRESS short listing entities 2146
application assertion 429, 468
application object 412
ARM diagrams 2447, 2468, 2478
mapping table 1692-1698, 1753
Binary_parameter
application object 66
ARM diagrams 2487
mapping table 1821
Binary_parameter_value
application assertion 429
application object 66
ARM diagrams 2485
mapping table 1822
Blinding_strip

application assertion 429
application object 355
ARM diagrams 2449
mapping table 995
Blinding_strip_shape
application assertion 429, 430, 457
application object 355
ARM diagrams 2449
mapping table 997
Boot
AIM diagrams 2497
AIM EXPRESS listing entities 2303
AIM EXPRESS short listing entities 2148
application assertion 430, 468
application object 413
ARM diagrams 2478
mapping table 1698-1700, 1702, 1703, 1754
Boot_location_on_cylinder_section
application assertion 430
application object 413
ARM diagrams 2480
mapping table 1699
Boot_location_on_head_section
application assertion 430
application object 414
ARM diagrams 2480
mapping table 1701
Boot_section_relationship
application assertion 430
application object 414
ARM diagrams 2478
mapping table 1703
Bounded_curve
AIM diagrams 2534
AIM EXPRESS listing entities 2303
application assertion 429, 481
application object 414
ARM diagrams 2478
mapping table 1704
Box_characteristic_select
AIM diagrams 2544
AIM EXPRESS listing types 2286
box_height
AIM EXPRESS listing types 2286
box_rotate_angle
AIM EXPRESS listing types 2286
box_slant_angle
AIM EXPRESS listing types 2286
box_width
AIM EXPRESS listing types 2286

Bubble_cap
application object . . . 355
ARM diagrams . . . 2450
mapping table . . . 999
Bubble_cap_shape
application assertion . . . 432, 476
application object . . . 355
ARM diagrams . . . 2453
mapping table . . . 1001
Bubble_slot_shape
application assertion . . . 432, 457
application object . . . 356
ARM diagrams . . . 2453
mapping table . . . 1003
Buffer_gas_system
application assertion . . . 434
application object . . . 254
ARM diagrams . . . 2446, 2458, 2468
mapping table . . . 946
build_2axes
AIM EXPRESS listing functions . . . 2362
build_axes
AIM EXPRESS listing functions . . . 2362
Bulk_thermodynamic_properties
application assertion . . . 431
application object . . . 82
ARM diagrams . . . 2455
mapping table . . . 1223
Bulk_thermophysical_properties
application assertion . . . 431, 432, 441, 462, 487
application assertions . . . 431
application object . . . 84
ARM diagrams . . . 2455, 2464, 2482, 2487
mapping table . . . 1229
Bulk_vapour_liquid_equilibrium_properties
application assertion . . . 432
application object . . . 84
ARM diagrams . . . 2455
mapping table . . . 1231
Buttweld
application object . . . 216
ARM diagrams . . . 2470
mapping table . . . 1468
C&IS . . . 15
CAD . . . 15
Calendar_date
AIM diagrams . . . 2501
AIM EXPRESS listing entities . . . 2303
Camera_model
AIM diagrams . . . 2549

AIM EXPRESS listing entities 2303
Camera_model_d2
AIM diagrams 2549
AIM EXPRESS listing entities 2303
Camera_model_d2_shape_clipping
AIM diagrams 2549
AIM EXPRESS listing entities 2303
Cap_shape
application assertion 432, 457
application object 356
ARM diagrams 2453
mapping table 1003
Cartesian_point
AIM diagrams 2530
AIM EXPRESS listing entities 2303
application assertion 432
application object 357
ARM diagrams 2452
mapping table 1007
Casing_nozzle
application assertion 432
application object 255
ARM diagrams 2446, 2459
mapping table 947
Catalogue
definition 8
CC 15
Cc_balance_piston
application assertion 432
application object 388
ARM diagrams 2460, 2471
mapping table 1282
Cc_casing
application assertion 433
application object 388
ARM diagrams 2460, 2471
mapping table 1285
Cc_critical_speed
application object 390
ARM diagrams 2460
mapping table 1298
Cc_diaphragm
application assertion 433
application object 391
ARM diagrams 2460, 2471
mapping table 1300
Cc_impeller
application assertion 433
application object 391
ARM diagrams 2460, 2471

mapping table 1302
Cc_labyrinth
application assertion 433
application object 393
ARM diagrams 2458, 2471
mapping table 1315
Cc_lateral_critical_speed
application assertion 433
application object 394
ARM diagrams 2460
mapping table 1317
Cc_miscellaneous
application assertion 433
application object 395
ARM diagrams 2460
mapping table 1321
Cc_shaft_sleeve
application assertion 433
application object 396
ARM diagrams 2460, 2471
mapping table 1326
Cc_speed_control_method
application assertion 433
application object 396
ARM diagrams 2458
mapping table 1328
Cc_speed_control_signal
application assertion 434
application object 397
ARM diagrams 2458
mapping table 1332
Cc_torsional_critical_speed
application assertion 434
application object 398
ARM diagrams 2460
mapping table 1336
Cc_weights
application assertion 434
application object 398
ARM diagrams 2458
mapping table 1337
Centrifugal_compressor
application assertion 427, 432-434, 493
application object 399
ARM diagrams 2446, 2460
mapping table 1341
Centrifugal_compressor_stage
application assertion 433, 434
application object 400
ARM diagrams 2461

mapping table 1347
Centrifugal_compressor_tests
application object 216
ARM diagrams 2466
mapping table 1469
Centrifugal_pump
application assertion 434, 453, 473
application object 400
ARM diagrams 2461, 2471
mapping table 1349
Certification
AIM diagrams 2513
AIM EXPRESS listing entities 2304
Certification_assignment
AIM diagrams 2513
AIM EXPRESS listing entities 2304
AIM EXPRESS short listing imported entity modifications 2214
Certification_role
AIM diagrams 2513
AIM EXPRESS listing entities 2304
Certification_type
AIM diagrams 2513
AIM EXPRESS listing entities 2304
Certified_item
AIM diagrams 2503
AIM EXPRESS listing types 2286
AIM EXPRESS short listing types 2137
mapping table 1505
Character_spacing_select
AIM diagrams 2522
AIM EXPRESS listing types 2286
Character_style_select
AIM diagrams 2546
AIM EXPRESS listing types 2286
Characterized_action_definition
AIM diagrams 2504
AIM EXPRESS listing types 2286
Characterized_definition
AIM diagrams 2499
AIM EXPRESS listing types 2286
Characterized_material_property
AIM diagrams 2519
AIM EXPRESS listing types 2286
Characterized_object
AIM diagrams 2499
AIM EXPRESS listing entities 2304
AIM EXPRESS short listing imported entity modifications 2214
characterized_object_relationship
AIM EXPRESS listing entities 2304
Characterized_product_definition

AIM diagrams 2497
AIM EXPRESS listing types 2286
Characterized_resource_definition
AIM diagrams 2509
AIM EXPRESS listing types 2287
Chemical_component
application assertion 435, 462, 485
application object 66
ARM diagrams 2457, 2486
mapping table 1824
Chemical_reaction
application assertion 434, 447, 450, 461, 474, 481
application object 80
ARM diagrams 2439, 2464, 2484, 2485, 2493
mapping table 497
Chemical_reaction_data
unit of functionality 21
Chemical_specie
application assertion 435
application object 66
ARM diagrams 2486
mapping table 1824
Chemical_specie_structural_group_relationship
application assertion 435
application object 68
ARM diagrams 2486
mapping table 1829
Circle
AIM diagrams 2533
AIM EXPRESS listing entities 2304
Citation
application assertion 435, 441, 444, 472, 480, 492
application object 61
ARM diagrams 2484, 2485, 2488
mapping table 1811
Citation_reference
application assertion 435, 472
application object 102
ARM diagrams 2488
mapping table 1868
class_name_in_hierarchy
AIM EXPRESS listing functions 2362
AIM EXPRESS short listing functions 2234
Classification_assignment
AIM diagrams 2515
AIM EXPRESS listing entities 2304
AIM EXPRESS short listing entities 2148
mapping table . . 497, 501, 503, 506, 516, 517, 531, 532, 537, 538, 545, 546, 552, 555, 556, 579-581, 595, 606-608, 619, 624, 629, 630, 644, 645, 649, 670, 694, 699, 700, 716, 741, 742, 753, 754, 764, 765, 769, 773, 774, 779, 785, 792, 802, 803, 852, 858, 859, 864, 894, 914, 915, 935,

938, 939, 945-947, 952, 953, 965, 972, 975, 976, 978, 979, 983, 984, 986, 988, 990, 991, 993-999, 1001-1003, 1006, 1009, 1010, 1019-1025, 1027, 1029, 1032, 1033, 1039-1044, 1047, 1048, 1051, 1054, 1057-1059, 1065, 1066, 1071-1074, 1079, 1081-1083, 1085-1088, 1090, 1100-1104, 1108, 1109, 1114, 1119-1126, 1128-1131, 1137-1140, 1150, 1164, 1165, 1168-1171, 1174, 1177, 1179, 1182, 1185, 1189, 1195-1199, 1201-1205, 1207, 1209, 1210, 1212-1214, 1222, 1238, 1239, 1255, 1259, 1265, 1267, 1277, 1282, 1284, 1285, 1298, 1300-1302, 1313-1315, 1317, 1320, 1321, 1325, 1326, 1328, 1332, 1336, 1337, 1340, 1341, 1347-1349, 1355-1361, 1363-1365, 1367, 1368, 1371, 1374-1379, 1381, 1383, 1384, 1389, 1398, 1404, 1420, 1426, 1448, 1450, 1457, 1458, 1461, 1465-1470, 1472, 1476-1478, 1482-1484, 1486, 1487, 1490-1493, 1498-1501, 1507, 1509-1514, 1518, 1522-1524, 1531, 1539, 1541, 1542, 1546, 1547, 1551, 1557, 1560, 1564, 1570, 1576, 1579-1581, 1583-1585, 1592, 1599, 1601, 1604, 1605, 1609, 1611, 1619, 1629, 1630, 1632, 1635, 1638, 1642, 1643, 1649-1652, 1655-1657, 1660, 1661, 1668, 1670, 1672, 1675, 1680-1683, 1688, 1692, 1697, 1699, 1701, 1703-1705, 1711, 1717, 1718, 1722, 1727, 1732, 1734, 1737, 1740, 1744-1749, 1751, 1753-1755, 1757, 1761, 1765, 1770, 1774, 1776, 1780, 1792, 1802, 1805, 1816-1818, 1820, 1821, 1823, 1824, 1830, 1831, 1838, 1839, 1841, 1842, 1845, 1846, 1848, 1855-1858, 1861, 1862, 1866-1868, 1871, 1873, 1875, 1876, 1878, 1879, 1885, 1886, 1890, 1891, 1893, 1896, 1903, 1905, 1906, 1910, 1912, 1913, 1915-1918, 1926-1930, 1934-1937, 1939, 1945, 1946, 1954-1956, 1959-1961, 1964, 1966, 1967, 1969, 1970, 1972-1975, 1977-1982, 1990, 1992, 1995-2000, 2006, 2009, 2010, 2014-2016, 2025, 2027, 2028, 2031, 2032, 2034, 2037, 2039-2044, 2046, 2047, 2050-2054, 2058-2063, 2067, 2068, 2070, 2071, 2073, 2075, 2079, 2083, 2086, 2088, 2095-2097, 2099-2105, 2108, 2109, 2113, 2115, 2116, 2118, 2120-2122, 2124, 2126-2129

Classified_item

AIM diagram 2516

AIM EXPRESS listing types 2287

AIM EXPRESS short listing types 2137

mapping table . . 496, 497, 501, 503, 506, 516, 517, 531, 532, 537, 538, 545, 546, 552, 555, 556, 579-581, 595, 606-608, 619, 624, 629, 630, 644, 645, 649, 670, 694, 699, 700, 716, 741, 742, 753, 754, 764, 765, 769, 773, 774, 779, 785, 792, 802, 803, 852, 858, 859, 864, 894, 914, 915, 935, 938, 939, 945-947, 952, 953, 965, 972, 975, 976, 978, 979, 983, 984, 986, 988, 990, 991, 993-999, 1001-1003, 1006, 1009, 1010, 1019-1025, 1027, 1029, 1032, 1033, 1039-1044, 1047, 1048, 1051, 1054, 1057-1059, 1065, 1066, 1071-1074, 1079, 1081-1083, 1085-1088, 1090, 1100-1104, 1108, 1109, 1114, 1119-1126, 1128-1131, 1137-1140, 1150, 1164, 1165, 1168-1171, 1174, 1177, 1179, 1182, 1185, 1189, 1195-1199, 1201-1205, 1207, 1209, 1210, 1212-1214, 1222, 1238, 1239, 1255, 1259, 1265, 1267, 1277, 1282, 1284, 1285, 1298, 1300-1302, 1313-1315, 1317, 1320, 1321, 1325, 1326, 1328, 1332, 1336, 1337, 1340, 1341, 1347-1349, 1355-1361, 1363-1365, 1367, 1368, 1371, 1374-1379, 1381, 1383, 1384, 1389, 1398, 1404, 1420, 1426, 1448, 1450, 1457, 1458, 1461, 1465-1470, 1472, 1476-1478, 1482-1484, 1486, 1487, 1490-1493, 1498-1501, 1507, 1509-1514, 1518, 1522-1524, 1531, 1539, 1541, 1542, 1546, 1547, 1551, 1557, 1560, 1564, 1570, 1576, 1579-1581, 1583-1585, 1592, 1599, 1601, 1604, 1605, 1609, 1611, 1619, 1629, 1630, 1632, 1635, 1638, 1642, 1643, 1649-1652, 1655-1657, 1660, 1661, 1668, 1670, 1672, 1675, 1680-1683, 1688, 1692, 1697, 1699, 1701, 1703-1705, 1711, 1717, 1718, 1722, 1727, 1732, 1734, 1737, 1740, 1744-1751, 1753-1755, 1757, 1761, 1765, 1770, 1774, 1776, 1780, 1792, 1802, 1805, 1816-1818, 1820, 1821, 1823, 1824, 1830, 1831, 1838, 1839, 1841, 1842, 1845, 1846, 1848, 1855-1858, 1861, 1862, 1866-1868, 1871, 1873, 1875, 1876, 1878, 1879, 1885, 1886, 1890, 1891, 1893, 1896, 1903, 1905, 1906, 1910, 1912, 1913, 1915-1918, 1926-1930, 1934-1937, 1939, 1945, 1946, 1954-1956, 1959-1961, 1964, 1966, 1967, 1969, 1970, 1972-1975, 1977-1982, 1990, 1992, 1995-2000, 2006, 2009, 2010, 2014-2016, 2025, 2027, 2028, 2031, 2032, 2034, 2037, 2039-2044, 2046,

