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ISO/PDTS 10303-1001

Product data representation and exchange: Application module: Appearance assignment

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ABSTRACT:

This document is the draft technical specification of the application module that provides mechanisms for the assignment of visual attributes to shape models, geometric elements and annotation.

KEYWORDS:

Application module, appearance assignment, styled element, visual attributes.

COMMENTS TO READER:

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

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Foreword

ISO (the International Organization for Standardization) 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the 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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50% of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed every three years with a view to deciding whether it can be transformed into an International Standard.

ISO/PDTS 10303-1001 was prepared by Technical Committee ISO/TC 184, Industrial automation systems and integration, Subcommittee SC4, Industrial data.

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 modules, application protocols, abstract test suites, implementation methods, and conformance testing. The series are described in ISO 10303-1. A complete list of parts of ISO 10303 is available from the Internet:

<http://www.nist.gov/sc4/editing/step/titles/>.

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

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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, application modules, 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 module series.

This part of ISO 10303 specifies an application module for the assignment of visual attributes to shape models, geometric elements and annotation. It provides for the association of visual attributes with shape models, geometric elements and annotation, but does not include specifications for those attributes.

For an example of bringing together a set of application modules to provide the capability to assign shape elements to layers and visual attributes, such as colours and curve fonts, to geometric and topological elements, see Annex F of ISO 10303-1009.

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Industrial automation systems and integration — Product data representation and exchange — Part 1001: Application module: Appearance assignment

1 Scope

This part of ISO 10303 specifies the application module for the assignment of visual attributes to shape models, geometric elements and annotation.

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

— association of visual attributes with shape models, geometric elements and annotation.

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

— definition of views in which shape models, geometric elements or annotation are presented;

— specification of shape models;

— specification of annotation;

— specification of visual attributes.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 8824-1:1994, *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.*

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

ISO 10303-43:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 43, Integrated generic resources: Representation structures.*

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

ISO 10303-202:1996, *Industrial automation systems and integration — Product data representation and exchange — Part 202: Application protocol: Associative draughting.*

ISO 10303-1006:[1] *Industrial automation systems and integration — Product data representation and exchange — Application module: Foundation representation.*

ISO 10303-1004:[1] *Industrial automation systems and integration — Product data representation and exchange — Application module: Elemental shape.*

3 Terms, definitions, and abbreviations

3.1 Terms defined in ISO 10303-1

For the purposes of this part of ISO 10303, the following terms defined in ISO 10303-1 apply:

— application;

— application object;

— application protocol;

— application reference model;

— data;

— information;

— integrated resource;

— product;

— product data;

— unit of functionality.

[1)] To be published.

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3.2 Terms defined in ISO 10303-202

For the purposes of this part of ISO 10303, the following terms defined in ISO 10303-202 apply:

— application interpreted construct.

3.3 Other terms and definitions

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

3.3.1
application module (AM)
a reusable collection of a scope statement, information requirements, mappings and module interpreted model that supports a specific usage of product data across multiple application contexts.

3.4 Abbreviations

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

AM	application module
ARM	application reference model
MIM	module integrated model
UoF	unit of functionality
URL	uniform resource locator

4 Information requirements

This clause specifies the information requirements for the appearance assignment module. The information requirements are specified as a set of units of functionality and application objects. The information requirements are defined using the terminology of the subject area of this application module.

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

NOTE 2 - The mapping specification is specified in 5.1 which shows how the information requirements are met using the integrated resources of this International Standard. The use of the integrated resources introduces additional requirements which are common to application modules and application protocols.

EXPRESS specification:

```
*)
SCHEMA appearance_assignment_arm;
(*
```

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4.1 Units of functionality

This subclause specifies the units of functionality (UoF) for this part of ISO 10303 as well as any support elements needed for the application module definition. This part of ISO 10303 specifies the following units of functionality:

— appearance_assignment.

This part of ISO 10303 uses the following units of functionality:

— elemental_shape;

— foundation_representation.

The units of functionality and a description of the functions that each UoF supports are given below. The ARM entities included in the UoFs are defined in 4.3.

4.1.1 Appearance_assignment

The appearance_assignment UoF specifies information for assignment of visual attributes to shape models, geometric elements and annotation. The following application elements are specified in the appearance_assignment UoF:

— Appearance;

— Appearance_assignment;

— Appearance_context;

— Context_dependent_appearance_assignment;

— Overriding_styled_element;

— Styled_element;

— Styled_geometric_model;

— Styled_model;

— Styled_model_element.

4.1.2 Elemental_shape

This UoF is specified in the elemental shape application module. (See ISO 10303-1004.) The following application elements in that UoF are referenced from this part of ISO 10303:

— Detailed_model_element;

— Geometric_model;

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— Template_instance.

4.1.3 Foundation_representation

This UoF is specified in the foundation representation application module. (See ISO 10303-1006.) The following application elements in that UoF are referenced from this part of ISO 10303:

— Representation_item.

4.2 Required AM ARMs

The following EXPRESS interface statements specify the elements imported from the ARMs of other modules.

EXPRESS specification:

```
*)
USE FROM elemental_shape_arm; -- ISO 10303-1004
USE FROM foundation_representation_arm; -- ISO 10303-1006
(*
```

4.3 ARM entity definitions

This subclause specifies the application entities for the appearance assignment application module. Each application entity is an atomic element that embodies a unique application concept and contains attributes specifying the data elements of the entity. The application entities and their definitions are given below.

4.3.1 Appearance

An Appearance indicates the styles of visual attributes that can be assigned to shape models, geometric elements and annotation. The styles are specified in application modules that use the appearance assignment application module.

EXPRESS specification:

```
*)
ENTITY appearance
     ABSTRACT SUPERTYPE;
END_ENTITY;
(*
```

4.3.2 Appearance_assignment

An Appearance_assignment governs the visual appearance of geometric elements and annotation. The appearance can be defined explicitly for each represented element or for a context in which the elements are represented. Several Appearance components for the representation of the different kinds of elements can be associated with the Appearance_assignment.

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EXPRESS specification:

```
*)
ENTITY appearance_assignment;
      component: SET [1:?] OF appearance;
END_ENTITY;
(*
```

Attribute definitions:

component: specifies the various appearance components to define the appearance of geometric and annotation objects.

4.3.3 Appearance_context

An Appearance_context indicates possible contexts for the assignment of overriding visual attributes. The contexts are specified in application modules that use the Appearance assignment application module.

EXPRESS specification:

```
*)
ENTITY appearance_context
    ABSTRACT SUPERTYPE;
END_ENTITY;
(*
```

4.3.4 Context_dependent_appearance_assignment

A Context_dependent_appearance_assignment is the appearance of geometric elements and annotation with regard to a context in which these elements are represented. The Context_-dependent_appearance_assignment is overridden by appearances associated with elements by an Appearance_assignment. A Context_dependent_appearance_assignment is a type of Appearance_-assignment.

EXPRESS specification:

```
*)
ENTITY context_dependent_appearance_assignment
SUBTYPE OF (appearance_assignment);
      context_definition: appearance_context;
END_ENTITY;
(*
```

Attribute definitions:

context_definition: specifies the context where the appearance components are valid.

4.3.5 Overriding_styled_element

An Overriding_styled_element supports the assignment of visual attributes to an element so that these attributes take precedence over other assigned styles.

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EXPRESS specification:

```
*)
ENTITY overriding_styled_element
      SUBTYPE OF (styled_element);
      is_defined_for: SET [1:?] OF appearance_context;
END_ENTITY;
(*
```

Attribute definitions:

is_defined_for: specifies the contexts to which the style assignment applies..

4.3.6 Styled_element

A Styled_element is a Detailed_element that has presentation information.

EXPRESS specification:

```
*)
ENTITY styled_element
    SUBTYPE OF (representation_item);
      appearance: appearance_assignment;
      invisible: BOOLEAN;
END_ENTITY;
(*
```

Attribute definitions:

appearance: specifies the associated presentation information.

invisible: specifies whether the Styled_element is invisible.

4.3.7 Styled_geometric_model

A Styled_geometric_model is a set of geometric elements that have presentation information.

EXPRESS specification:

```
*)
ENTITY styled_geometric_model
  SUBTYPE OF (styled_model);
      styled_geometry: geometric_model;
END_ENTITY;
(*
```

Attribute definitions:

styled_geometry: specifies the Geometric_model that contains the Styled_geometric_elements.

4.3.8 Styled_model

A Styled_model is a set of geometric or annotation elements that have presentation information.

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EXPRESS specification:

```
*)
ENTITY styled_model;
      additional_elements: SET [0:?] OF template_instance;
      description: OPTIONAL STRING;
      element: SET [1:?] OF styled_element;
      model_id: STRING;
END_ENTITY;
(*
```

Attribute definitions:

additional_elements: specifies the Template_instance objects that are additionally imported into the Styled_model. The additional_elements shall be Styled_models.

description: specifies additional information about the Styled_model

element: specifies the set of Styled_element objects that forms the Styled_model.

model_id: specifies the identifier of the Styled_model.

4.3.9 Styled_model_element

A Styled_model_element is a Styled_element that represents geometry.

EXPRESS specification:

```
*)
ENTITY styled_model_element
  SUBTYPE OF (styled_element);
element: detailed_model_element;
END_ENTITY;
(*
```

Attribute definitions:

element: specifies the Detailed_model_element that is attached to the presentation information.

EXPRESS specification:

```
*)
END_SCHEMA;
(*
```

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5 Module interpreted model

5.1 Mapping specification

This clause contains the mapping table that shows how each UoF and application element of this part of ISO 10303 (see clause 4) maps to one or several MIM resource constructs. The mapping table is organized in five columns. The contents of these five columns are:

Column 1) Application element: Name of an application element as it appears in the application entity definition. Application entity names are written in uppercase. Attribute names are listed after the application entity to which they belong and are written in lower case.

Column 2) MIM element: Name of an MIM element as it appears in the MIM, the term 'IDENTICAL MAPPING', or the term 'PATH'. MIM entities are written in lower case. Attribute names of MIM entities are referred to as <entity name>.<attribute name>. The mapping of an application element may result in several related MIM elements. Each of these MIM elements will require a line of its own in the table. The term 'IDENTICAL MAPPING' indicates that both application entities of an application assertion map to the same MIM element. The term 'PATH' indicates that the application assertion maps to the entire reference path.

Column 3) Source: For those MIM elements that are interpreted from the integrated resources, this is the number of the corresponding part of ISO 10303. For those MIM elements that are created for the purpose of this part of ISO 10303, this is the number of this part.

Column 4) Rules: One or more numbers may be given which refer to rules that apply to the current MIM element or reference path. For rules that are derived from relationships between application entities, the same rule is referred to by the mapping entries of all the involved MIM elements. The expanded names of the rules are listed after the table.

Column 5) Reference path: To describe fully the mapping of an application entity, it may be necessary to specify a reference path through several related MIM elements. The reference path column documents the role of a MIM element relative to the MIM element in the row succeeding it. Two or more such related MIM elements define the interpretation of the integrated resources that satisfies the requirement specified by the application entity. For each MIM 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 MIM elements, the following notational conventions apply:

a) [] : multiple MIM elements or sections of the reference path are required to satisfy an information requirement;

b) () : multiple MIM 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) -> : attribute references the entity or select type given in the following row;

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e) <- : entity or select type is referenced by the attribute in the following row;

f) [i] : attribute is an aggregation of which a single member is given in the following row;

g) [n] : attribute is an aggregation of which member n is given in the following row;

h) => : entity is a supertype of the entity given in the following row;

i) <= : entity is a subtype of the entity given in the following row;

j) = : the string, select or enumeration type is constrained to a choice or value;

k) \ : the line continuation for strings that wrap.

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Table 1 - Mapping table for appearance_assignment UoF

Application element	AIM element	Source	Rules	Reference path
APPEARANCE_-ASSIGNMENT	presentation_style_-assignment	46		
component	PATH			presentation_style_assignment presentation_style_assignment.styles[i]->presentation_style_select
CONTEXT_DEPENDENT_-APPEARANCE_ -ASSIGNMENT	presentation_style_-by_ context	46		
context_definition	PATH			presentation_style_by_context presentaton_style_by_context.style_context style_context_select
OVERRIDING_STYLED_ -ELEMENT	context_dependent_overriding_styled_item	46		
is_defined_for	PATH			context_dependent_over_riding_styled_item <= over_riding_styled_item <= styled_item styled_item.item ->representation_item
STYLED_ELEMENT	styled_item	46		
appearance	PATH			styled_item styled_item.styles[i]->presentation_style_assignment

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Table 1 - Mapping table for appearance_assignment UoF

Application element	AIM element	Source	Rules	Reference path
invisible	invisibility.invisible_-items	46		styled_item invisible_item=styled_item invisible_item<- invisibility.invisible_items[i]
STYLED_GEOMETRIC_ -MODEL	(draughting_model) (mechanical_design_-geometric_presenta-tion_representation (representation)	1001 1001 1006		(draughting_model<=) (mechanical_design_-geometric_presentation_representation<=) (representation)
styled_geometry	PATH			(draughting_model<=) (mechanical_design_-geometric_presentation_representation<=) representation representation.items[i]->representation_item=> mapped_item mapped_item.mapping_source->representation_map representation_map.mapped_representation->representation=> shape_representation
STYLED_MODEL	(draughting_model) (mechanical_design_-geometric_presenta-tion_representation) (representation)	1001 1006		(draughting_model<=) (mechanical_design_geometric_presentation_-representation<=) (representation)

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Table 1 - Mapping table for appearance_assignment UoF

Application element	AIM element	Source	Rules	Reference path
additional_elements	PATH			(draughting_model<=) (mechanical_design_geometric_presentation_- representation <= representation representation_items[i]-> representation_item=> mapped_item {mapped_item.mapping_source-> representation_map representation_map.mapped_representation-> representation=> mechanical_design_geometric_presentation_- representation})
description	representation. description	1006		(draughting_model<=) (mechanical_design_geometric_presentation_- representation<=) representation representation.description
elements	PATH			(draughting_model<=) (mechanical_design_geometric_presentation_ representation<=) representation representation.items[i]-> representation_item=> styled_item

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Table 1 - Mapping table for appearance_assignment UoF

Application element	AIM element	Source	Rules	Reference path
model_id	representation.id	1006		(draughting_model<=) (mechanical_design_geometric_presentation_- representation<=) representation representation.id
STYLED_MODEL_- ELEMENT	styled_item	46		
element	PATH			styled_item styled_item.item->representation_item

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5.2 MIM EXPRESS short listing

This clause specifies the EXPRESS schema that uses elements from the integrated resources, application interpreted constructs or application module MIMs 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 textual material for constructs that are imported from the integrated resources. The definitions and EXPRESS provided in the integrated resources or application interpreted constructs for constructs used in the MIM may include select list items and subtypes which are not imported into the MIM. Requirements stated in the integrated resources or application interpreted constructs which refer to such items and subtypes apply exclusively to those items which are imported into the MIM.

EXPRESS specification:

```
*)
SCHEMA appearance_assignment_mim;

USE FROM elemental_shape_mim; -- ISO 10303-1004
USE FROM foundation_representation_mim; -- ISO 10303-1006

USE FROM presentation_appearance_schema
( context_dependent_over_riding_styled_item,
  invisibility,
  presentation_style_assignment,
  presentation_style_by_context,
  styled_item); -- ISO 10303-46
(*
```

NOTE 1 - See annex D for a graphical presentation of this schema using the EXPRESS-G notation.

NOTE 2 - The schemas referenced above can be found in the following parts of ISO 10303:

elemental_shape_mim	ISO 10303-1004
foundation_representation_mim	ISO 10303-1006
presentation_appearance_schema	ISO 10303-46

5.2.1 Application module entity definitions

This subclause contains the EXPRESS entity definitions in the MIM.

5.2.1.1 Draughting_model

A **draughting_model** is a representation of the shape of a product for the purpose of presentation and/or draughting. This entity is a subtype of **representation**.

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EXPRESS specification:

```
*)
ENTITY draughting_model
      SUBTYPE OF (representation);
END_ENTITY;
(*
```

5.2.1.2 Mechanical_design_geometric_presentation_representation

A **mechanical_design_geometric_presentation_representation** specifies the shape that shall be viewed in a presentation area. This entity is a subtype of **representation**.