2047, 2050-2054, 2058-2063, 2067, 2068, 2070, 2071, 2073, 2075, 2079, 2083, 2086, 2088, 2095-2097, 2099-2105, 2108, 2109, 2113, 2115, 2116, 2118, 2120-2122, 2124, 2126-2129
Clock_time
application assertion . . . 435, 486
application object . . . 46
ARM diagrams . . . 2465
mapping table . . . 1400
CODAP . . . 15
Coefficient
application assertion . . . 435
application object . . . 68
ARM diagrams . . . 2485
mapping table . . . 1831
Collection
definition . . . 8
Colour
AIM diagrams . . . 2546
AIM EXPRESS listing entities . . . 2304
Colour_rgb
AIM diagrams . . . 2546
AIM EXPRESS listing entities . . . 2304
Colour_specification
AIM diagrams . . . 2546
AIM EXPRESS listing entities . . . 2304
compatible_dimension
AIM EXPRESS listing rules . . . 2353
Component
definition . . . 8
Component_in_mixture_properties
application assertion . . . 435, 436
application object . . . 85
ARM diagrams . . . 2457, 2486
mapping table . . . 1235
Composite_curve
AIM diagrams . . . 2534
AIM EXPRESS listing entities . . . 2305
Composite_curve_segment
AIM diagrams . . . 2534
AIM EXPRESS listing entities . . . 2305
Composition_relationship
application assertion . . . 436
application object . . . 68
ARM diagrams . . . 2462, 2486
mapping table . . . 1833
Compound_item_definition
AIM diagrams . . . 2527
AIM EXPRESS listing types . . . 2287
Compound_representation_item
AIM diagrams . . . 2527
AIM EXPRESS listing entities . . . 2305

Compression
application object . . . 216
ARM diagrams . . . 2470
mapping table . . . 1470
Condition_definition
AIM diagrams . . . 2507
AIM EXPRESS listing types . . . 2287
Conditional_property
application assertion . . . 467
Conditional_property_value
application assertion . . . 467
application object . . . 216
ARM diagrams . . . 2441, 2465, 2469
mapping table . . . 1470
Conformance class . . . 7
Conformance testing . . . 6
Conic
AIM diagrams . . . 2533
AIM EXPRESS listing entities . . . 2305
Conical_head
application object . . . 414
ARM diagrams . . . 2479
mapping table . . . 1705
Connected_equipment_port
application object . . . 217, 436
ARM diagrams . . . 2467
mapping table . . . 1470
Connected_process_port
application assertion . . . 436
application object . . . 98
ARM diagrams . . . 2473, 2481
mapping table . . . 1598
Connection
definition . . . 8
Connector_end_type_classification
AIM diagrams . . . 2515
AIM EXPRESS listing entities . . . 2305
AIM EXPRESS short listing entities . . . 2149
mapping table . . . 1486, 1487, 1490-1492, 1509
constraints_param_b_spline
AIM EXPRESS listing functions . . . 2363
Construction material
definition . . . 8
Construction_material
application assertion . . . 429, 437, 440, 448, 454, 462
application object . . . 86
ARM diagrams . . . 2454, 2468, 2479
mapping table . . . 1239
Context_dependent_invisibility
AIM diagrams . . . 2538

AIM EXPRESS listing entities 2305
Context_dependent_measure
AIM diagrams 2522
AIM EXPRESS listing types 2287
Context_dependent_unit
AIM diagrams 2520
AIM EXPRESS listing entities 2305
Continuous_control_objective
application assertion 437
application object 199
ARM diagrams 2441, 2462
mapping table 507
Continuous_control_scheme
application assertion 437
application object 200
ARM diagrams 2441
mapping table 508
Control_adjustment
application assertion 437, 438
application object 201
ARM diagrams 2441, 2462, 2473
mapping table 508
Control_event
application assertion 437
application object 201
ARM diagrams 2440, 2465, 2473
mapping table 509
Control_logic
application assertion 437, 442
application object 201
ARM diagrams 2440, 2465
mapping table 510
Control_logic_condition
application assertion 437, 438, 451
application object 202
ARM diagrams 2440, 2465, 2473
mapping table 511
Control_loop
application assertion 437, 438
application object 204
ARM diagrams 2441, 2462
mapping table 512
Control_objective
AIM diagrams 2507
AIM EXPRESS listing entities 2305
AIM EXPRESS short listing entities 2149
mapping table 507, 508, 511, 513, 514
Control_scheme
AIM diagrams 2507
AIM EXPRESS listing entities 2306

AIM EXPRESS short listing entities 2150
mapping table 507, 508, 513, 514
Control_strategy
unit of functionality 21
Convergence_block_property_value_usage
application assertion 438
application object 175
ARM diagrams 2465, 2475
mapping table 1623
Conversion_based_unit
AIM diagrams 2520
AIM EXPRESS listing entities 2306
Coordinated_universal_time_offset
AIM diagrams 2501
AIM EXPRESS listing entities 2306
Corrugation
application assertion 438, 440
application object 357
ARM diagrams 2453
mapping table 1008
Count_measure
AIM diagrams 2522
AIM EXPRESS listing types 2287
Coupling
application assertion 439
application object 218
ARM diagrams 2459, 2471
mapping table 1472
Cross_baffle
application assertion 439
application object 264
ARM diagrams 2445
mapping table 517
Curve
AIM diagrams 2532
AIM EXPRESS listing entities 2306
application assertion 432, 439, 440, 459, 487
application object 357
ARM diagrams 2449
mapping table 1010
Curve_font_or_scaled_curve_font_select
AIM diagrams 2545
AIM EXPRESS listing types 2287
Curve_or_annotation_curve_occurrence
AIM diagrams 2541
AIM EXPRESS listing types 2287
Curve_or_render
AIM diagrams 2545
AIM EXPRESS listing types 2287
Curve_style

AIM diagrams 2545
AIM EXPRESS listing entities 2306
Curve_style_font
AIM diagrams 2545
AIM EXPRESS listing entities 2306
Curve_style_font_pattern
AIM diagrams 2545
AIM EXPRESS listing entities 2306
Curve_style_font_select
AIM diagrams 2545
AIM EXPRESS listing types 2287
curve_weights_positive
AIM EXPRESS listing functions 2364
Cylindrical_pressure_vessel
application assertion 440, 441, 476
application object 415
ARM diagrams 2448, 2477
mapping table 1711
Cylindrical_pressure_vessel_connection
application assertion 440
application object 416
ARM diagrams 2477
mapping table 1714
Cylindrical_pressure_vessel_cylinder_section
application assertion 430, 453, 488
application object 417
ARM diagrams 2448, 2479
mapping table 1718
Cylindrical_pressure_vessel_eccentric_section
application object 417
ARM diagrams 2479
mapping table 1722
Cylindrical_pressure_vessel_head_section
application assertion 430, 454
application object 418
ARM diagrams 2479
mapping table 1727
Cylindrical_pressure_vessel_section
application assertion 430, 440, 441, 469, 477
application object 418
ARM diagrams 2448, 2468, 2477
mapping table 1727
Data sheet
definition 8
Data_curve
AIM diagrams 2524
AIM EXPRESS listing entities 2306
AIM EXPRESS short listing entities 2151
mapping table 1262-1265, 1521-1524, 1581, 1803
Data_entry

application assertion 441, 492
application object 61
ARM diagrams 2484
mapping table 1811
Data_environment
AIM diagrams 2519
AIM EXPRESS listing entities 2307
Data_quality
application assertion 492
application object 62
ARM diagrams 2484, 2485, 2487
mapping table 1815
Data_source
application assertion 441
application object 62
ARM diagrams 2484
mapping table 1813
Date
AIM diagrams 2501
AIM EXPRESS listing entities 2307
application assertion 435
application object 46
ARM diagrams 2465
mapping table 1401
Date_and_time
AIM diagrams 2501
AIM EXPRESS listing entities 2307
Date_and_time_assignment
AIM diagrams 2501
AIM EXPRESS listing entities 2307
AIM EXPRESS short listing imported entity modifications 2214
Date_assignment
AIM diagrams 2501
AIM EXPRESS listing entities 2307
AIM EXPRESS short listing imported entity modifications 2214
Date_role
AIM diagrams 2501
AIM EXPRESS listing entities 2307
Date_time_item
AIM diagrams 2501
AIM EXPRESS listing types 2288
AIM EXPRESS short listing types 2138
mapping table 1447
Date_time_role
AIM diagrams 2501
AIM EXPRESS listing entities 2307
Date_time_select
AIM diagrams 2501
AIM EXPRESS listing types 2288
Dated_item

AIM diagrams 2511
AIM EXPRESS listing types 2288
AIM EXPRESS short listing types 2137
mapping table 1814
day_in_month_number
AIM EXPRESS listing types 2288
Defined_symbol
AIM diagrams 2548
AIM EXPRESS listing entities 2308
Defined_symbol_select
AIM diagrams 2514
AIM EXPRESS listing types 2288
Demister_pad
application assertion 441, 455
application object 357
ARM diagrams 2448, 2468
mapping table 1020
Demister_pad_stack
application assertion 441, 455
application object 358
ARM diagrams 2448, 2468
mapping table 1022
Density_properties
application assertion 441, 442
application object 87
ARM diagrams 2455
mapping table 1240
dependent_instantiable_application_context
AIM EXPRESS listing rules 2353
AIM EXPRESS short listing rules 2219
dependent_instantiable_product_context
AIM EXPRESS listing rules 2354
AIM EXPRESS short listing rules 2220
dependent_instantiable_product_definition_context
AIM EXPRESS listing rules 2354
AIM EXPRESS short listing rules 2220
derive_dimensional_exponents
AIM EXPRESS listing functions 2364
Derived_unit
AIM diagrams 2520
AIM EXPRESS listing entities 2308
Derived_unit_element
AIM diagrams 2520
AIM EXPRESS listing entities 2308
Descriptive_representation_item
AIM diagrams 2526
AIM EXPRESS listing entities 2308
Design
definition 8
Design package

definition 9
Design_project
application assertion 442
application object 220
ARM diagrams 2466, 2474
mapping table 1476
Design_project_assignment
application assertion 442
application object 220
ARM diagrams 2466
mapping table 1477
Detuning_plate
application assertion 442
application object 268
ARM diagrams 2445
mapping table 532
dimension_count
AIM EXPRESS listing types 2288
dimension_of
AIM EXPRESS listing functions 2365
Dimensional_exponents
AIM diagrams 2520
AIM EXPRESS listing entities 2308
dimensions_for_si_unit
AIM EXPRESS listing functions 2365
DIN 15
DIPPR 15
Direct_current_port
application object 220
ARM diagrams 2469
mapping table 1478
Direction
AIM diagrams 2531
AIM EXPRESS listing entities 2308
Discrete_control_objective
application assertion 442
application object 207
ARM diagrams 2440, 2465
mapping table 513
Discrete_control_scheme
application assertion 442
application object 208
ARM diagrams 2440
mapping table 514
Disengaging_panel_opening_shape
application assertion 443, 457
application object 358
ARM diagrams 2453
mapping table 1025
Distillation_curve

application assertion 443
application object 64
ARM diagrams 2484, 2486
mapping table 1816
Distillation_stage_phase
application assertion 443, 452
application object 166
ARM diagrams 2481, 2491
mapping table 1774
Distribution_belt
application assertion 443
ARM diagrams 2444
Distributor_belt
application object 269
mapping table 538
Document
AIM diagrams 2511
AIM EXPRESS listing entities 2308
Document_reference
AIM diagrams 2511
AIM EXPRESS listing entities 2308
AIM EXPRESS short listing imported entity modifications 2215
Document_reference_item
AIM diagrams 2512
AIM EXPRESS listing types 2288
AIM EXPRESS short listing types 2138
mapping table 958, 969, 1431, 1505, 1811, 1819, 1839, 1864, 1865, 1868, 1876
Document_relationship
AIM diagrams 2511
AIM EXPRESS listing entities 2308
Document_role
AIM diagrams 2511
AIM EXPRESS listing entities 2309
Document_type
AIM diagrams 2511
AIM EXPRESS listing entities 2309
Document_usage_constraint
AIM diagrams 2511
AIM EXPRESS listing entities 2309
Document_with_properties
AIM diagrams 2511
AIM EXPRESS listing entities 2309
AIM EXPRESS short listing entities 2152
dot_product
AIM EXPRESS listing functions 2366
Downcomer
application assertion 443, 444
application object 358
ARM diagrams 2450
mapping table 1027

Downcomer_apron_section_shape
application assertion 439, 444, 465
application object 358
ARM diagrams 2451
mapping table 1029
Downcomer_apron_shape
application assertion 443, 444
application object 358
ARM diagrams 2451
mapping table 1031
Downcomer_disengaging_panel_shape
application assertion 428, 443, 444, 457, 493
application object 359
ARM diagrams 2450
mapping table 1032
Downcomer_hydraulics
application assertion 444
application object 359
ARM diagrams 2450
mapping table 1033
Downcomer_liquid_flow_channel_shape
application assertion 444, 457
application object 360
ARM diagrams 2453
mapping table 1037
Downcomer_shape
application assertion 443-445
application object 360
ARM diagrams 2449
mapping table 1039
Draughting_titled_item
AIM diagrams 2537
AIM EXPRESS listing types 2288
Drawing_definition
AIM diagrams 2537
AIM EXPRESS listing entities 2309
Drawing_revision
AIM diagrams 2537
AIM EXPRESS listing entities 2309
Drawing_revision_sequence
AIM diagrams 2537
AIM EXPRESS listing entities 2309
Drawing_sheet_revision
AIM diagrams 2536
AIM EXPRESS listing entities 2309
Drawing_sheet_revision_usage
AIM diagrams 2537
AIM EXPRESS listing entities 2309
drawing_sheets_not_nested
AIM EXPRESS listing rules 2354