EXPRESS specification:

```
*)
ENTITY mechanical_design_geometric_presentation_representation
      SUBTYPE OF (representation);
END_ENTITY;
(*
```

EXPRESS specification:

```
*)
END_SCHEMA;
(*
```

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Annex A
(normative)

MIM short names

Table A.1 provides the short names for entities defined in the MIM of this part of ISO 10303. Requirements on the use of the short names are found in the implementation methods included in ISO 10303. The EXPRESS MIM short names are available from the Internet:

http://www.mel.nist.gov/div826/subject/apde/snr/

Table A.1 - MIM short names of entities

Entity name	Short name
DRAUGHTING_MODEL	DRGMDL
MECHANICAL_DESIGN_GEOMETRIC_PRESENTATION_REPRESENTATION	MDGPR

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Annex B
(normative)

Information object registration

B.1 Document identification

To provide for unambiguous identification of an information object in an open system, the object identifier

{ iso standard 10303 part(1001) 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.

B.2 Schema identification

To provide for unambiguous identification of the schema specifications given in this application module in an open information system, the object identifiers are assigned as follows:

{ iso standard 10303 part(1001) version(-1) object(1) appearance-assignment-arm(1) }

is assigned to the appearance_assignment_arm schema.

{ iso standard 10303 part(1001) version(-1) object(2) appearance-assignment-mim(1) }

is assigned to the appearance_assignment_mim schema. The meaning of this value is defined in ISO 8824-1, and is described in ISO 10303-1.

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Annex C
(informative)

ARM EXPRESS-G

The following diagrams correspond to the ARM EXPRESS listing given in clause 4. The diagrams use the EXPRESS-G graphical notation for the EXPRESS language. EXPRESS-G is defined in annex D of ISO 10303-11.

NOTE - The inter-page referencing is to the diagram number and not the figure number.

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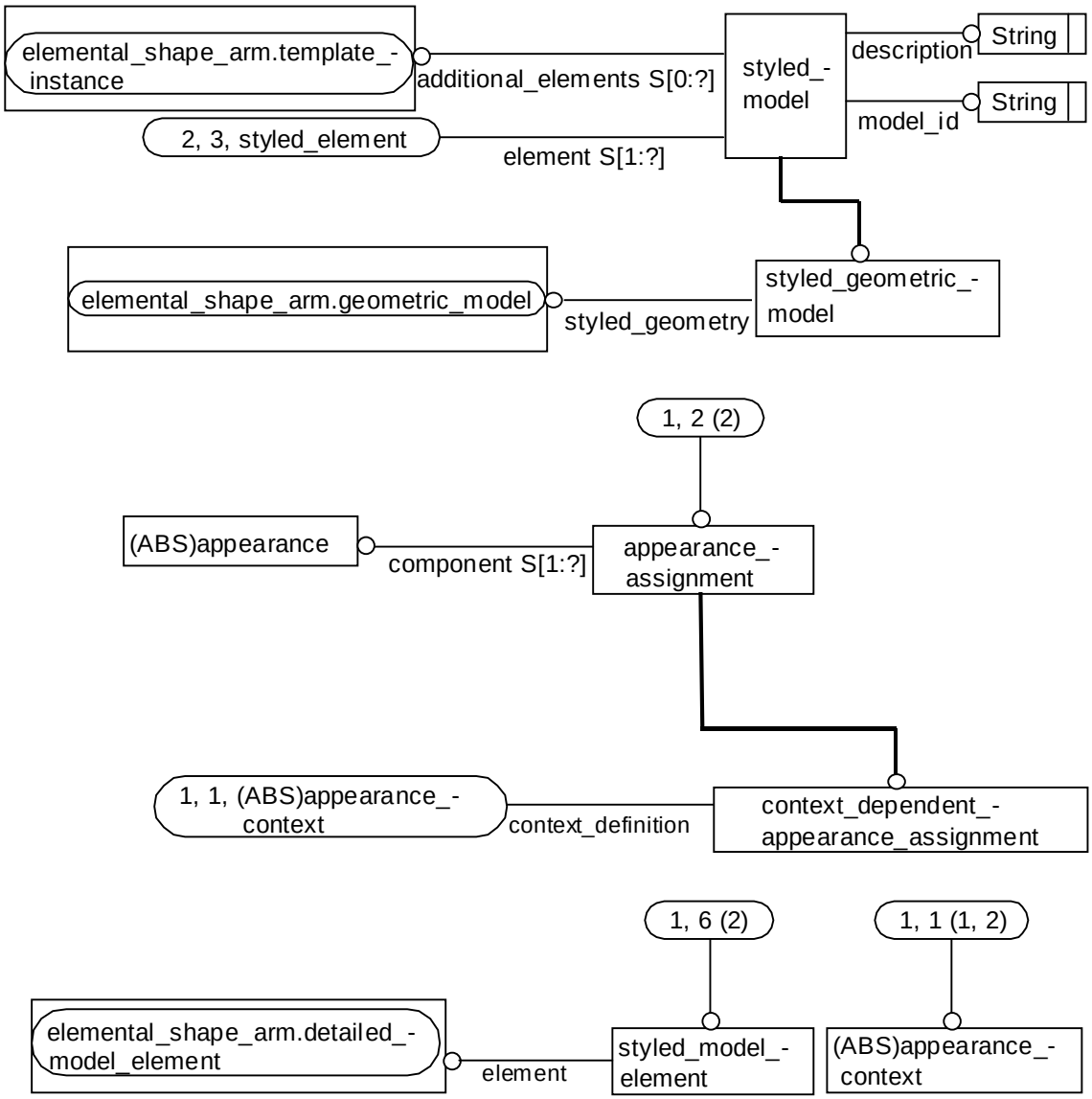

Figure C.1 - ARM EXPRESS-G diagram 1 of 2

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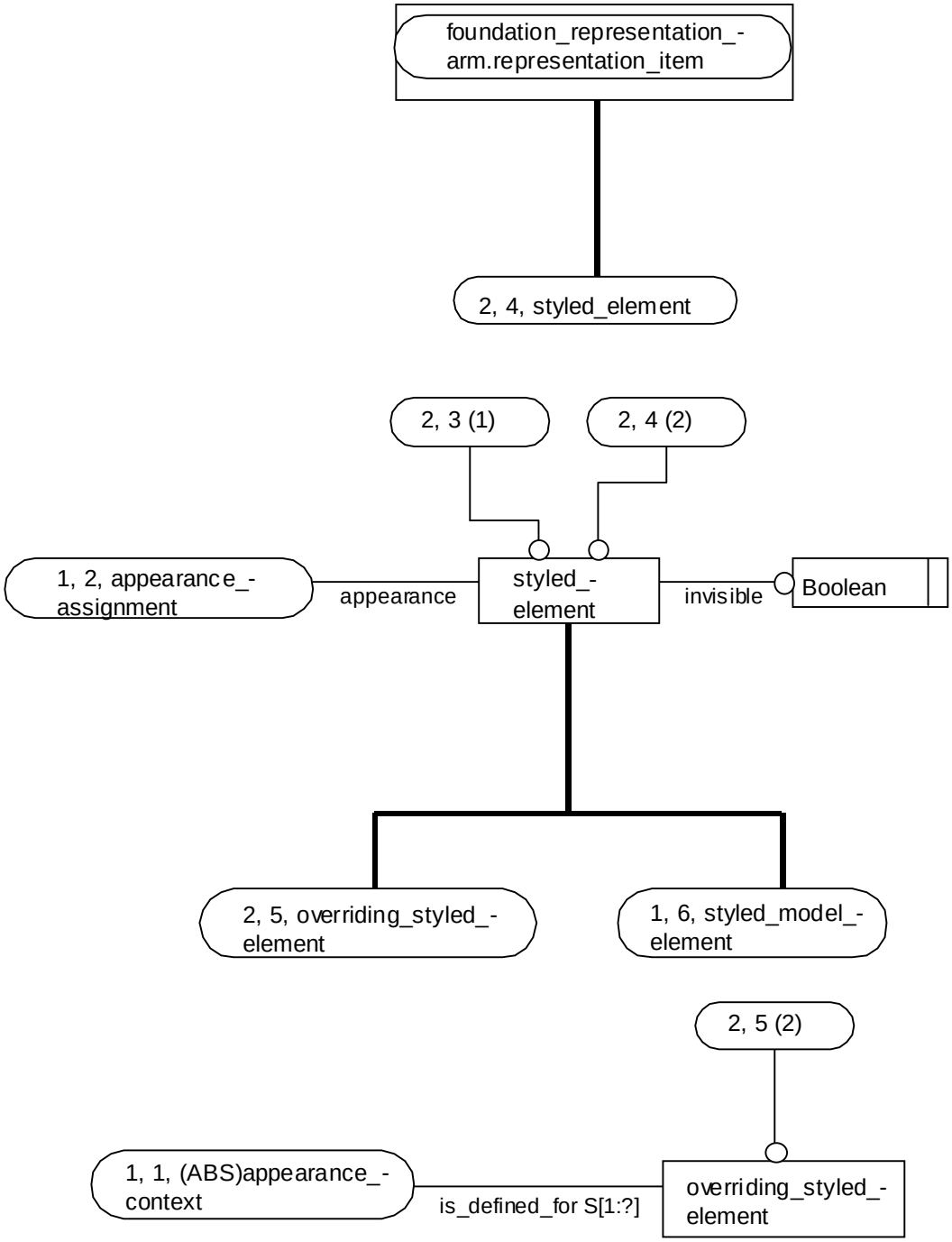