Duty
definition . . . 9
E&C . . . 15
Elbow_nozzle_section
application object . . . 256
ARM diagrams . . . 2447
mapping table . . . 953
Electric_current_measure
AIM diagrams . . . 2522
AIM EXPRESS listing types . . . 2288
Electric_current_measure_with_unit
AIM diagrams . . . 2521
AIM EXPRESS listing entities . . . 2310
Electric_current_unit
AIM diagrams . . . 2520
AIM EXPRESS listing entities . . . 2310
Electrical_power_port
application object . . . 221
ARM diagrams . . . 2469
mapping table . . . 1478
Electrical_service
application object . . . 47
ARM diagrams . . . 2462
mapping table . . . 1401
Ellipse
AIM diagrams . . . 2533
AIM EXPRESS listing entities . . . 2310
Ellipsoidal_head
application object . . . 419
ARM diagrams . . . 2479
mapping table . . . 1734
End_partion_plate
application assertion . . . 446
End_partition_plate
application object . . . 270
ARM diagrams . . . 2444
mapping table . . . 546
Energy_port
application object . . . 221
ARM diagrams . . . 2469
mapping table . . . 1483
Energy_stream
application object . . . 166
ARM diagrams . . . 2481
mapping table . . . 1775
Enthalpy
definition . . . 9
Entropy
definition . . . 9
EPA . . . 15

Equation_group
application assertion 444, 445, 480
application object 70
ARM diagrams 2475, 2484, 2485
mapping table 1838
Equilibrium_item
AIM diagrams 2515
AIM EXPRESS listing types 2288
AIM EXPRESS short listing types 2138
mapping table 1806
Equipment
definition 9
Equipment data sheet
definition 10
Equipment_port
AIM diagrams 2528
AIM EXPRESS listing entities 2310
AIM EXPRESS short listing entities 2153
application assertion 436, 445, 459, 465, 470
application object 222
ARM diagrams 2464, 2467, 2473, 2474
mapping table . . 965, 1423, 1448, 1449, 1470, 1471, 1478-1486, 1501-1504, 1510, 1513, 1514, 1545, 1547-1551, 1560-1563, 1570-1575, 1581, 1602, 1606
Equipment_port_connection
application assertion 436
application object 223
ARM diagrams 2467
mapping table 1486
Escape_area_shape
application assertion 445, 457
application object 361
ARM diagrams 2451
mapping table 1041
Event_sequence
application assertion 438
application object 98
ARM diagrams 2440, 2473
Event_sequence_with_condition
AIM diagrams 2505
AIM EXPRESS listing entities 2310
AIM EXPRESS short listing entities 2153
mapping table 1599
Excess_properties
application assertion 445
application object 88
ARM diagrams 2455, 2487
mapping table 1245
Exchanger_assembly
application assertion 445-447, 475
application object 271

ARM diagrams 2444, 2468
mapping table 552
Exchanger_bundle
application assertion 439, 442, 446, 451, 455, 489
application object 272
ARM diagrams 2445, 2468
mapping table 556
Exchanger_design_criteria
application assertion 446, 478
application object 275
ARM diagrams 2442
mapping table 581
Exchanger_end
application assertion 446
application object 279
ARM diagrams 2444
mapping table 595
Exchanger_nozzle
application assertion 443, 446, 449, 453, 454
application object 282
ARM diagrams 2444, 2446
mapping table 608
Exchanger_performance
application assertion 446-448, 454, 478, 489
application object 284
ARM diagrams 2443
mapping table 624
Exchanger_shell
application assertion 447, 491
application object 285
ARM diagrams 2444
mapping table 630
Exchanger_zone
AIM diagrams 2528
AIM EXPRESS listing entities 2310
AIM EXPRESS short listing entities 2154
application assertion 447
application object 289
ARM diagrams 2443
mapping table 645-693
Expansion_joint
application assertion 447
application object 297
ARM diagrams 2444
mapping table 694
Experiment
application object 64
ARM diagrams 2484
mapping table 1817
Expression_operand

AIM diagrams 2521
AIM EXPRESS listing types 2288
Extents_specified_chemical_reaction
application assertion 447
application object 80
ARM diagrams 2439, 2493
mapping table 497
External_circuit_component
application assertion 447
application object 298
ARM diagrams 2444
mapping table 700
External_classification
application assertion 447
application object 48
ARM diagrams 2463, 2466, 2472
mapping table 1403
External_identification_assignment
AIM diagrams 2518
AIM EXPRESS listing entities 2311
External_reference
application assertion 447, 448, 465
application object 49
ARM diagrams 2463, 2466, 2472, 2473
mapping table 1404
External_source
AIM diagrams 2514
AIM EXPRESS listing entities 2311
External_source_relationship
AIM diagrams 2514
AIM EXPRESS listing entities 2311
External_treatment
application assertion 429, 440, 454, 472
application object 257
ARM diagrams 2447, 2478
mapping table 955
Externally_defined_action_method
AIM diagrams 2505
AIM EXPRESS listing entities 2311
AIM EXPRESS short listing entities 2155
mapping table 1405
Externally_defined_action_resource
AIM diagrams 2514
AIM EXPRESS listing entities 2311
AIM EXPRESS short listing entities 2155
mapping table 511, 512, 1416, 1624, 1625
Externally_defined_classification
AIM diagrams 2515
AIM EXPRESS listing entities 2311
AIM EXPRESS short listing entities 2156

mapping table 1403, 1404
Externally_defined_curve_font
AIM diagrams 2514
AIM EXPRESS listing entities 2311
Externally_defined_group
AIM diagrams 2514
AIM EXPRESS listing entities 2311
AIM EXPRESS short listing entities 2156
mapping table 1599
Externally_defined_hatch_style
AIM diagrams 2514
AIM EXPRESS listing entities 2311
Externally_defined_item
AIM diagrams 2514
AIM EXPRESS listing entities 2311
AIM EXPRESS short listing imported entity modifications 2215
Externally_defined_plant_item_definition
AIM diagrams 2497
AIM EXPRESS listing entities 2311
AIM EXPRESS short listing entities 2156
mapping table . 1239, 1404, 1405, 1411, 1413, 1485, 1491, 1508, 1509, 1520-1522, 1531-1545, 1555, 1583, 1584
Externally_defined_plant_system
AIM diagrams 2497
AIM EXPRESS listing entities 2311
AIM EXPRESS short listing entities 2157
mapping table 1404, 1405, 1593-1595
Externally_defined_representation_item
AIM diagrams 2514
AIM EXPRESS listing entities 2311
AIM EXPRESS short listing entities 2157
mapping table 1840
Externally_defined_simulation_algorithm
application assertion 471
application object 176
ARM diagrams 2475
mapping table 1624
Externally_defined_symbol
AIM diagrams 2514
AIM EXPRESS listing entities 2311
Externally_defined_text_font
AIM diagrams 2514
AIM EXPRESS listing entities 2311
Externally_defined_tile_style
AIM diagrams 2529
AIM EXPRESS listing entities 2312
Externally_defined_variable_value
application object 71
ARM diagrams 2485
mapping table 1840

Family
application assertion 435
application object 71
ARM diagrams 2486
mapping table 1840
FDA 15
Female_end
application object 223
ARM diagrams 2470
mapping table 1486
Fill_area_style
AIM diagrams 2547
AIM EXPRESS listing entities 2312
Fill_area_style_colour
AIM diagrams 2547
AIM EXPRESS listing entities 2312
Fill_area_style_hatching
AIM diagrams 2547
AIM EXPRESS listing entities 2312
Fill_area_style_tile_shape_select
AIM diagrams 2529
AIM EXPRESS listing types 2288
Fill_area_style_tile_symbol_with_style
AIM diagrams 2529
AIM EXPRESS listing entities 2312
Fill_area_style_tiles
AIM diagrams 2529
AIM EXPRESS listing entities 2312
Fill_style_select
AIM diagrams 2547
AIM EXPRESS listing types 2288
first_proj_axis
AIM EXPRESS listing functions 2366
Flanged
application object 223
ARM diagrams 2470
mapping table 1487
Flanged_end
application object 224
ARM diagrams 2470
mapping table 1487
Flashing_feed_gallery
application object 361
ARM diagrams 2449
mapping table 1044
Flat_head
application object 419
ARM diagrams 2479
mapping table 1737
Flow_vibration_analysis

application assertion 448
application object 300
ARM diagrams 2443
mapping table 716
Fluid_transfer_machine
application assertion 428, 429, 432, 439, 453, 473, 478, 486
application object 401
ARM diagrams 2446, 2459, 2471
mapping table 1360
Fluid_transfer_performance_data_point
application assertion 448
application object 103
ARM diagrams 2490
mapping table 1868
Font_select
AIM diagrams 2517
AIM EXPRESS listing types 2289
Function
definition 10
Functional
definition 10
Functional_volume
application assertion 448
application object 225
ARM diagrams 2466
mapping table 1491
Functional_volume_service_case
AIM diagrams 2528
AIM EXPRESS listing entities 2312
AIM EXPRESS short listing entities 2158
application assertion 448
application object 225
ARM diagrams 2454, 2467, 2473
mapping table 1491-1493
Gas_transfer_machine
application object 401
ARM diagrams 2461
mapping table 1361
Gasket
application assertion 448, 455
application object 225
ARM diagrams 2447, 2454, 2470
mapping table 1493
Geometric_representation_context
AIM diagrams 2524
AIM EXPRESS listing entities 2313
Geometric_representation_item
AIM diagrams 2529
AIM EXPRESS listing entities 2313
Global_unit_assigned_context

AIM diagrams 2524
AIM EXPRESS listing entities 2313
Graphical_transformation
AIM diagrams 2527
AIM EXPRESS listing entities 2313
Group
AIM diagrams 2515
AIM EXPRESS listing entities 2313
AIM EXPRESS short listing imported entity modifications 2215
Group_assignment
AIM diagrams 2515
AIM EXPRESS listing entities 2313
AIM EXPRESS short listing imported entity modifications 2215
Group_relationship
AIM diagrams 2515
AIM EXPRESS listing entities 2313
Group_role
AIM diagrams 2515
AIM EXPRESS listing entities 2313
Grouped_item
AIM diagrams 2516
AIM EXPRESS listing types 2289
AIM EXPRESS short listing types 2139
mapping table . . . 505, 509, 510, 512, 615, 956, 957, 959, 960, 963, 977, 980, 1223-1229, 1231-1250, 1261, 1262, 1267, 1270-1281, 1410, 1417-1419, 1450-1456, 1461, 1464, 1472, 1473, 1475, 1484, 1506, 1507, 1515, 1517, 1551-1554, 1564-1569, 1596, 1597, 1625, 1654, 1655, 1662, 1665, 1667, 1677, 1688, 1691, 1692, 1731, 1750, 1803-1805, 1812, 1813, 1822, 1828, 1833, 1847, 1857, 1861, 1863
Heat_exchanger_coefficient
ARM diagrams 2491
Heat_exchanger_component
AIM diagrams 2497
AIM EXPRESS listing entities 2313
AIM EXPRESS short listing entities 2159
mapping table . 517-580, 595-607, 624, 629-645, 694-716, 742-769, 774-785, 792-802, 852-864, 894-915, 935-945
Heat_exchanger_internal_data
AIM diagrams 2524
AIM EXPRESS listing entities 2322
AIM EXPRESS short listing entities 2169
application assertion 448, 449
application object 104
ARM diagrams 2481, 2491
mapping table 1776, 1871-1873
Heat_exchanger_internal_phase
application assertion 449
application object 166
ARM diagrams 2481, 2491
mapping table 1775
Heat_port

application object . . . 227
ARM diagrams . . . 2469
mapping table . . . 1501
Heat_release_curve
application assertion . . . 449
application object . . . 305
ARM diagrams . . . 2442
mapping table . . . 731
Heat_release_point
application assertion . . . 449, 462, 485
application object . . . 307
ARM diagrams . . . 2443
mapping table . . . 735
Heat_transfer_coefficient
application assertion . . . 449
application object . . . 104
mapping table . . . 1874
Heat_transfer_equipment
AIM diagrams . . . 2497
AIM EXPRESS listing entities . . . 2322
AIM EXPRESS short listing entities . . . 2170
application object . . . 308
ARM diagrams . . . 2442, 2446
mapping table . . . 516, 555, 581, 739, 803-825
Heat_transfer_equipment_data
unit of functionality . . . 22
Hemispherical_head
application object . . . 420
ARM diagrams . . . 2479
mapping table . . . 1740
Hiding_or_blanking_select
AIM diagrams . . . 2536
AIM EXPRESS listing types . . . 2289
hour_in_day
AIM EXPRESS listing types . . . 2289
HVAC . . . 15
Hyperbola
AIM diagrams . . . 2533
AIM EXPRESS listing entities . . . 2322
Identification_assignment
AIM diagrams . . . 2518
AIM EXPRESS listing entities . . . 2322
AIM EXPRESS short listing imported entity modifications . . . 2215
Identification_role
AIM diagrams . . . 2518
AIM EXPRESS listing entities . . . 2323
Identified_item
AIM diagrams . . . 2518
AIM EXPRESS listing types . . . 2289
AIM EXPRESS short listing types . . . 2139

mapping table 962, 1400, 1427, 1616, 1627, 1676, 1825-1827, 1832, 1861
identifier
AIM EXPRESS listing types 2289
Impingement_protection
application assertion 449
application object 309
ARM diagrams 2444
mapping table 742
Implementation method 6
Implementation under test 7
Information_stream
application object 166
ARM diagrams 2481
mapping table 1776
Inside_diameter
mapping table 1735
Inspection_and_tests
AIM diagrams 2503
AIM EXPRESS listing entities 2323
AIM EXPRESS short listing entities 2171
application assertion 449
application object 228
ARM diagrams 2467
mapping table 1504, 1506-1508, 1580
Instrument
definition 10
Instrumentation_and_control_system
AIM diagrams 2497
AIM EXPRESS listing entities 2323
AIM EXPRESS short listing entities 2171
mapping table 1404, 1424, 1593-1597
Insulation
definition 10
Integrated resource 6
Internal_stream_phase
application assertion 450, 472
application object 166
ARM diagrams 2462, 2482, 2488
mapping table 1777
Interphase
AIM diagrams 2508
AIM EXPRESS listing entities 2323
AIM EXPRESS short listing entities 2172
mapping table 501, 1250, 1251
Interphase_chemical_reaction
application assertion 450
application object 81
ARM diagrams 2439, 2483
mapping table 501
Interphase_thermophysical_properties

application assertion 450
application object 89
ARM diagrams 2457, 2483
mapping table 1250
Intersection_description
AIM diagrams 2524
AIM EXPRESS listing entities 2323
AIM EXPRESS short listing entities 2173
application object 420
ARM diagrams 2480
mapping table 1699-1703, 1742-1747
Invisibility
AIM diagrams 2538
AIM EXPRESS listing entities 2324
Invisibility_context
AIM diagrams 2538
AIM EXPRESS listing types 2289
Invisible_item
AIM diagrams 2538
AIM EXPRESS listing types 2289
ISA 15
Item
definition 10
Item_defined_transformation
AIM diagrams 2527
AIM EXPRESS listing entities 2324
item_in_context
AIM EXPRESS listing functions 2367
Item_property_reference
application assertion 450, 459, 468
application object 49
ARM diagrams 2464, 2474
mapping table 1405
IUPAC 15
Knot_type
AIM diagrams 2535
AIM EXPRESS listing types 2290
Known_source
AIM diagrams 2517
AIM EXPRESS listing entities 2325
AIM EXPRESS short listing entities 2175
label
AIM EXPRESS listing types 2290
Layered_item
AIM diagrams 2538
AIM EXPRESS listing types 2290
leap_year
AIM EXPRESS listing functions 2367
Length_measure
AIM diagrams 2522