Figure C.2 - ARM EXPRESS-G diagram 2 of 2

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Annex D
(informative)

MIM EXPRESS-G

The following diagrams correspond to the MIM EXPRESS expanded listing given in annex E. The diagrams use the EXPRESS-G graphical notation for the EXPRESS language. EXPRESS-G is defined in annex D of ISO 10303-11.

NOTE - The inter-page referencing is to the diagram number and not the figure number.

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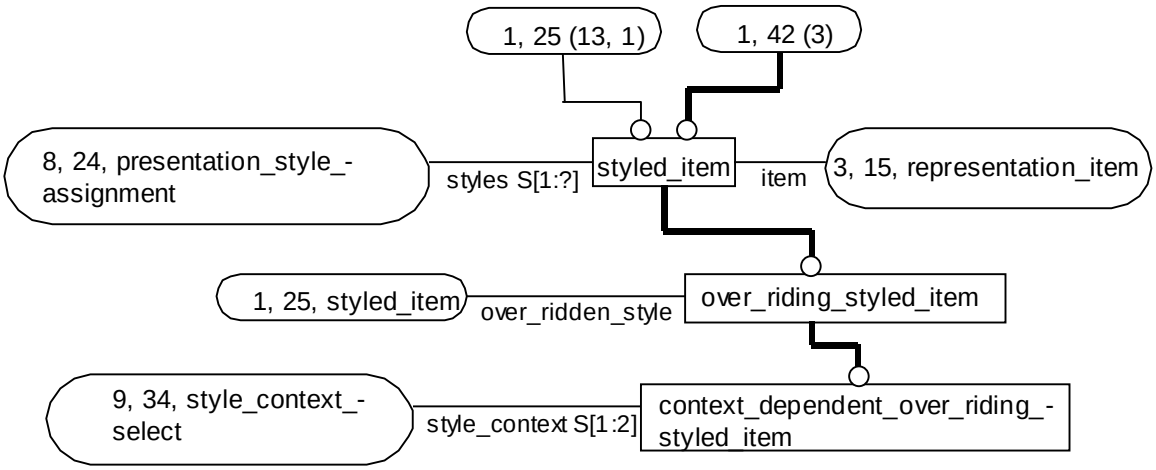

Figure D.1 - MIM EXPRESS-G diagram 1 of 13

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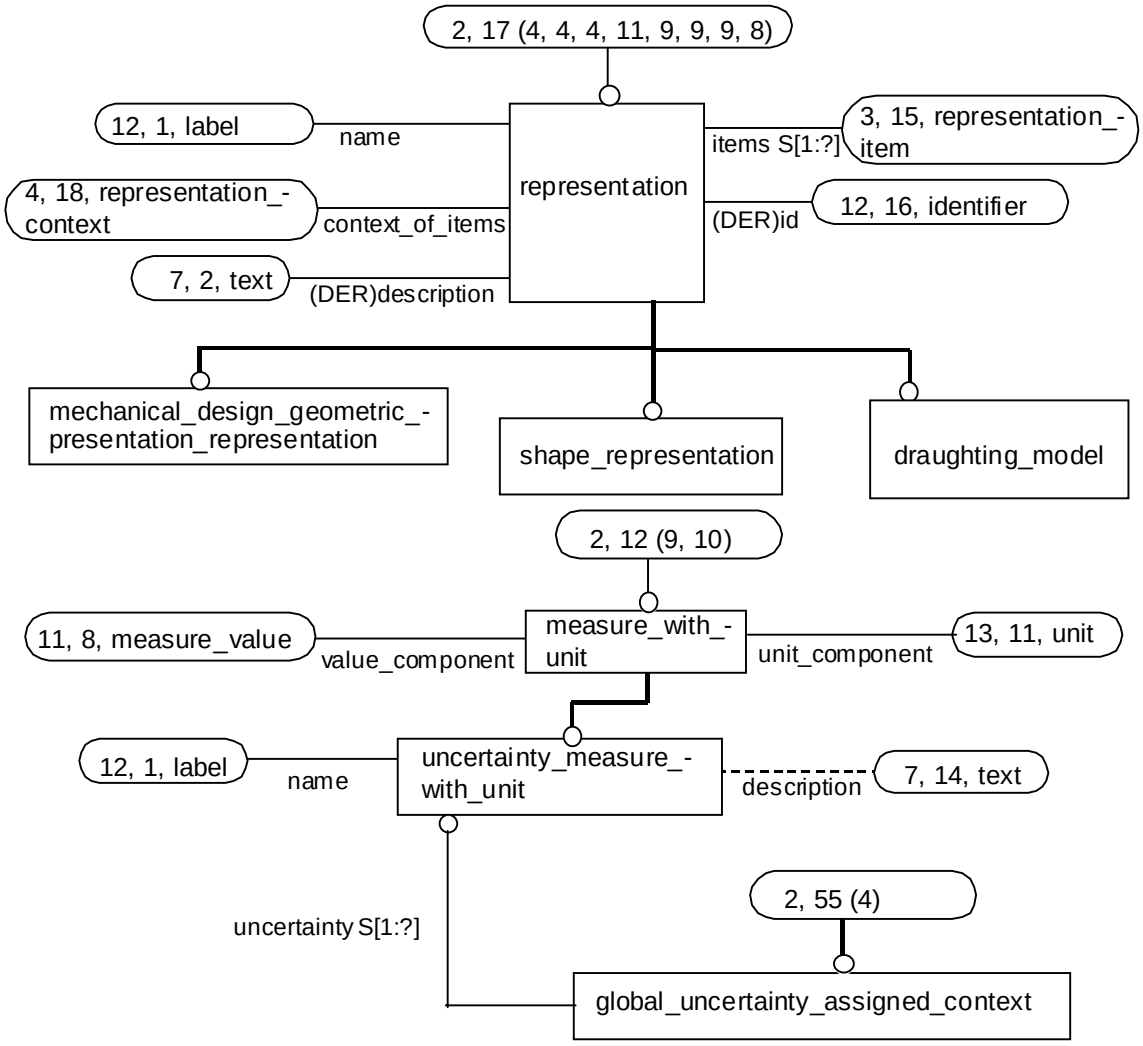