AIM EXPRESS listing types 2290
Length_measure_with_unit
AIM diagrams 2521
AIM EXPRESS listing entities 2325
Length_unit
AIM diagrams 2520
AIM EXPRESS listing entities 2325
Line
AIM diagrams 2532
AIM EXPRESS listing entities 2325
List_representation_item
AIM diagrams 2527
AIM EXPRESS listing types 2290
list_to_array
AIM EXPRESS listing functions 2367
LMTD 15
Local_time
AIM diagrams 2501
AIM EXPRESS listing entities 2325
Location_conditions
application assertion 450
application object 230
ARM diagrams 2466
mapping table 1508
Location_in_plant
application assertion 450
application object 49
ARM diagrams 2462, 2466
mapping table 1406
Location_in_site
application assertion 450
application object 49
ARM diagrams 2462, 2466
mapping table 1407
Logical_operation
AIM diagrams 2506
AIM EXPRESS listing entities 2325
AIM EXPRESS short listing entities 2176
application assertion 451
application object 209
ARM diagrams 2440
mapping table 514, 515
Longitudinal_baffle
application assertion 451
application object 311
ARM diagrams 2445
mapping table 754
Luminous_intensity_measure
AIM diagrams 2522
AIM EXPRESS listing types 2290

Luminous_intensity_measure_with_unit
AIM diagrams . . . 2521
AIM EXPRESS listing entities . . . 2326
Luminous_intensity_unit
AIM diagrams . . . 2520
AIM EXPRESS listing entities . . . 2326
Major process equipment
definition . . . 10
Major_process_equipment_data
unit of functionality . . . 24
Make_from_usage_option
AIM diagrams . . . 2498
AIM EXPRESS listing entities . . . 2326
Male_end
application object . . . 230
ARM diagrams . . . 2470
mapping table . . . 1509
Mapped_item
AIM diagrams . . . 2526
AIM EXPRESS listing entities . . . 2326
Marker_select
AIM diagrams . . . 2544
AIM EXPRESS listing types . . . 2290
Marker_type
AIM diagrams . . . 2544
AIM EXPRESS listing types . . . 2290
Mass_measure
AIM diagrams . . . 2522
AIM EXPRESS listing types . . . 2290
Mass_measure_with_unit
AIM diagrams . . . 2521
AIM EXPRESS listing entities . . . 2326
Mass_transfer_equipment
application object . . . 361
ARM diagrams . . . 2446, 2448
mapping table . . . 1047
Mass_transfer_equipment_data
unit of functionality . . . 25
Mass_unit
AIM diagrams . . . 2520
AIM EXPRESS listing entities . . . 2326
Matched_perimeter_segments
application assertion . . . 451
application object . . . 362
ARM diagrams . . . 2453
mapping table . . . 1048
Material
application assertion . . . 451, 469
application object . . . 89
ARM diagrams . . . 2454, 2464

definition 10
mapping table 1251
Material stream
definition 10
Material_amount
application assertion 431, 448, 451, 452, 469, 472, 478, 485
application object 90
ARM diagrams 2454, 2465, 2467, 2475, 2482, 2488
mapping table 1252
Material_amount_phase
application assertion 451
application object 167
ARM diagrams 2457, 2483
mapping table 1781
Material_amount_reference_time
AIM diagrams 2510
AIM EXPRESS listing entities 2326
AIM EXPRESS short listing entities 2176
application assertion 452
application object 50
ARM diagrams 2454, 2465
mapping table 1399, 1400, 1408, 1409, 1422, 1427-1429, 1445-1447
Material_cost
application assertion 452
application object 91
ARM diagrams 2454, 2462, 2482
mapping table 1256
Material_data
unit of functionality 28
Material_designation
AIM diagrams 2519
AIM EXPRESS listing entities 2327
Material_designation_characterization
AIM diagrams 2519
AIM EXPRESS listing entities 2327
Material_port
application assertion 453
application object 230
ARM diagrams 2446, 2469
mapping table 1510
Material_property
AIM diagrams 2523
AIM EXPRESS listing entities 2327
Material_property_representation
AIM diagrams 2519
AIM EXPRESS listing entities 2327
Material_stream
application assertion 431, 452, 453, 469, 470, 473, 478, 483, 485
application object 168
ARM diagrams 2454, 2462, 2482, 2491

mapping table 1788
Material_stream_phase
application assertion 453, 483
application object 169
ARM diagrams 2483, 2490
Material_transfer_equipment
application object 402
ARM diagrams 2446, 2459
mapping table 1363
Material_transfer_equipment_data
unit of functionality 29
Measure_representation_item
AIM diagrams 2521
AIM EXPRESS listing entities 2327
Measure_value
AIM diagrams 2522
AIM EXPRESS listing types 2290
Measure_with_unit
AIM diagrams 2521
AIM EXPRESS listing entities 2327
Mechanical_component
application object 231
ARM diagrams 2458, 2469
mapping table 1511
Mechanical_power_port
application object 232
ARM diagrams 2469
mapping table 1513
Mechanical_seal
application assertion 434, 453
application object 232
ARM diagrams 2459, 2471
mapping table 1514
minute_in_hour
AIM EXPRESS listing types 2290
Mixture
application assertion 431, 436, 479
application object 72
ARM diagrams 2457, 2486
mapping table 1841
Molecular_structural_group
AIM diagrams 2499
AIM EXPRESS listing entities 2327
AIM EXPRESS short listing entities 2177
mapping table 1830, 1857, 1858
month_in_year_number
AIM EXPRESS listing types 2291
MSDS 15
Named_unit
AIM diagrams 2520

AIM EXPRESS listing entities 2328
Next_assembly_usage_occurrence
AIM diagrams 2498
AIM EXPRESS listing entities 2328
Noise_specification
application assertion 453
application object 233
ARM diagrams 2466
mapping table 1518
normalise
AIM EXPRESS listing functions 2368
Nozzle
AIM diagrams 2497
AIM EXPRESS listing entities 2328
AIM EXPRESS short listing entities 2178
application assertion 453, 454
application object 257
ARM diagrams 2442, 2446, 2469
mapping table 545, 608-623, 753, 769, 773, 947, 958-965, 971
Nozzle_dome
application assertion 453
application object 313
ARM diagrams 2444
mapping table 765
Nozzle_location_for_pressure_vessel_cylinder_section
application assertion 453
application object 421
ARM diagrams 2447, 2480
mapping table 1743
Nozzle_location_for_pressure_vessel_head_section
application assertion 454
application object 421
ARM diagrams 2447, 2480
mapping table 1745
Nozzle_performance
application assertion 454
application object 313
ARM diagrams 2443
mapping table 769
Nozzle_section
application assertion 453, 454
application object 260
ARM diagrams 2447, 2468, 2480
mapping table 965
Nozzle_section_connection
application assertion 454, 455
application object 261
ARM diagrams 2447, 2470
mapping table 972
NPSH 15

Numeric_measure
AIM diagrams . . . 2522
AIM EXPRESS listing types . . . 2291
Offset_curve_2d
AIM diagrams . . . 2532
AIM EXPRESS listing entities . . . 2328
One_direction_repeat_factor
AIM diagrams . . . 2531
AIM EXPRESS listing entities . . . 2328
Organization
AIM diagrams . . . 2500
AIM EXPRESS listing entities . . . 2328
Organization_assignment
AIM diagrams . . . 2500
AIM EXPRESS listing entities . . . 2328
AIM EXPRESS short listing imported entity modifications . . . 2216
Organization_item
AIM diagrams . . . 2500
AIM EXPRESS listing types . . . 2291
AIM EXPRESS short listing types . . . 2139
mapping table . . . 1095, 1433, 1474, 1511, 1535, 1580, 1620, 1627, 1815, 2121
Organization_relationship
AIM diagrams . . . 2500
AIM EXPRESS listing entities . . . 2329
Organization_role
AIM diagrams . . . 2500
AIM EXPRESS listing entities . . . 2329
Organizational_project
AIM diagrams . . . 2500
AIM EXPRESS listing entities . . . 2329
orthogonal_complement
AIM EXPRESS listing functions . . . 2368
OSHA . . . 15
Outside_diameter
mapping table . . . 1736
P&ID . . . 15
Packaging
application assertion . . . 455
application object . . . 233
ARM diagrams . . . 2466
mapping table . . . 1520
Packing_stack
application assertion . . . 476
application object . . . 362
ARM diagrams . . . 2449
mapping table . . . 1049
Pad_and_pad_stack
application assertion . . . 455
application object . . . 362
ARM diagrams . . . 2448

mapping table 1051
Parabola
AIM diagrams 2533
AIM EXPRESS listing entities 2329
Parameter_value
AIM diagrams 2522
AIM EXPRESS listing types 2291
Particle_fraction
application assertion 455
application object 170
ARM diagrams 2483
mapping table 1799
Particle_size
application assertion 455
application object 170
ARM diagrams 2483
mapping table 1800
Particle_size_distribution
application assertion 455, 473, 484
application object 170
ARM diagrams 2483, 2486
mapping table 1800
Particle_size_distribution_values
AIM diagrams 2524
AIM EXPRESS listing entities 2329
AIM EXPRESS short listing entities 2179
application assertion 455, 461, 472, 473
application object 171
ARM diagrams 2454, 2483
mapping table 1799-1801
Partition_seal_rod
application assertion 489
application object 314
ARM diagrams 2445
mapping table 774
Passlane
application assertion 455
application object 314
ARM diagrams 2445
mapping table 779
Pattern
application assertion 455
application object 363
ARM diagrams 2452
mapping table 1054
Perforation_cover
application assertion 455
application object 363
ARM diagrams 2451
mapping table 1057

Perforation_cover_shape
application assertion . . . 455, 456
application object . . . 363
ARM diagrams . . . 2453
mapping table . . . 1059
Perforation_shape
application assertion . . . 455, 458, 488
application object . . . 364
ARM diagrams . . . 2452
mapping table . . . 1060
Performance_curve
application assertion . . . 456
application object . . . 234
ARM diagrams . . . 2467, 2473, 2488
mapping table . . . 1521
Performance_map
application assertion . . . 456
application object . . . 234
ARM diagrams . . . 2467
mapping table . . . 1523
Performance_map_curve
application assertion . . . 456
application object . . . 234
ARM diagrams . . . 2467
mapping table . . . 1523
Performance_point
application assertion . . . 456
application object . . . 234
ARM diagrams . . . 2464, 2467
mapping table . . . 1524
Perimeter
application assertion . . . 457-459
application object . . . 364
ARM diagrams . . . 2452
mapping table . . . 1061
Perimeter_segment
application assertion . . . 451, 459
application object . . . 365
ARM diagrams . . . 2453
mapping table . . . 1074
Person
AIM diagrams . . . 2500
AIM EXPRESS listing entities . . . 2329
Person_and_organization
AIM diagrams . . . 2500
AIM EXPRESS listing entities . . . 2329
Person_assignment
AIM diagrams . . . 2500
AIM EXPRESS listing entities . . . 2329
AIM EXPRESS short listing imported entity modifications . . . 2216

Person_item
AIM diagrams . . . 2500
AIM EXPRESS listing types . . . 2291
AIM EXPRESS short listing types . . . 2140
mapping table . . . 1433, 1813, 1815
Person_organization_select
AIM diagrams . . . 2500
AIM EXPRESS listing types . . . 2291
Person_role
AIM diagrams . . . 2500
AIM EXPRESS listing entities . . . 2329
Petroleum_cut
application object . . . 72
ARM diagrams . . . 2486
mapping table . . . 1842
Petroleum_mixture
application assertion . . . 443
application object . . . 72
ARM diagrams . . . 2484, 2486
mapping table . . . 1845
PF&CD . . . 15
PFD . . . 15
application assertion . . . 459-461
application object . . . 196
ARM diagrams . . . 2473, 2474
mapping table . . . 1605
Pfd_curve
application assertion . . . 460
application object . . . 197
ARM diagrams . . . 2474
mapping table . . . 1606
Pfd_element
application assertion . . . 459, 460
application object . . . 197
ARM diagrams . . . 2446, 2462, 2467, 2473, 2474, 2481, 2488
mapping table . . . 1606
Pfd_point
application assertion . . . 460
application object . . . 197
ARM diagrams . . . 2474
mapping table . . . 1613
Pfd_presentation_component
application assertion . . . 459, 460
application object . . . 197
ARM diagrams . . . 2474
mapping table . . . 1614
Pfd_presentation_component_composition
application assertion . . . 460
application object . . . 197
ARM diagrams . . . 2474

mapping table 1614
Pfd_symbol_definition
application assertion 460, 461
application object 198
ARM diagrams 2474
mapping table 1615
Pfd_symbol_occurrence
application assertion 461
application object 198
ARM diagrams 2474
mapping table 1619
Pfd_text
application assertion 461
application object 199
ARM diagrams 2474
mapping table 1619
Pfd_title_block
application assertion 442, 461
application object 199
ARM diagrams 2466, 2474
mapping table 1619
Phase
AIM diagrams 2515
AIM EXPRESS listing entities 2330
AIM EXPRESS short listing entities 2179
application assertion 461, 462, 474, 479, 480, 492
application object 72
ARM diagrams 2439, 2457, 2464, 2475, 2483, 2485, 2492
mapping table . . . 501, 505, 1230, 1250, 1260, 1267, 1424, 1425, 1681, 1774-1787, 1792-1798, 1803-1807, 1846, 1847, 1856, 1865, 1877, 1884
Phase_distribution_coefficient
application assertion 462
application object 91
ARM diagrams 2457, 2483, 2486
mapping table 1258
Phase_fraction
application assertion 462
Phase_properties
application assertion 462
application object 315
ARM diagrams 2443
mapping table 785
Phase_region
application assertion 462, 481
application object 171
ARM diagrams 2456, 2483, 2485
mapping table 1802
Phases_in_equilibrium
application assertion 481
application object 171