Figure D.2 - MIM EXPRESS-G diagram 2 of 13

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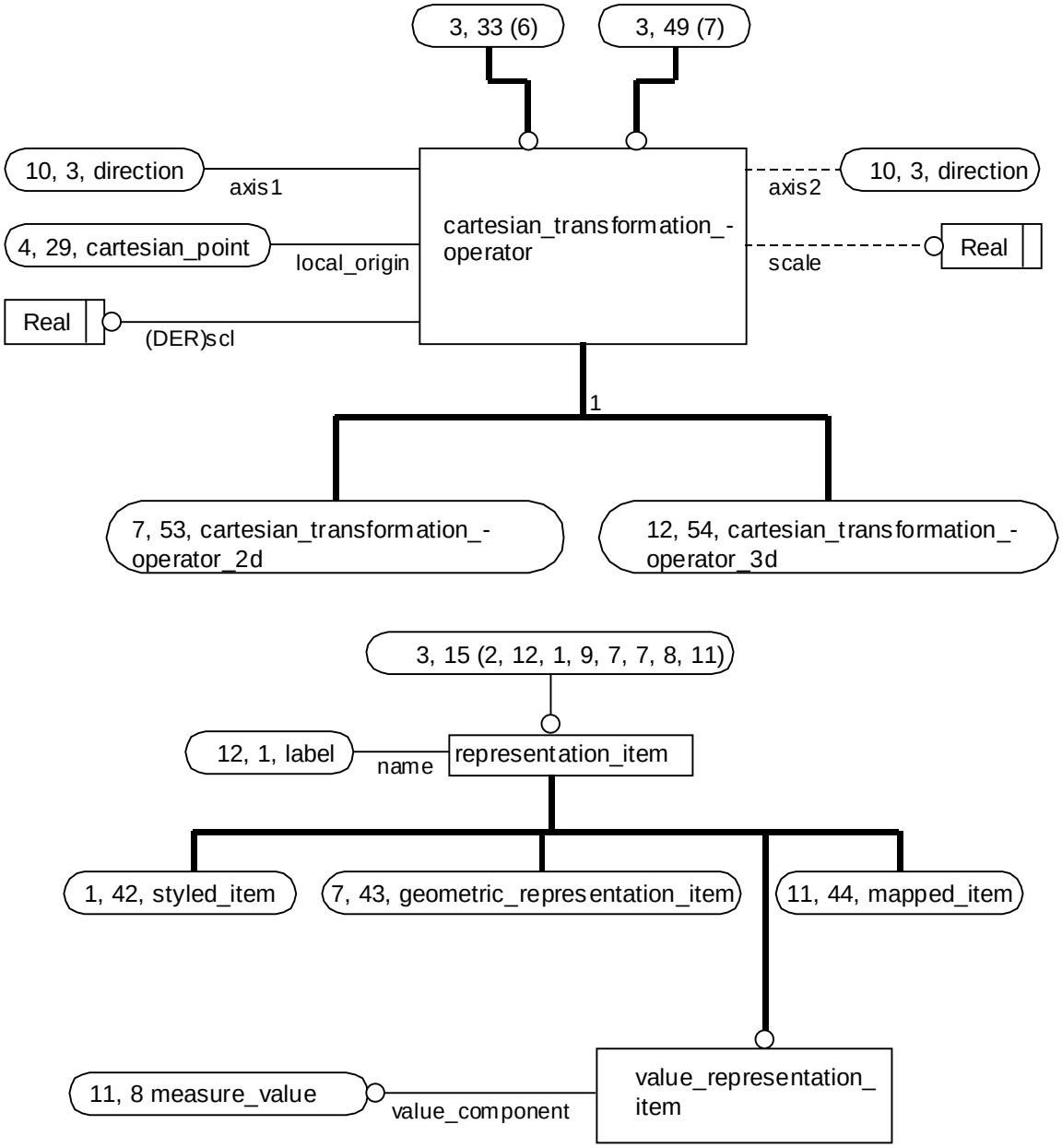

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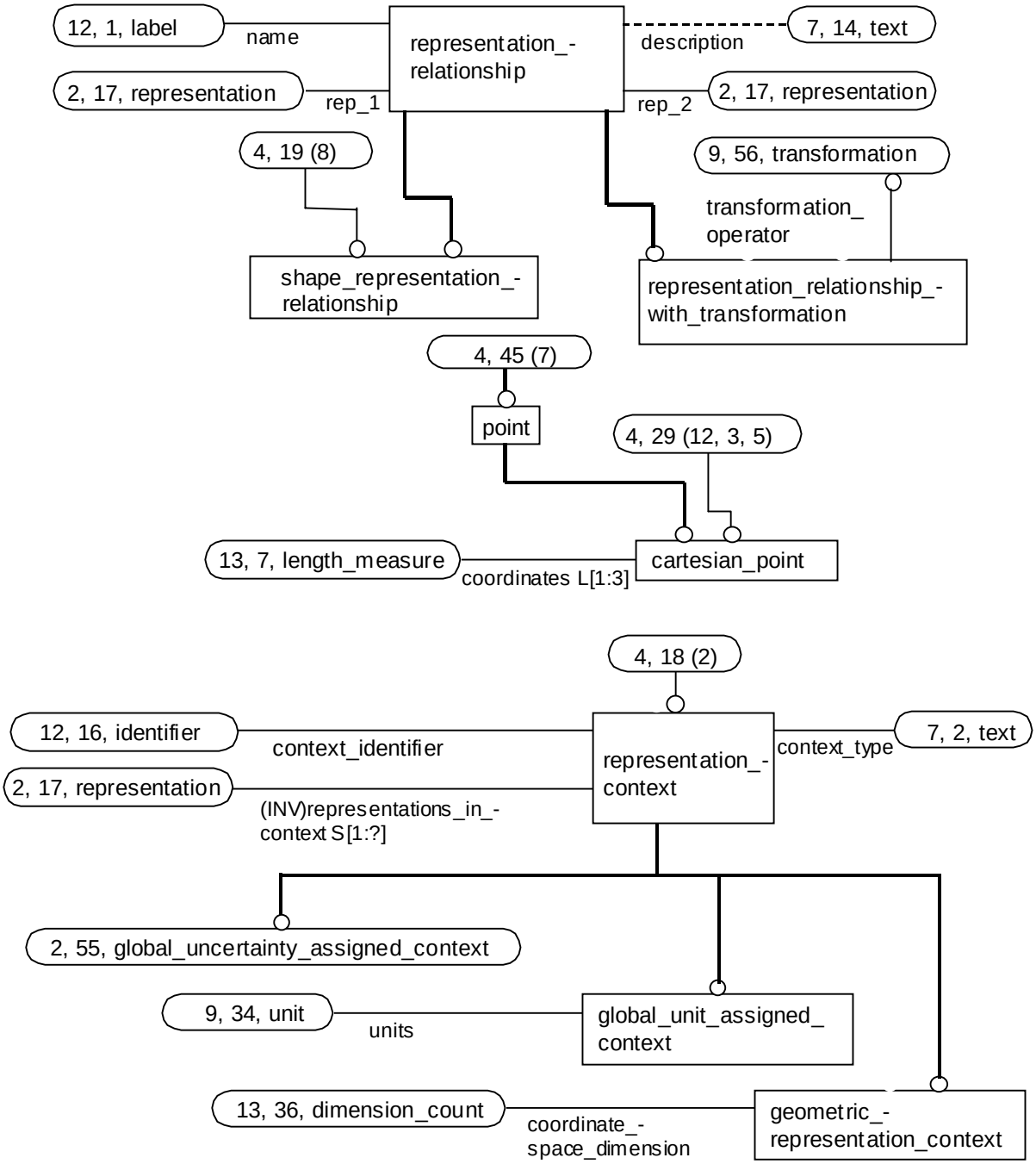