ARM diagrams 2483
mapping table 1803
Phases_in_equilibrium_group_assignment
AIM diagrams 2515
AIM EXPRESS listing entities 2330
AIM EXPRESS short listing entities 2180
mapping table 1806
Physical
definition 10
PICS 15
Pipe
definition 10
Piping and instrumentation diagram
definition 11
Piping_connector
application assertion 462
application object 234
ARM diagrams 2454, 2470
mapping table 1524
Piping_connector_classification
AIM diagrams 2515
AIM EXPRESS listing entities 2330
AIM EXPRESS short listing entities 2180
mapping table 1468, 1470, 1487, 1524, 1541, 1581, 1584
Placement
AIM diagrams 2531
AIM EXPRESS listing entities 2330
Planar_box
AIM diagrams 2542
AIM EXPRESS listing entities 2330
Planar_extent
AIM diagrams 2542
AIM EXPRESS listing entities 2330
Plane_angle_measure
AIM diagrams 2522
AIM EXPRESS listing types 2291
Planned
definition 11
Plant
AIM diagrams 2496
AIM EXPRESS listing entities 2330
AIM EXPRESS short listing entities 2181
application assertion 450, 462-464, 479, 484
application object 50
ARM diagrams 2463, 2472, 2473
mapping table . . 1399, 1407, 1409-1413, 1422, 1427-1429, 1439, 1442, 1443, 1445-1447, 1593, 1599
Plant item
definition 11
Plant system

definition 11
Plant_context
unit of functionality 30
Plant_item
application assertion 437, 442, 445, 447-450, 453, 455, 456, 463, 464, 466, 467, 480
application object 236
ARM diagrams 2442, 2446, 2448, 2454, 2458, 2463, 2466, 2472, 2473, 2477
mapping table 1531
Plant_item_assembly_relationship
application object 238
ARM diagrams 2466
mapping table 1541
Plant_item_collection_relationship
application object 238
ARM diagrams 2466
mapping table 1541
Plant_item_connector
application assertion 463
application object 238
ARM diagrams 2470
mapping table 1541
Plant_item_data
unit of functionality 32
Plant_item_group_relationship
application assertion 463
application object 239
ARMm diagrams 2466
mapping table 1542
Plant_item_location
application assertion 464
application object 239
ARM diagrams 2462, 2466
mapping table 1544
Plant_item_reference_time
AIM diagrams 2523
AIM EXPRESS listing entities 2330
AIM EXPRESS short listing entities 2181
application assertion 464
application object 51
ARM diagrams 2465, 2466
mapping table 1399, 1400, 1413
Plant_system
application assertion 447, 448, 464-466
application object 59
ARM diagrams 2463, 2466, 2472, 2473
mapping table 1593
Plant_system_assembly
application assertion 465
application object 60
ARM diagrams 2472

mapping table 1595
Plant_system_definition
unit of functionality 34
POD 16
Point
AIM diagrams 2530
AIM EXPRESS listing entities 2330
Point_on_curve
AIM diagrams 2530
AIM EXPRESS listing entities 2330
Point_style
AIM diagrams 2544
AIM EXPRESS listing entities 2331
Polyline
AIM diagrams 2534
AIM EXPRESS listing entities 2331
Port_service_case
AIM diagrams 2523
AIM EXPRESS listing entities 2331
AIM EXPRESS short listing entities 2182
application assertion 465
application object 239
ARM diagrams 2467, 2473, 2481
mapping table 1545, 1546
Positive_displacement_compressor
application object 402
ARM diagrams 2461
mapping table 1364
Positive_length_measure
AIM diagrams 2533
AIM EXPRESS listing types 2291
Positive_plane_angle_measure
AIM diagrams 2522
AIM EXPRESS listing types 2291
Positive_ratio_measure
AIM diagrams 2522
AIM EXPRESS listing types 2291
Power_port
application object 240
ARM diagrams 2469
mapping table 1547
Pre_defined_colour
AIM diagrams 2517
AIM EXPRESS listing entities 2331
Pre_defined_curve_font
AIM diagrams 2517
AIM EXPRESS listing entities 2331
Pre_defined_item
AIM diagrams 2517
AIM EXPRESS listing entities 2331

Pre_defined_text_font
AIM diagrams . . . 2517
AIM EXPRESS listing entities . . . 2331
Precision_qualifier
AIM diagrams . . . 2527
AIM EXPRESS listing entities . . . 2331
presentable_text
AIM EXPRESS listing types . . . 2291
Presentation_area
AIM diagrams . . . 2536
AIM EXPRESS listing entities . . . 2331
Presentation_layer_assignment
AIM diagrams . . . 2538
AIM EXPRESS listing entities . . . 2331
Presentation_layer_usage
AIM diagrams . . . 2538
AIM EXPRESS listing entities . . . 2332
Presentation_representation
AIM diagrams . . . 2536
AIM EXPRESS listing entities . . . 2332
AIM EXPRESS short listing imported entity modifications . . . 2216
Presentation_representation_relationship
AIM diagrams . . . 2525
AIM EXPRESS listing entities . . . 2332
Presentation_representation_select
AIM diagrams . . . 2539
AIM EXPRESS listing types . . . 2291
Presentation_scaled_placement
AIM diagrams . . . 2529
AIM EXPRESS listing entities . . . 2332
Presentation_set
AIM diagrams . . . 2537
AIM EXPRESS listing entities . . . 2332
Presentation_size
AIM diagrams . . . 2542
AIM EXPRESS listing entities . . . 2333
Presentation_size_assignment_select
AIM diagrams . . . 2542
AIM EXPRESS listing types . . . 2291
Presentation_style_assignment
AIM diagrams . . . 2548
AIM EXPRESS listing entities . . . 2333
Presentation_style_by_context
AIM diagrams . . . 2548
AIM EXPRESS listing entities . . . 2333
Presentation_style_select
AIM diagrams . . . 2548
AIM EXPRESS listing types . . . 2292
Presentation_view
AIM diagrams . . . 2536

AIM EXPRESS listing entities 2333
Presentation_with_association
AIM diagrams 2536
AIM EXPRESS listing entities 2333
AIM EXPRESS short listing entities 2183
mapping table 1477, 1606-1613
Presented_item
AIM diagrams 2539
AIM EXPRESS listing entities 2333
AIM EXPRESS short listing imported entity modifications 2216
Presented_item_association
AIM diagrams 2539
AIM EXPRESS listing entities 2333
AIM EXPRESS short listing entities 2183
Presented_item_representation
AIM diagrams 2539
AIM EXPRESS listing entities 2334
Presented_item_select
AIM diagrams 2539
AIM EXPRESS listing types 2292
AIM EXPRESS short listing types 2140
Presented_item_with_association
AIM diagrams 2539
AIM EXPRESS listing entities 2334
AIM EXPRESS short listing entities 2184
mapping table 1477, 1605-1613
Pressure_equalization_channel_shape
application assertion 458, 465
application object 365
ARM diagrams 2453
mapping table 1076
Pressure_vessel
application object 421
ARM diagrams 2477
mapping table 1748
Process activity
definition 11
Process design
definition 12
Process engineering
definition 12
Process flow diagram
definition 12
Process material
definition 13
Process plant
definition 13
Process topology
definition 13
Process_control_unit

application assertion 465
application object 60
ARM diagrams 2472
mapping table 1596
Process_definition
application assertion 459, 462-467, 470
application object 99
ARM diagrams 2441, 2463, 2468, 2472-2475, 2488
mapping table 1599
Process_definition_reference_time
AIM diagrams 2506
AIM EXPRESS listing entities 2334
AIM EXPRESS short listing entities 2184
application assertion 466
application object 51
ARM diagrams 2465, 2473
mapping table 1399, 1400, 1414, 1422, 1427-1429, 1445-1447
Process_definition_relationship
application assertion 466
application object 100
ARM diagrams 2473
mapping table 1600
Process_description
unit of functionality 35
Process_design_case
AIM diagrams 2523
AIM EXPRESS listing entities 2334
AIM EXPRESS short listing entities 2185
application assertion 465, 467
application object 240
ARM diagrams 2468, 2473
mapping table . 1239, 1404, 1411, 1413, 1424, 1485, 1491, 1508, 1509, 1520-1522, 1531-1545, 1551-1556, 1583, 1584, 1592-1595
Process_design_case_relationship
application assertion 467
application object 245
ARM diagrams 2468
mapping table 1556
Process_design_case_resource
AIM diagrams 2508
AIM EXPRESS listing entities 2334
AIM EXPRESS short listing entities 2186
mapping table 1680, 1683, 1684
Process_design_property_curve_point_usage
ARM diagrams 2464
Process_design_property_value
AIM diagrams 2524
AIM EXPRESS listing entities 2334
AIM EXPRESS short listing entities 2186

application assertion . 434, 437, 438, 442, 445, 451, 452, 459, 461, 463, 464, 466-469, 471, 474, 479, 481, 482, 484, 485
application object 51
ARM diagrams 2439, 2441, 2456, 2464, 2469, 2472-2475, 2481, 2483, 2486, 2488
mapping table . . 505, 1252, 1261, 1270, 1405, 1409, 1412-1421, 1425, 1434, 1443, 1486, 1541, 1608, 1624, 1685, 1806, 1808, 1847, 1860
Process_design_property_value_usage
application assertion 456, 468
mapping table 1420
Process_design_property_variable_usage
application assertion 468, 470
application object 52
ARM diagrams 2464, 2467
mapping table 1260
Process_design_property_variable_value
ARM diagrams 2456
Process_equipment
application assertion 459
application object 262
ARM diagrams 2442, 2446, 2448, 2458, 2468, 2474, 2477
mapping table 976
Process_equipment_driver
application object 263
ARM diagrams 2446
mapping table 978
process_flow_diagram
unit of functionality 35
Process_material
AIM diagrams 2497
AIM EXPRESS listing entities 2334
AIM EXPRESS short listing entities 2187
application assertion 452, 469, 470, 481
application object 92
ARM diagrams 2454, 2482, 2485
mapping table . 1251, 1252, 1257, 1262-1264, 1399, 1400, 1409, 1422, 1424, 1427-1429, 1445-1447, 1790, 1807, 1860
Process_material_reference_time
AIM diagrams 2510
AIM EXPRESS listing entities 2335
AIM EXPRESS short listing entities 2187
application assertion 469
application object 53
ARM diagrams 2454, 2465
mapping table 1409
Process_port
AIM diagrams 2540
AIM EXPRESS listing entities 2335
AIM EXPRESS short listing entities 2188
application assertion 436, 459, 470
application object 100

ARM diagrams 2467, 2473, 2474
mapping table 1598, 1600-1603, 1610
process_port_connection
AIM EXPRESS listing entities 2335
AIM EXPRESS short listing entities 2189
application assertion 436, 470
application object 102
ARM diagrams 2473
mapping table 1603
Process_port_stream_case
application assertion 470
application object 102
ARM diagrams 2473, 2481
Process_product_association
AIM diagrams 2504
AIM EXPRESS listing entities 2335
Process_property_association
AIM diagrams 2503
AIM EXPRESS listing entities 2335
Process_property_curve
application assertion 462, 470, 471, 485
application object 93
ARM diagrams 2456, 2483, 2488
mapping table 1263
Process_property_curve_point
application assertion 468, 470
application object 93
ARM diagrams 2456, 2464
mapping table 1265
Process_resource_plant_item
AIM diagrams 2508
AIM EXPRESS listing entities 2335
AIM EXPRESS short listing entities 2189
Process_service
application assertion 448, 456, 465
application object 102
ARM diagrams 2467, 2473
mapping table 1604
Process_simulation
AIM diagrams 2505
AIM EXPRESS listing entities 2335
AIM EXPRESS short listing entities 2190
application assertion 428, 451, 467, 471, 472, 482, 484
application object 176
ARM diagrams 2454, 2463, 2475, 2481
mapping table . . . 1255, 1399, 1400, 1420-1422, 1427-1429, 1445-1447, 1622-1680, 1682, 1808
Process_simulation_data
unit of functionality 36
Process_simulation_reference_time
AIM diagrams 2506

AIM EXPRESS listing entities . . . 2336
AIM EXPRESS short listing entities . . . 2191
application assertion . . . 471
application object . . . 53
ARM diagrams . . . 2465, 2475
mapping table . . . 1421
Process_simulation_relationship
application assertion . . . 472
application object . . . 178
ARM diagrams . . . 2475
mapping table . . . 1628
Process_train
application assertion . . . 465
application object . . . 60
ARM diagrams . . . 2472
mapping table . . . 1597
Process_unit_operation
application assertion . . . 451, 456, 460, 467, 471, 472
application object . . . 106
ARM diagrams . . . 2456, 2465, 2467, 2473, 2474, 2482, 2488
mapping table . . . 1876
Process_vessel
application assertion . . . 469, 472
application object . . . 422
ARM diagrams . . . 2446, 2477
mapping table . . . 1749
Process_vessel_equipment_data
unit of functionality . . . 38
Process_vessel_level
application assertion . . . 468, 469
application object . . . 422
ARM diagrams . . . 2446, 2478
mapping table . . . 1751
Product . . . 6
AIM diagrams . . . 2496
AIM EXPRESS listing entities . . . 2336
AIM EXPRESS short listing imported entity modifications . . . 2216
Product data . . . 7
Product_category
AIM diagrams . . . 2496
AIM EXPRESS listing entities . . . 2336
Product_category_relationship
AIM diagrams . . . 2496
AIM EXPRESS listing entities . . . 2336
Product_context
AIM diagrams . . . 2495
AIM EXPRESS listing entities . . . 2336
AIM EXPRESS short listing imported entity modifications . . . 2217
Product_data_representation_view
AIM diagrams . . . 2536

AIM EXPRESS listing entities 2336
Product_definition
AIM diagrams 2497
AIM EXPRESS listing entities 2336
AIM EXPRESS short listing imported entity modifications 2217
Product_definition_context
AIM diagrams 2495
AIM EXPRESS listing entities 2336
AIM EXPRESS short listing imported entity modifications 2217
Product_definition_formation
AIM diagrams 2496
AIM EXPRESS listing entities 2336
Product_definition_process
AIM diagrams 2504
AIM EXPRESS listing entities 2337
Product_definition_relationship
AIM diagrams 2497
AIM EXPRESS listing entities 2337
Product_definition_shape
AIM diagrams 2528
AIM EXPRESS listing entities 2337
Product_definition_usage
AIM diagrams 2498
AIM EXPRESS listing entities 2337
Product_definition_with_associated_documents
AIM diagrams 2497
AIM EXPRESS listing entities 2337
Product_related_product_category
AIM diagrams 2496
AIM EXPRESS listing entities 2337
Property
definition 13
Property_data_group
application assertion 472
application object 65
ARM diagrams 2484
mapping table 1818
Property_data_set
application assertion 441, 472
application object 65
ARM diagrams 2484, 2485
mapping table 1819
Property_definition
AIM diagrams 2523
AIM EXPRESS listing entities 2337
AIM EXPRESS short listing imported entity modifications 2217
Property_definition_relationship
AIM diagrams 2523
AIM EXPRESS listing entities 2337
Property_definition_representation

AIM diagrams 2524
AIM EXPRESS listing entities 2338
Property_note
application assertion 435, 444
application object 65
ARM diagrams 2484, 2485
mapping table 1820
Property_or_shape_select
AIM diagrams 2523
AIM EXPRESS listing types 2292
Property_process
AIM diagrams 2503
AIM EXPRESS listing entities 2338
Protocol information and conformance statement 7
Pseudo-component
definition 13
Pseudo_component
application assertion 443
application object 73
ARM diagrams 2484, 2486
mapping table 1848
Pump
application object 403
ARM diagrams 2461
mapping table 1367
Pump_casing
application assertion 473
application object 403
ARM diagrams 2461
mapping table 1368
Pump_casing_test
application assertion 473
application object 405
ARM diagrams 2461
mapping table 1371
Pump_gland
application assertion 473
application object 406
ARM diagrams 2461, 2471
mapping table 1375
Pump_gland_taps
application assertion 473
application object 406
ARM diagrams 2461
mapping table 1376
Pump_impeller
application assertion 473
application object 407
ARM diagrams 2461
mapping table 1379

Pump_packing
application assertion . . . 473
application object . . . 407
ARM diagrams . . . 2461
mapping table . . . 1381
QFD . . . 16
Qualified_representation_item
AIM diagrams . . . 2527
AIM EXPRESS listing entities . . . 2338
Quantified_assembly_component_usage
AIM diagrams . . . 2498
AIM EXPRESS listing entities . . . 2338
Quasi_uniform_curve
AIM diagrams . . . 2535
AIM EXPRESS listing entities . . . 2338
Radial_bearing
application assertion . . . 473
application object . . . 246
ARM diagrams . . . 2459, 2471
mapping table . . . 1557
Ratio_measure
AIM diagrams . . . 2522
AIM EXPRESS listing types . . . 2292
Ratio_measure_with_unit
AIM diagrams . . . 2521
AIM EXPRESS listing entities . . . 2338
Ratio_unit
AIM diagrams . . . 2520
AIM EXPRESS listing entities . . . 2338
Rational_b_spline_curve
AIM diagrams . . . 2535
AIM EXPRESS listing entities . . . 2338
Reaction_order
application assertion . . . 474
application object . . . 81
ARM diagrams . . . 2439, 2486
mapping table . . . 502
Reaction_parametric_data
application assertion . . . 474
application object . . . 65
ARM diagrams . . . 2439, 2484
mapping table . . . 503, 1820
Reaction_rate
application assertion . . . 474
application object . . . 81
ARM diagrams . . . 2439, 2464, 2487
mapping table . . . 504
Reaction_system_equipment
application object . . . 263
ARM diagrams . . . 2446

mapping table 979
Reactor_yield
AIM diagrams 2524
AIM EXPRESS listing entities 2339
AIM EXPRESS short listing entities 2191
application assertion 474, 475
application object 106
ARM diagrams 2486, 2492
mapping table 1876-1879
Reboiler_piping
application assertion 447, 475
application object 318
ARM diagrams 2444
mapping table 792
Reciprocating_compressor
application assertion 475
application object 408
ARM diagrams 2461
mapping table 1383
Reciprocating_compressor_stage
application assertion 475
application object 408
ARM diagrams 2461
mapping table 1384
Reciprocating_power_port
application object 246
ARM diagrams 2469
mapping table 1560
Reducing_nozzle_section
application object 263
ARM diagrams 2447
mapping table 979
Reference_state
AIM diagrams 2527
AIM EXPRESS listing entities 2340
AIM EXPRESS short listing entities 2192
application assertion 431, 445, 475, 485, 489
application object 75
ARM diagrams 2455, 2487
mapping table 1229, 1249, 1278, 1854, 1855
Reference_time_relationship
application assertion 475
application object 53
ARM diagrams 2465
mapping table 1421
Referenced_object
application assertion . 431, 434, 436, 445, 450, 451, 461, 463, 464, 474, 479, 481, 482, 484, 485
application object 53
ARM diagrams 2439, 2456, 2464, 2466, 2481, 2483, 2486
mapping table 1422

Relative_time_reference
application assertion . . . 475
application object . . . 53
ARM diagrams . . . 2465
mapping table . . . 1427
Representation
AIM diagrams . . . 2524
AIM EXPRESS listing entities . . . 2339
AIM EXPRESS short listing imported entity modifications . . . 2217
definition . . . 13
Representation_context
AIM diagrams . . . 2524
AIM EXPRESS listing entities . . . 2339
Representation_item
AIM diagrams . . . 2526
AIM EXPRESS listing entities . . . 2339
Representation_item_relationship
AIM diagrams . . . 2527
AIM EXPRESS listing entities . . . 2339
Representation_map
AIM diagrams . . . 2526
AIM EXPRESS listing entities . . . 2339
Representation_relationship
AIM diagrams . . . 2525
AIM EXPRESS listing entities . . . 2340
Representation_relationship_with_transformation
AIM diagrams . . . 2525
AIM EXPRESS listing entities . . . 2340
Represented_definition
AIM diagrams . . . 2528
AIM EXPRESS listing types . . . 2292
Required
definition . . . 13
Requirement_for_action_resource
AIM diagrams . . . 2509
AIM EXPRESS listing entities . . . 2340
Reserved_space
AIM diagrams . . . 2528
AIM EXPRESS listing entities . . . 2340
AIM EXPRESS short listing entities . . . 2193
mapping table . . . 1581-1583
Resource_property
AIM diagrams . . . 2510
AIM EXPRESS listing entities . . . 2340
AIM EXPRESS short listing imported entity modifications . . . 2218
Resource_property_relationship
AIM diagrams . . . 2510
AIM EXPRESS listing entities . . . 2340
Resource_property_representation
AIM diagrams . . . 2510

AIM EXPRESS listing entities 2340
Resource_requirement_type
AIM diagrams 2509
AIM EXPRESS listing entities 2341
rhov2 16
Riser_and_tray_panel_shape
application assertion 475, 476
application object 365
ARM diagrams 2452
mapping table 1077
Riser_shape
application assertion 458, 475, 476
application object 366
ARM diagrams 2453
mapping table 1079
Rotating_equipment_tests
application object 247
ARM diagrams 2467
mapping table 1564
Rotating_power_port
application object 249
ARM diagrams 2469
mapping table 1570
scalar_times_vector
AIM EXPRESS listing functions 2369
Seal_pan
application assertion 476
application object 366
ARM diagrams 2450
mapping table 1082
Seal_pan_recess_shape
application assertion 458, 476
application object 366
ARM diagrams 2452
mapping table 1084
Seal_pan_shape
application assertion 428, 445, 458, 476, 493
application object 366
ARM diagrams 2452
mapping table 1086
second_in_minute
AIM EXPRESS listing types 2292
Separation_efficiency
application assertion 476, 477, 487, 491
application object 367
ARM diagrams 2450, 2488
mapping table 1088
Separation_packing
application assertion 476
application object 367

ARM diagrams 2449
mapping table 1090
Separation_packing_component
application object 369
ARM diagrams 2449
mapping table 1101
Separation_packing_internal
application object 370
ARM diagrams 2449
mapping table 1104
Separation_packing_stack
application assertion 476
application object 370
ARM diagrams 2449
mapping table 1109
Separation_tower
AIM diagrams 2497
AIM EXPRESS listing entities 2341
AIM EXPRESS short listing entities 2193
application assertion 440, 441, 477
application object 371
ARM diagrams 2448
mapping table 1114-1120, 1125
Separation_tower_internal
application assertion 476, 477
application object 372
ARM diagrams 2448
mapping table 1121
Separation_tray
application assertion 477, 487, 488
application object 373
ARM diagrams 2448
mapping table 1126
Separation_tray_baffle
application assertion 477
application object 373
ARM diagrams 2449
mapping table 1129
Separation_tray_baffle_shape
application assertion 428, 477
application object 373
ARM diagrams 2449
mapping table 1131
Separation_tray_component
application assertion 477
application object 374
ARM diagrams 2448
mapping table 1138
Separation_tray_component_definition
AIM diagrams 2497

AIM EXPRESS listing entities 2341
AIM EXPRESS short listing entities 2194
mapping table . . 986, 990, 993, 994, 996-998, 1001, 1006, 1010, 1019, 1029, 1032, 1033, 1039-1044, 1058-1060, 1071-1073, 1079, 1081, 1083, 1085-1088, 1128, 1130, 1131, 1133-1137, 1150-1164, 1176, 1179, 1182, 1185, 1189-1195, 1198, 1201-1203, 1205, 1207, 1209, 1210, 1212-1214, 1216-1222
Separation_tray_component_feature
AIM diagrams 2528
AIM EXPRESS listing entities 2341
AIM EXPRESS short listing entities 2195
mapping table . . . 987, 1003, 1006-1008, 1015, 1025, 1026, 1029-1033, 1037, 1038, 1041-1043, 1048, 1054-1056, 1060-1081, 1084, 1085, 1089, 1180-1185, 1195, 1206
Separation_tray_component_feature_definition
AIM diagrams 2528
AIM EXPRESS listing entities 2343
AIM EXPRESS short listing entities 2198
Separation_tray_hydraulics
application assertion 477
application object 374
ARM diagrams 2448
mapping table 1140
Separation_tray_shape
application assertion 430, 444, 458, 476, 477, 487, 488, 494
application object 377
ARM diagrams 2449
mapping table 1150
Separation_tray_stack
application assertion 487
application object 380
ARM diagrams 2448
mapping table 1165
Separation_tray_structural_component
application assertion 477
application object 381
ARM diagrams 2449
mapping table 1169
Service_connections
application assertion 478
application object 409
ARM diagrams 2459
mapping table 1389, 1398
Set_representation_item
AIM diagrams 2527
AIM EXPRESS listing types 2292
SFD 16
Shaft
application assertion 478
application object 250
ARM diagrams 2459, 2471
mapping table 1576

Shape_aspect
AIM diagrams . . . 2528
AIM EXPRESS listing entities . . . 2344
AIM EXPRESS short listing imported entity modifications . . . 2218
Shape_aspect_relationship
AIM diagrams . . . 2528
AIM EXPRESS listing entities . . . 2344
Shape_definition
AIM diagrams . . . 2528
AIM EXPRESS listing types . . . 2292
Shape_representation
AIM diagrams . . . 2524
AIM EXPRESS listing entities . . . 2344
Shell_and_tube_heat_exchanger_unit
application assertion . . . 445, 478
application object . . . 320
ARM diagrams . . . 2442
mapping table . . . 803
Shellside_design
application assertion . . . 446, 449
application object . . . 324
ARM diagrams . . . 2442
mapping table . . . 825
Shellside_performance
application assertion . . . 478
application object . . . 327
ARM diagrams . . . 2443
mapping table . . . 836
Shop_testing_requirement
application assertion . . . 449
application object . . . 251
ARM diagrams . . . 2467
mapping table . . . 1579
Si_prefix
AIM diagrams . . . 2520
AIM EXPRESS listing types . . . 2292
Si_unit
AIM diagrams . . . 2520
AIM EXPRESS listing entities . . . 2344
Si_unit_name
AIM diagrams . . . 2520
AIM EXPRESS listing types . . . 2292
Signal_port
application object . . . 251
mapping table . . . 1581
Simple_performance_curve
application assertion . . . 456
application object . . . 178, 252
ARM diagrams . . . 2467
mapping table . . . 1581

Simulated_process_definition
AIM diagrams . . . 2505
AIM EXPRESS listing entities . . . 2344
AIM EXPRESS short listing entities . . . 2200
application assertion . . . 466, 471
ARM diagrams . . . 2473, 2475
mapping table . . . 1628, 1629
Simulation_block
application assertion . . . 482
application object . . . 179
ARM diagrams . . . 2475
mapping table . . . 1629
Simulation_centrifuge
application object . . . 179
ARM diagrams . . . 2476
mapping table . . . 1630
Simulation_compressor
application object . . . 179
ARM diagrams . . . 2476
mapping table . . . 1632
Simulation_countercurrent_solids_decanter
application object . . . 180
ARM diagrams . . . 2476
mapping table . . . 1635
Simulation_crystallizer
application object . . . 180
ARM diagrams . . . 2476
mapping table . . . 1638
Simulation_dissolver
application object . . . 181
ARM diagrams . . . 2476
mapping table . . . 1642
Simulation_distillation
application object . . . 182
ARM diagrams . . . 2476
mapping table . . . 1643
Simulation_distillation_stage
application object . . . 183
ARM diagrams . . . 2476
mapping table . . . 1649
Simulation_electrostatic_precipitator
application object . . . 183
ARM diagrams . . . 2476
mapping table . . . 1650
Simulation_fabric_filter
application object . . . 184
ARM diagrams . . . 2476
mapping table . . . 1651
Simulation_flash
application object . . . 184