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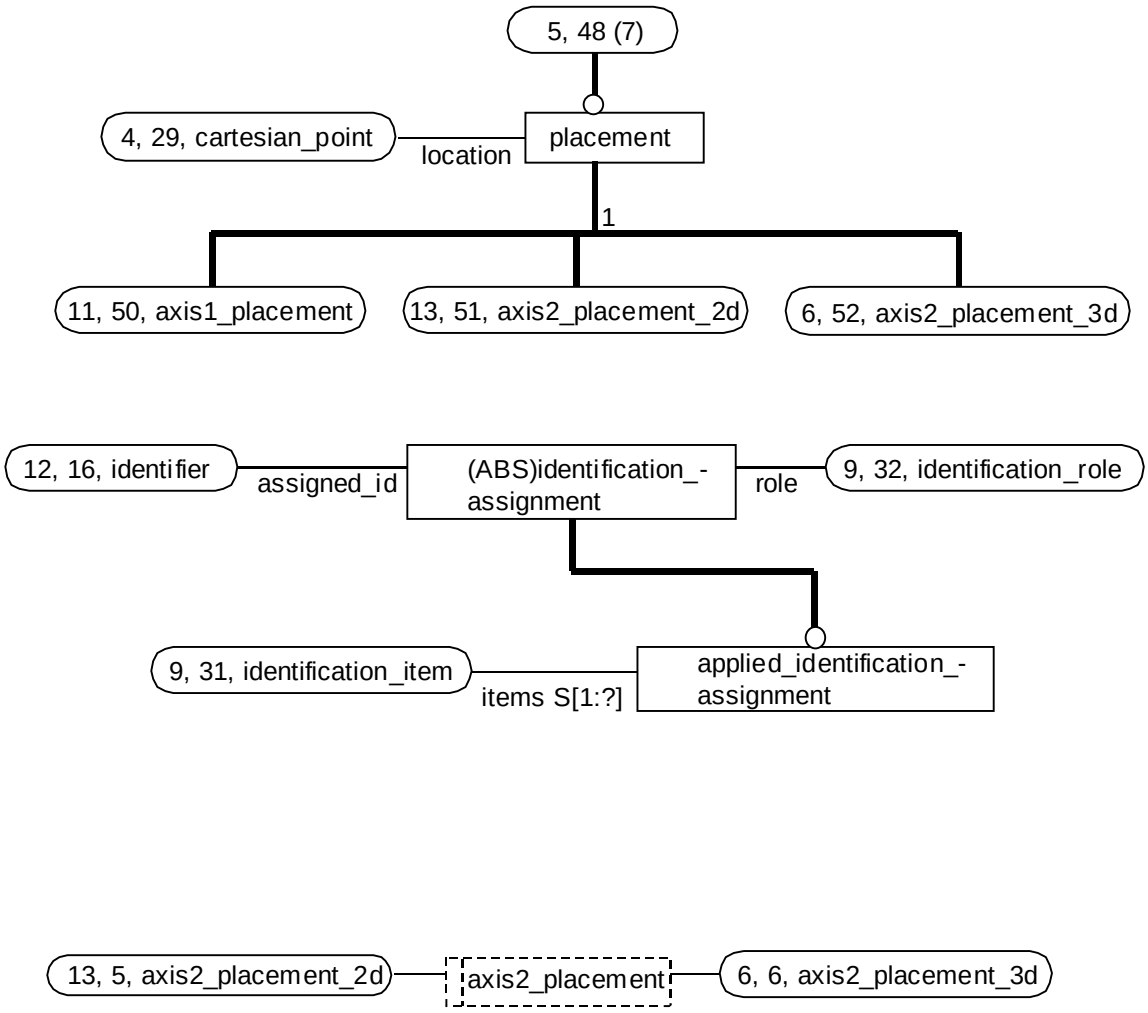

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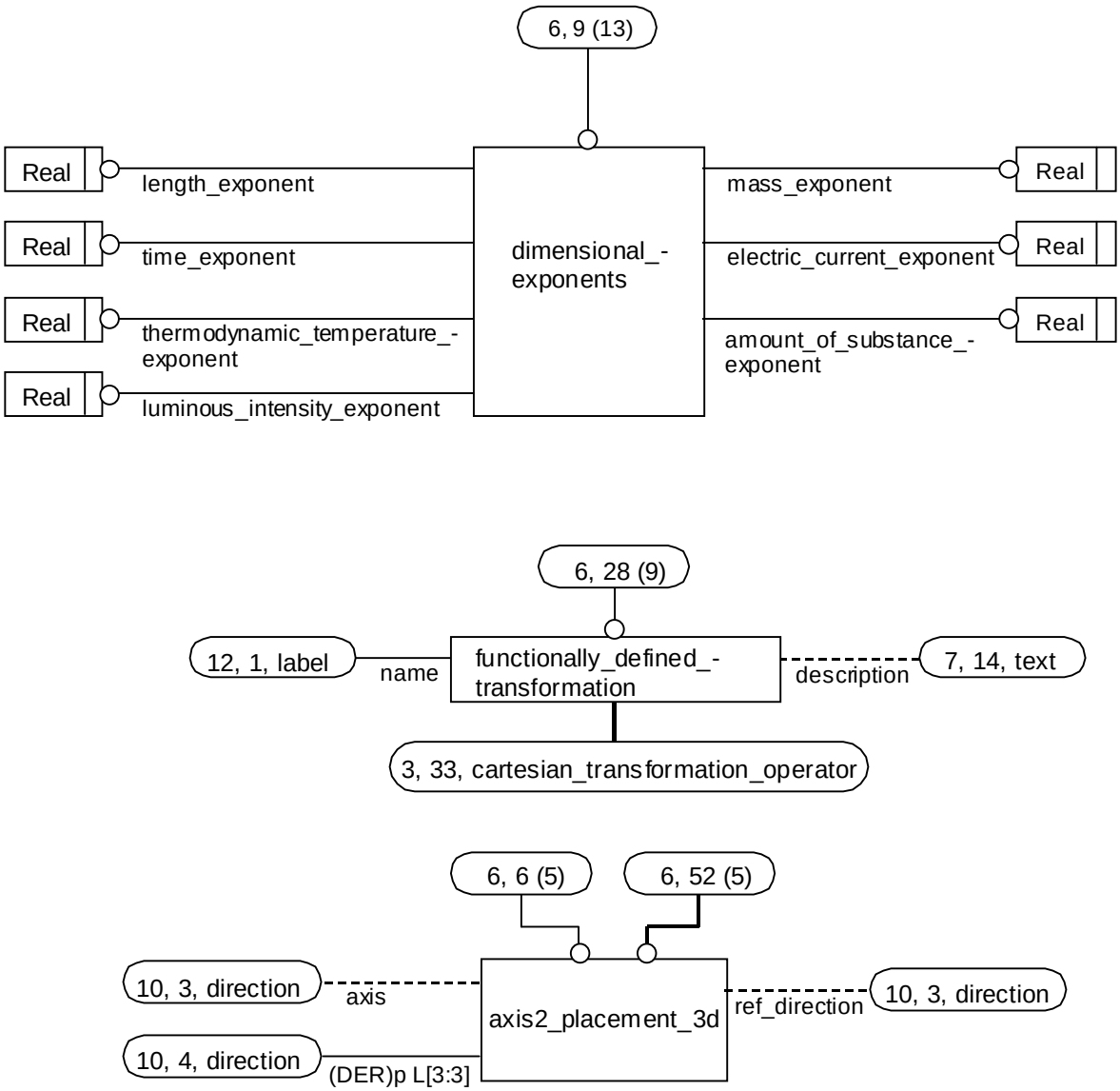