ARM diagrams 2476
mapping table 1652
Simulation_gas_solid_separator
application object 185
ARM diagrams 2476
mapping table 1655
Simulation_heat_exchanger
application object 186
ARM diagrams 2476
mapping table 1656
Simulation_hydrocyclone
application object 186
ARM diagrams 2476
mapping table 1657
Simulation_liquid_solid_separator
application object 186
ARM diagrams 2476
mapping table 1660
Simulation_pipeline
application object 187
ARM diagrams 2476
mapping table 1661
Simulation_pipeline_node
application object 189
ARM diagrams 2476
mapping table 1668
Simulation_polytropic_compressor
application assertion 478
application object 189
ARM diagrams 2476
mapping table 1670
Simulation_polytropic_compressor_stage
application assertion 478
application object 189
ARM diagrams 2476
mapping table 1672
Simulation_rotary_filter
application object 190
ARM diagrams 2476
mapping table 1675
Simulation_section_relationship
application object 190
ARM diagrams 2475
mapping table 1676
Simulation_unit_operation
application object 190
ARM diagrams 2475
mapping table 1677
Single_phase_thermophysical_properties
application assertion 436, 442, 445, 462, 478, 479, 486, 487

application object 94
ARM diagrams 2455, 2482, 2487
mapping table 1266
Site
AIM diagrams 2499
AIM EXPRESS listing entities 2344
AIM EXPRESS short listing entities 2200
application assertion 450, 452, 479, 480
application object 54
ARM diagrams 2454, 2462
definition 13
mapping table . 1257, 1258, 1400, 1408, 1422, 1425, 1427-1437, 1439, 1440, 1442, 1443, 1445-1447, 1781, 1791, 1885, 1889
Site_reference_time
AIM diagrams 2523
AIM EXPRESS listing entities 2344
AIM EXPRESS short listing entities 2201
application assertion 468, 479, 486
application object 56
ARM diagrams 2463
mapping table 1399, 1434
site_standard_condition
AIM EXPRESS listing entities 2344
AIM EXPRESS short listing entities 2202
ARM diagrams 2454
Site_standard_conditions
application assertion 450, 452, 479, 483
application object 56
ARM diagrams 2462, 2482, 2490
mapping table 1434
Site_utility_service
application assertion 479
application object 57
ARM diagrams 2462
mapping table 1437
Sited_plant
AIM diagrams 2523
AIM EXPRESS listing entities 2345
AIM EXPRESS short listing entities 2201
application assertion 479, 480
application object 58
ARM diagrams 2462
mapping table 1439, 1440
Size_select
AIM diagrams 2545
AIM EXPRESS listing types 2293
Socket
application object 252
ARM diagrams 2470
mapping table 1581

Solid_angle_measure
AIM diagrams . . . 2522
AIM EXPRESS listing types . . . 2293
Solid_angle_measure_with_unit
AIM diagrams . . . 2521
AIM EXPRESS listing entities . . . 2345
Solid_angle_unit
AIM diagrams . . . 2520
AIM EXPRESS listing entities . . . 2345
Solids_processing_equipment
application object . . . 264
ARM diagrams . . . 2446
mapping table . . . 983
Solids_storage_bin
AIM diagrams . . . 2497
AIM EXPRESS listing entities . . . 2345
AIM EXPRESS short listing entities . . . 2202
application assertion . . . 429
application object . . . 424
ARM diagrams . . . 2477
mapping table . . . 1698, 1755, 1756
Source_item
AIM diagrams . . . 2514
AIM EXPRESS listing types . . . 2293
Space_requirements
application assertion . . . 480
application object . . . 252
ARM diagrams . . . 2466
mapping table . . . 1581
Spare_item_relationship
application assertion . . . 480
application object . . . 252
ARM diagrams . . . 2466
mapping table . . . 1583
Specific_equation
AIM diagrams . . . 2524
AIM EXPRESS listing entities . . . 2345
AIM EXPRESS short listing entities . . . 2203
application assertion . . . 435, 472, 480
application object . . . 76
ARM diagrams . . . 2484, 2485
mapping table . . . 1820, 1832, 1855-1857
Specific_phase
AIM diagrams . . . 2508
AIM EXPRESS listing entities . . . 2346
AIM EXPRESS short listing entities . . . 2204
application assertion . . . 431, 450, 462, 469, 479-481, 485
application object . . . 172
ARM diagrams . . . 2439, 2455, 2464, 2483, 2485
mapping table . . . 501, 1230, 1251, 1260, 1268, 1804, 1806

Spherical_pressure_vessel
application object 425
ARM diagrams 2477
mapping table 1757
Spheroidal_pressure_vessel
application assertion 481
application object 425
ARM diagrams 2477
mapping table 1761
Stage
definition 13
Stage_column_section
AIM diagrams 2515
AIM EXPRESS listing entities 2347
AIM EXPRESS short listing entities 2206
application assertion 481, 490
application object 107
ARM diagrams 2492
mapping table 1879-1881, 1971
Standard conditions
definition 14
Standard_dished_head
application object 426
ARM diagrams 2479
mapping table 1765
Stoichiometric_coefficient
application assertion 481
application object 82
ARM diagrams 2439, 2454, 2486
mapping table 505
Straight_nozzle_section
application object 264
ARM diagrams 2447
mapping table 984
Stream
AIM diagrams 2499
AIM EXPRESS listing entities 2347
AIM EXPRESS short listing entities 2207
application assertion 460, 465, 470, 482, 490, 491
application object 172
ARM diagrams 2462, 2467, 2473-2475, 2481, 2488
definition 14
mapping table 509, 510, 713, 1229, 1230, 1263, 1264, 1266, 1399, 1400, 1422, 1425, 1427-1429, 1443, 1445-1447, 1546, 1603, 1604, 1612, 1775-1777, 1788-1792, 1807-1810, 1881-1890, 1947, 2026, 2049
Stream_convergence_block
application assertion 438, 482, 486
application object 191
ARM diagrams 2475, 2481
mapping table 1677

Stream_data
unit of functionality 39
Stream_reference_time
AIM diagrams 2510
AIM EXPRESS listing entities 2347
AIM EXPRESS short listing entities 2207
application assertion 482
application object 58
ARM diagrams 2465, 2481
mapping table 1443
Stream_separation_specification
AIM diagrams 2524
AIM EXPRESS listing entities 2347
AIM EXPRESS short listing entities 2208
application assertion 483
application object 107
ARM diagrams 2462, 2482, 2486, 2489
mapping table 1881
Stream_split_specification
AIM diagrams 2524
AIM EXPRESS listing entities 2348
AIM EXPRESS short listing entities 2209
application assertion 483
application object 108
ARM diagrams 2462, 2489
mapping table 1886
Structural_group
application assertion 435
application object 76
ARM diagrams 2486
mapping table 1857
Style_context_select
AIM diagrams 2537
AIM EXPRESS listing types 2293
Styled_item
AIM diagrams 2548
AIM EXPRESS listing entities 2348
Sub_plant_relationship
application assertion 484
application object 58
ARM diagrams 2462
mapping table 1443
Substance
application assertion 429, 436, 469, 474, 475, 481, 483, 484, 489, 491, 492
application object 77
ARM diagrams 2439, 2456, 2464, 2475, 2486, 2492
mapping table 1858
Substance_experimental_data
unit of functionality 40
Substance_model_data

unit of functionality 40
Substance_name
application assertion 484
application object 77
ARM diagrams 2486
mapping table 1860
Substance_property
application assertion 489
application object 77
ARM diagrams 2487
Substance_property_value
application object 77
ARM diagrams 2485
mapping table 1861
subtype_exclusive_action_method
AIM EXPRESS listing rules 2354
AIM EXPRESS short listing rules 2221
subtype_exclusive_action_method_relationship
AIM EXPRESS listing rules 2354
AIM EXPRESS short listing rules 2221
subtype_exclusive_action_property
AIM EXPRESS listing rules 2354
AIM EXPRESS short listing rules 2222
subtype_exclusive_action_resource
AIM EXPRESS listing rules 2355
AIM EXPRESS short listing rules 2222
subtype_exclusive_characterized_object
AIM EXPRESS listing rules 2355
AIM EXPRESS short listing rules 2223
subtype_exclusive_externally_defined_item
AIM EXPRESS listing rules 2355
AIM EXPRESS short listing rules 2224
subtype_exclusive_group
AIM EXPRESS listing rules 2355
AIM EXPRESS short listing rules 2224
subtype_exclusive_presented_item
AIM EXPRESS listing rules 2356
AIM EXPRESS short listing rules 2225
subtype_exclusive_product
AIM EXPRESS listing rules 2356
AIM EXPRESS short listing rules 2225
subtype_exclusive_product_definition
AIM EXPRESS listing rules 2356
AIM EXPRESS short listing rules 2226
subtype_exclusive_property_definition
AIM EXPRESS listing rules 2356
AIM EXPRESS short listing rules 2227
subtype_exclusive_representation
AIM EXPRESS listing rules 2357
AIM EXPRESS short listing rules 2227

subtype_exclusive_resource_property
AIM EXPRESS listing rules . . . 2357
AIM EXPRESS short listing rules . . . 2228
subtype_exclusive_shape_aspect
AIM EXPRESS listing rules . . . 2357
AIM EXPRESS short listing rules . . . 2229
subtype_mandatory_approval_assignment
AIM EXPRESS listing rules . . . 2357
AIM EXPRESS short listing rules . . . 2229
subtype_mandatory_certification_assignment
AIM EXPRESS listing rules . . . 2357
AIM EXPRESS short listing rules . . . 2230
subtype_mandatory_date_and_time_assignment
AIM EXPRESS listing rules . . . 2358
AIM EXPRESS short listing rules . . . 2231
subtype_mandatory_date_assignment
AIM EXPRESS listing rules . . . 2358
AIM EXPRESS short listing rules . . . 2230
subtype_mandatory_document_reference
AIM EXPRESS listing rules . . . 2358
AIM EXPRESS short listing rules . . . 2231
subtype_mandatory_group_assignment
AIM EXPRESS listing rules . . . 2358
AIM EXPRESS short listing rules . . . 2232
subtype_mandatory_identification_assignment
AIM EXPRESS listing rules . . . 2358
AIM EXPRESS short listing rules . . . 2232
subtype_mandatory_organization_assignment
AIM EXPRESS listing rules . . . 2358
AIM EXPRESS short listing rules . . . 2233
subtype_mandatory_person_assignment
AIM EXPRESS listing rules . . . 2359
AIM EXPRESS short listing rules . . . 2233
subtype_mandatory_versioned_action_request
AIM EXPRESS listing rules . . . 2359
AIM EXPRESS short listing rules . . . 2234
Supported_item
AIM diagrams . . . 2508
AIM EXPRESS listing types . . . 2293
Symbol_colour
AIM diagrams . . . 2544
AIM EXPRESS listing entities . . . 2348
Symbol_representation
AIM diagrams . . . 2524
AIM EXPRESS listing entities . . . 2348
Symbol_representation_map
AIM diagrams . . . 2526
AIM EXPRESS listing entities . . . 2348
Symbol_representation_relationship
AIM diagrams . . . 2525

AIM EXPRESS listing entities 2348
symbol_representation_rule
AIM EXPRESS listing rules 2359
Symbol_style
AIM diagrams 2544
AIM EXPRESS listing entities 2349
Symbol_style_select
AIM diagrams 2544
AIM EXPRESS listing types 2293
Symbol_target
AIM diagrams 2548
AIM EXPRESS listing entities 2349
Technology package
definition 14
TEMA 16
text
AIM EXPRESS listing types 2293
text_alignment
AIM EXPRESS listing types 2293
text_delineation
AIM EXPRESS listing types 2293
Text_literal
AIM diagrams 2543
AIM EXPRESS listing entities 2349
Text_literal_with_associated_curves
AIM diagrams 2543
AIM EXPRESS listing entities 2349
Text_literal_with_blanking_box
AIM diagrams 2543
AIM EXPRESS listing entities 2349
Text_literal_with_delination
AIM diagrams 2543
text_literal_with_delineation
AIM EXPRESS listing entities 2349
Text_literal_with_extent
AIM diagrams 2543
AIM EXPRESS listing entities 2349
Text_or_character
AIM diagrams 2543
AIM EXPRESS listing types 2294
text_path
AIM EXPRESS listing types 2294
Text_path]
AIM diagrams 2543
Text_string_representation
AIM diagrams 2524
AIM EXPRESS listing entities 2349
Text_style
AIM diagrams 2544
AIM EXPRESS listing entities 2350