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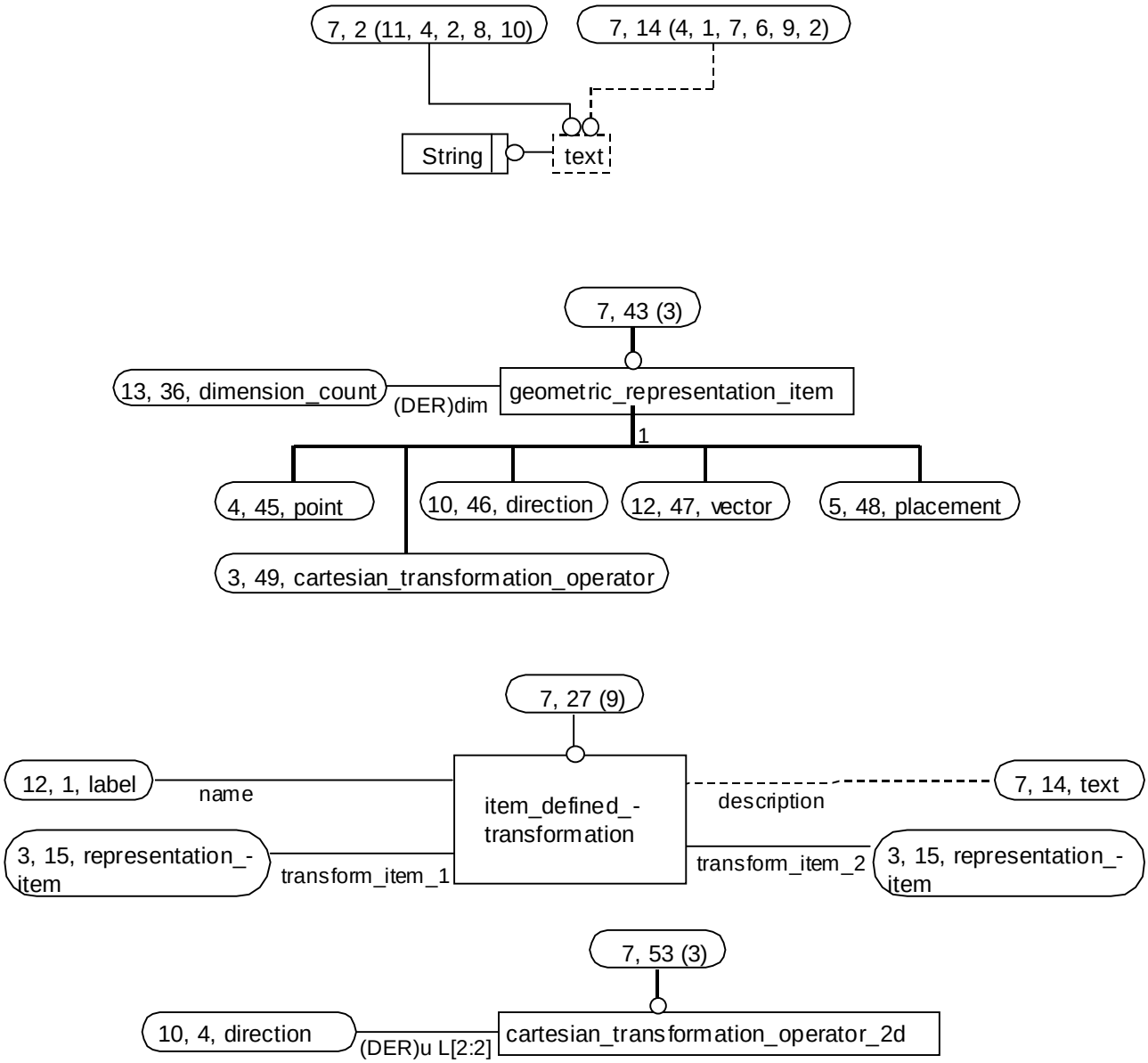

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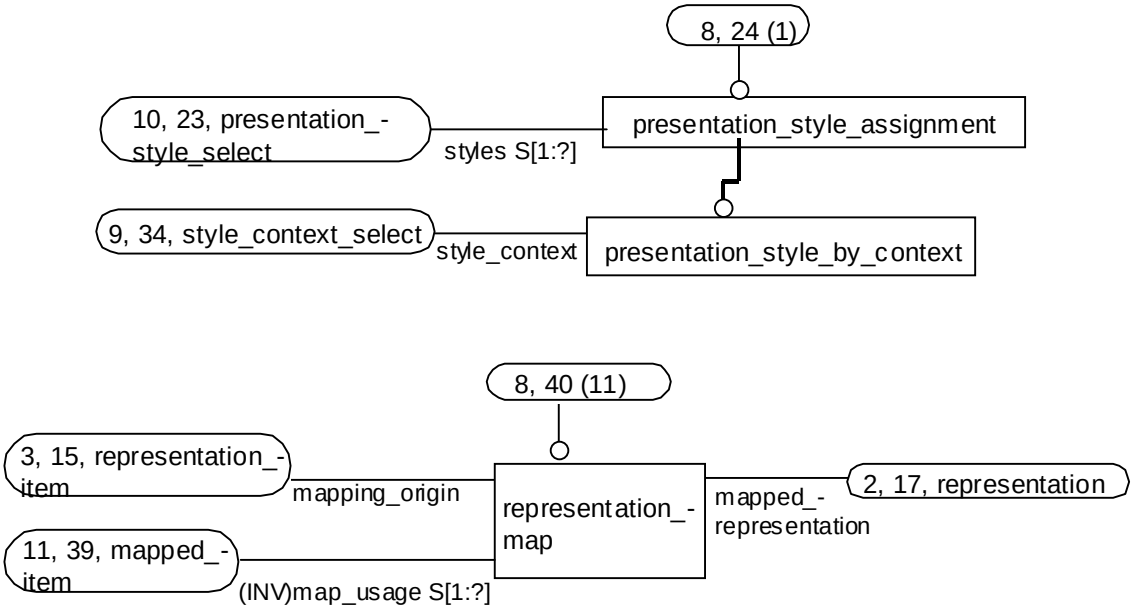

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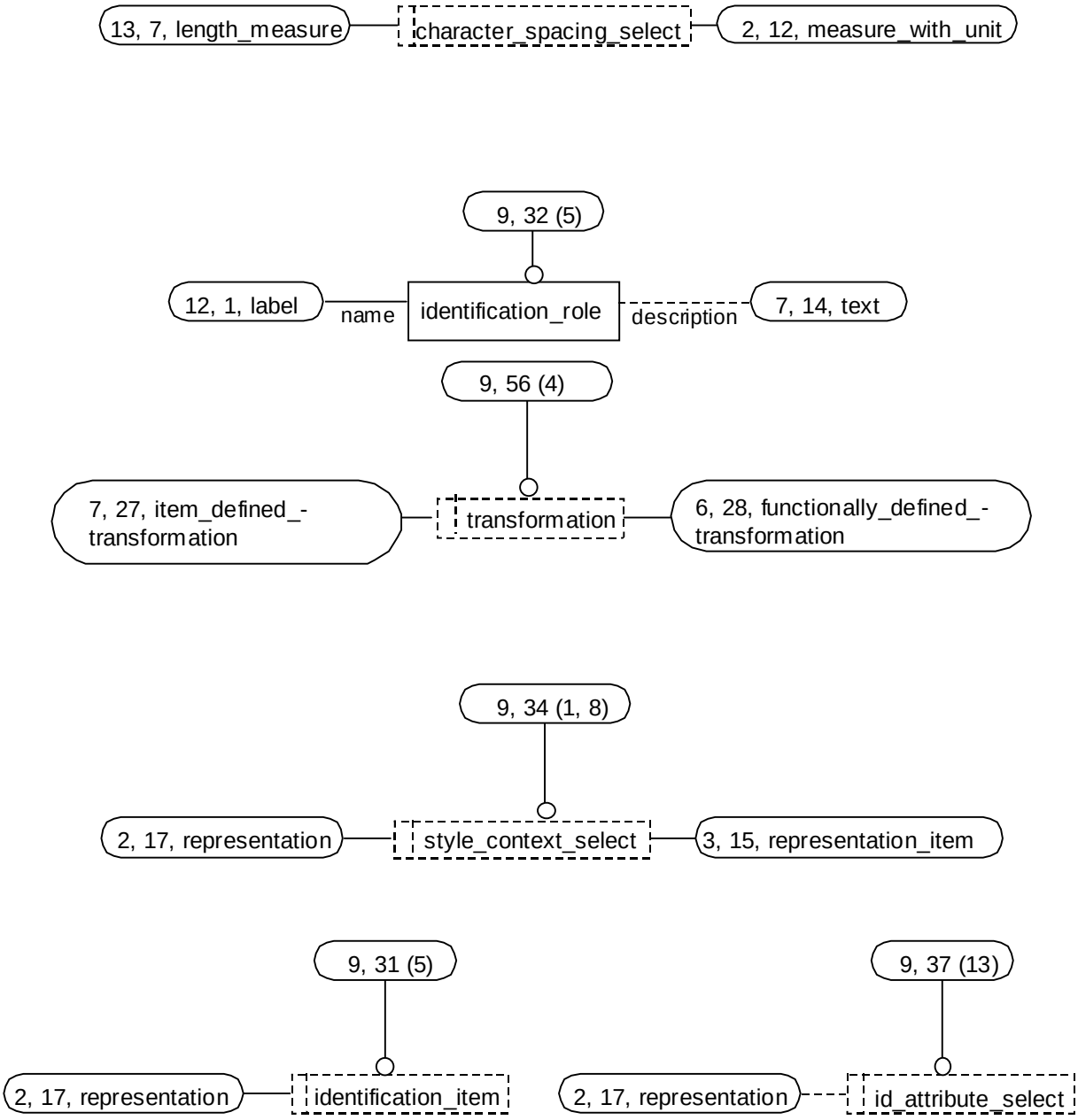