Text_style_for_defined_font
AIM diagrams 2546
AIM EXPRESS listing entities 2350
Text_style_with_box_characteristics
AIM diagrams 2544
AIM EXPRESS listing entities 2350
Text_style_with_mirror
AIM diagrams 2544
AIM EXPRESS listing entities 2350
Thermal_stream
application object 173
ARM diagrams 2481
mapping table 1809
Thermodynamic_condition
AIM diagrams 2519
AIM EXPRESS listing entities 2350
AIM EXPRESS short listing entities 2209
application assertion 452, 485
ARM diagrams 2454, 2482
mapping table 1256, 1258, 1268-1270, 1426, 1791, 1807
Thermodynamic_conditions
application object 94
ARM diagrams 2464
Thermodynamic_properties
application assertion 485, 486
application object 95
ARM diagrams 2457, 2487
mapping table 1270
Thermodynamic_temperature_measure
AIM diagrams 2522
AIM EXPRESS listing types 2294
Thermodynamic_temperature_measure_with_unit
AIM diagrams 2521
AIM EXPRESS listing entities 2350
Thermodynamic_temperature_unit
AIM diagrams 2520
AIM EXPRESS listing entities 2350
Thermophysical_point_property
mapping table 1862
Thermophysical_property_classification
AIM diagrams 2515
AIM EXPRESS listing entities 2350
AIM EXPRESS short listing entities 2210
mapping table 1223-1229, 1231-1250, 1270-1281
Thermophysical_property_method
application assertion 444, 484
application object 192
ARM diagrams 2475, 2485
mapping table 1681
Thermophysical_property_method_option

application assertion 484
application object 193
ARM diagrams 2475
mapping table 1681
Thing
definition 14
Threaded
application object 253
ARM diagrams 2470
mapping table 1584
Thrust_bearing
application assertion 486
application object 253
ARM diagrams 2459, 2471
mapping table 1585
Tie_rod
application assertion 486
application object 332
ARM diagrams 2445
mapping table 852
Tie_rod_spacer
application assertion 486
application object 333
ARM diagrams 2445
mapping table 859
Time_measure
AIM diagrams 2522
AIM EXPRESS listing types 2294
Time_measure_with_unit
AIM diagrams 2521
AIM EXPRESS listing entities 2351
Time_reference
application assertion 452, 464, 466, 469, 471, 475, 482, 486
application object 58
ARM diagrams 2465
mapping table 1445
Time_unit
AIM diagrams 2520
AIM EXPRESS listing entities 2351
Torispherical_head
application object 427
ARM diagrams 2479
mapping table 1770
Trace_component_specification
application assertion 461, 484, 486
application object 194
ARM diagrams 2475
mapping table 1683
Transformation
AIM diagrams 2527

AIM EXPRESS listing types 2294
Transition_code
AIM diagrams 2534
AIM EXPRESS listing types 2294
Transport_properties
application assertion 442, 487
application object 97
ARM diagrams 2455
mapping table 1279
Tray_and_tray_stack
application assertion 487
application object 381
ARM diagrams 2448
mapping table 1171
Tray_cascade
application assertion 487
application object 381
ARM diagrams 2449
mapping table 1174
Tray_panel
application assertion 487
application object 382
ARM diagrams 2450
mapping table 1177
Tray_panel_and_perforation_shape
application assertion 432, 488
application object 382
ARM diagrams 2452
mapping table 1180
Tray_panel_and_slot_shape
application assertion 432, 488
application object 382
ARM diagrams 2452
mapping table 1182
Tray_panel_hydraulics
application assertion 487
application object 383
ARM diagrams 2450
mapping table 1186
Tray_panel_shape
application assertion 427, 428, 438, 458, 476, 487, 488, 493
application object 384
ARM diagrams 2450
mapping table 1189
Tray_slot_shape
application assertion 458, 488
application object 385
ARM diagrams 2452
mapping table 1195
Tray_support

application assertion 488
application object 385
ARM diagrams 2448
mapping table 1196
Tray_support_shape
application assertion 488
application object 385
ARM diagrams 2448
mapping table 1198
Trigger
AIM diagrams 2506
AIM EXPRESS listing entities 2351
AIM EXPRESS short listing entities 2211
application assertion 466
application object 209
ARM diagrams 2440, 2473
mapping table 515
Trimmed_curve
AIM diagrams 2534
AIM EXPRESS listing entities 2351
Trimming_preference
AIM diagrams 2534
AIM EXPRESS listing types 2294
Trimming_select
AIM diagrams 2534
AIM EXPRESS listing types 2294
Tube_external_characteristics
application assertion 488
application object 333
ARM diagrams 2445
mapping table 864
Tube_internal_characteristics
application assertion 489
application object 335
ARM diagrams 2445
mapping table 871
Tube_type
AIM diagrams 2515
AIM EXPRESS listing entities 2352
AIM EXPRESS short listing entities 2211
application assertion 446, 488, 489
application object 337
ARM diagrams 2445
mapping table 580, 871, 877-893
Tubesheet
application assertion 486, 489
application object 340
ARM diagrams 2445
mapping table 894
Tubeside_design

application assertion 446, 449
application object 346
ARM diagrams 2442
mapping table 916
Tubeside_performance
application assertion 489
application object 350
ARM diagrams 2443
mapping table 927
Two_direction_repeat_factor
AIM diagrams 2531
AIM EXPRESS listing entities 2352
Type_qualifier
AIM diagrams 2527
AIM EXPRESS listing entities 2352
U_bend_support
application assertion 489
application object 352
ARM diagrams 2445
mapping table 935
Uniform_curve
AIM diagrams 2535
AIM EXPRESS listing entities 2352
Unit
AIM diagrams 2520
AIM EXPRESS listing types 2294
Unit of functionality 7
Unit_operation
unit of functionality 42
UO 16
Uo_air_cooled_heat_exchanger
application object 109
ARM diagrams 2491
mapping table 1891
Uo_centrifugal_compressor
application assertion 489
application object 109
ARM diagrams 2490
mapping table 1891
Uo_centrifugal_compressor_stage
application assertion 489
application object 109
ARM diagrams 2490
mapping table 1893
Uo_centrifuge
application object 110
ARM diagrams 2489
mapping table 1896
Uo_completely_stirred_reactor
application object 112

ARM diagrams 2493
mapping table 1903
Uo_complex_distillation
application assertion 489
application object 113
ARM diagrams 2492
mapping table 1905
Uo_compressor
application object 113
ARM diagrams 2490
mapping table 1906
Uo_compressor_stage
application object 114
ARM diagrams 2490
mapping table 1910
Uo_countercurrent_solids_decant
application assertion 491
application object 114
ARM diagrams 2489
mapping table 1913
Uo_countercurrent_solids_decanter
ARM diagrams 2486
Uo_crush
application object 115
ARM diagrams 2488
mapping table 1916
Uo_crystallization
application object 116
ARM diagrams 2489
mapping table 1918
Uo_cyclone
application object 118
ARM diagrams 2492
mapping table 1926
Uo_dissolve
application object 120
ARM diagrams 2489
mapping table 1939
Uo_distillation
application assertion 481, 489, 490
application object 122
ARM diagrams 2486, 2493
mapping table 1945
Uo_distillation_stage
application assertion 443, 453, 490
application object 126
ARM diagrams 2481, 2491
mapping table 1961
Uo_distillation_stage_phase_pump_around
application object 129

ARM diagrams 2488
mapping table 1974
Uo_double_pipe
application object 130
Uo_double_pipe_heat_exchanger
ARM diagrams 2491
mapping table 1982
Uo_electrostatic_precipitator
application object 130
ARM diagrams 2492
mapping table 1982
Uo_expander
application object 132
ARM diagrams 2490
mapping table 1992
Uo_extent_specified_reactor
application assertion 447
application object 133
ARM diagrams 2439, 2493
mapping table 1995
Uo_extract
application object 134
ARM diagrams 2492
mapping table 1997
Uo_fabric_filter
application object 134
ARM diagrams 2492
mapping table 1997
Uo_fired_heater
application object 135
ARM diagrams 2488
mapping table 2006
Uo_fired_reactor
ARM diagrams 2493
mapping table 2009
Uo_flash
application object 136
ARM diagrams 2492
mapping table 2010
Uo_fluid_transfer
application assertion 448
application object 138
ARM diagrams 2490
mapping table 2014
Uo_gas_solid_separation
application object 138
ARM diagrams 2492
mapping table 2015
Uo_heat_exchanger
application assertion 449, 490

application object 139
ARM diagrams 2491
mapping table 2016
Uo_heat_exchanger_fluid
application assertion 471, 490
application object 141
ARM diagrams 2481, 2488
mapping table 2025
Uo_heat_exchanger_side
application assertion 448, 490
application object 142
ARM diagrams 2491
mapping table 2028
Uo_hydrocyclone
application object 142
ARM diagrams 2489
mapping table 2032
Uo_jet_ejector
application object 144
ARM diagrams 2490
mapping table 2042
Uo_liquid_liquid_flash
application object 144
ARM diagrams 2492
mapping table 2042
Uo_liquid_solid_separation
application object 144
ARM diagrams 2489
mapping table 2043
Uo_liquid_vapour_flash
application object 145
ARM diagrams 2492
mapping table 2043
Uo_melt
application object 145
ARM diagrams 2490
mapping table 2044
Uo_mix
application object 145
ARM diagrams 2488
mapping table 2044
Uo_multi_phase_flash
application object 145
ARM diagrams 2492
mapping table 2046
Uo_phase_change
application object 146
ARM diagrams 2490
mapping table 2052
Uo_pipeline

application assertion 490, 491
application object 147
ARM diagrams 2493
mapping table 2053
Uo_pipeline_node
application assertion 490
application object 147
ARM diagrams 2493
mapping table 2054
Uo_pipeline_segment
application assertion 490, 491
application object 148
ARM diagrams 2493
mapping table 2061
Uo_plug_flow_reactor
application object 150
ARM diagrams 2493
mapping table 2068
Uo_positive_displacement_compressor
application assertion 491
application object 150
ARM diagrams 2490
mapping table 2070
Uo_positive_displacement_compressor_stage
application assertion 491
application object 151
ARM diagrams 2490
mapping table 2071
Uo_pressure_change
application object 151
ARM diagrams 2490
mapping table 2073
Uo_pump
application object 153
ARM diagrams 2490
mapping table 2079
Uo_reactor
application assertion 434, 443
application object 154
ARM diagrams 2439, 2493
mapping table 2083
Uo_restrict
application object 155
ARM diagrams 2490
mapping table 2086
Uo_rotary_filter
application object 156
ARM diagrams 2489
mapping table 2088
Uo_screen

application object 157
ARM diagrams 2488
mapping table 2095
Uo_separation
application assertion 491
application object 159
ARM diagrams 2488
mapping table 2099
Uo_separation_three_phase_flash
mapping table 2100
Uo_separator
ARM diagrams 2450
Uo_separator_three_phase_flash
application object 159
ARM diagrams 2492
Uo_shell_and_tube_heat_exchanger
application object 159
ARM diagrams 2491
mapping table 2103
Uo_single_phase_flash
application object 159
ARM diagrams 2492
mapping table 2103
Uo_solid_solid_separation
application object 160
ARM diagrams 2488
mapping table 2104
Uo_solids_decant_stage
application assertion 491
application object 160
ARM diagrams 2489
mapping table 2105
Uo_solids_drying
application object 161
ARM diagrams 2489
mapping table 2109
Uo_specified_yield_reactor
application assertion 475
application object 162
ARM diagrams 2492
mapping table 2113
Uo_split
application object 162
ARM diagrams 2489
mapping table 2113
Uo_stream_split
application object 162, 483
ARM diagrams 2489
mapping table 2115
Uo_substance_split

application assertion 483
application object 162
ARM diagrams 2489
mapping table 2115
Uo_valve
application object 163
ARM diagrams 2490
mapping table 2116
Uo_vapourize
application object 164
ARM diagrams 2490
mapping table 2122
Uo_venturi_scrubber
application object 164
ARM diagrams 2491
mapping table 2122
UoF 16
using_representations
AIM EXPRESS listing functions 2369
Utility_material_service
application assertion 460, 491
application object 59
ARM diagrams 2462, 2474, 2481
mapping table 1447
Utility_service_stream_demand
application assertion 460, 491
application object 173
ARM diagrams 2462, 2474, 2481
mapping table 1809
Utility_stream
application object 173
ARM diagrams 2481
mapping table 1810
valid_calendar_date
AIM EXPRESS listing functions 2370
valid_time
AIM EXPRESS listing functions 2370
valid_units
AIM EXPRESS listing functions 2370
Value_qualifier
AIM diagrams 2527
AIM EXPRESS listing types 2294
Valve_cap
application object 385
ARM diagrams 2450
mapping table 1199
Valve_cap_shape
application object 385
ARM diagrams 2453
mapping table 1201

Vapour_belt
application assertion . . . 491
application object . . . 353
ARM diagrams . . . 2444
mapping table . . . 939
Variable
application assertion . . . 475, 480, 492
application object . . . 78
ARM diagrams . . . 2484, 2487
mapping table . . . 1862
Variable_adjustment_specification
application assertion . . . 468, 492
application object . . . 195
ARM diagrams . . . 2465, 2475
mapping table . . . 1685
Variable_approval_context
application assertion . . . 445, 480, 493
application object . . . 78
ARM diagrams . . . 2485
mapping table . . . 1863
Variable_convergence_block
application assertion . . . 482, 492
application object . . . 195
ARM diagrams . . . 2475, 2481
mapping table . . . 1686
Variable_convergence_specification
application assertion . . . 492
application object . . . 195
ARM diagrams . . . 2475
mapping table . . . 1686
Variable_value
application assertion . . . 435, 492, 493
application object . . . 78
ARM diagrams . . . 2484, 2485
mapping table . . . 1863
Vector
AIM diagrams . . . 2531
AIM EXPRESS listing entities . . . 2352
vector_difference
AIM EXPRESS listing functions . . . 2372
Vector_or_direction
AIM diagrams . . . 2531
AIM EXPRESS listing types . . . 2294
Velocity head
definition . . . 14
Versioned_action_request
AIM diagrams . . . 2507
AIM EXPRESS listing entities . . . 2353
AIM EXPRESS short listing imported entity modifications . . . 2218
Vibration_detector

application assertion 493
ARM diagrams 2458
VLE 16
Volume_measure
AIM diagrams 2522
AIM EXPRESS listing types 2294
Volume_measure_with_unit
AIM diagrams 2521
AIM EXPRESS listing entities 2353
Volume_unit
AIM diagrams 2520
AIM EXPRESS listing entities 2353
Weir
application assertion 493
application object 386
ARM diagrams 2450
mapping table 1204
Weir_and_disengaging_panel_intersection
application assertion 439, 493
application object 386
mapping table 1206
Weir_and_seal_pan_intersection
application assertion 439, 493
application object 386
ARM diagrams 2452
mapping table 1207
Weir_and_tray_panel_intersection
application assertion 440, 493
application object 386
ARM diagrams 2450
mapping table 1210
Weir_shape
application assertion 440, 493, 494
application object 387
ARM diagrams 2450
mapping table 1214
Work_stream
application object 173
ARM diagrams 2481
mapping table 1810
year_number
AIM EXPRESS listing types 2294