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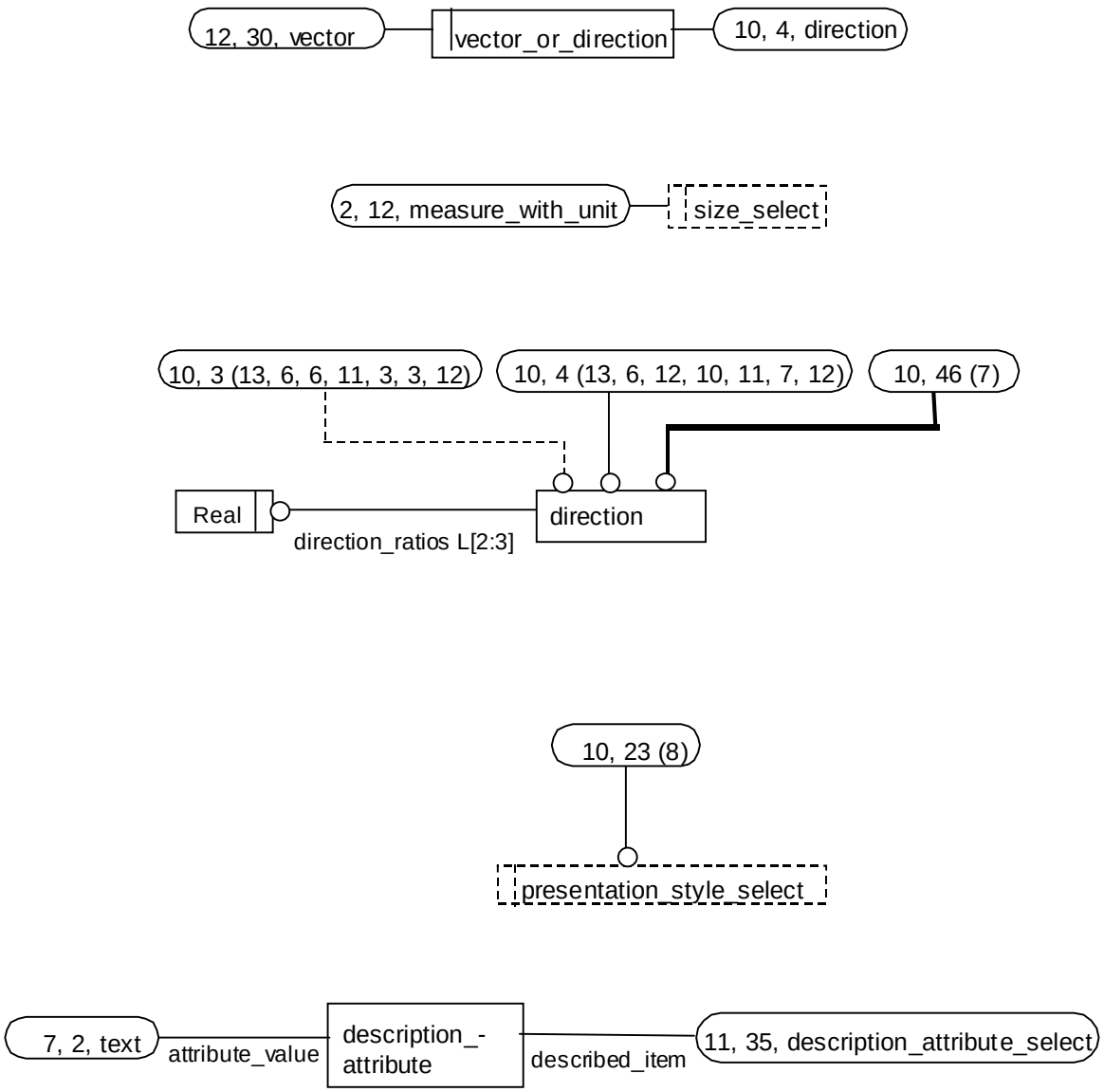

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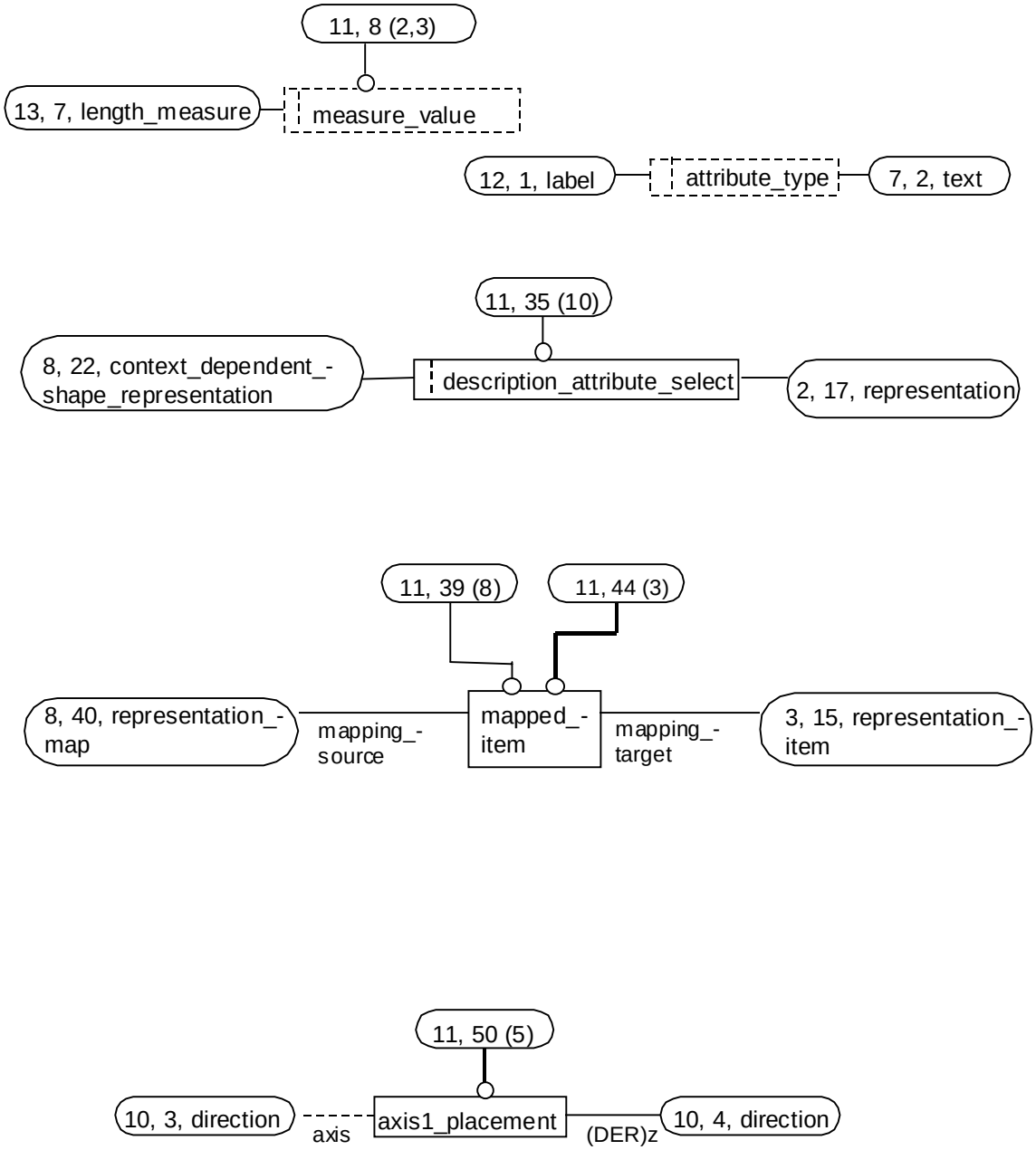

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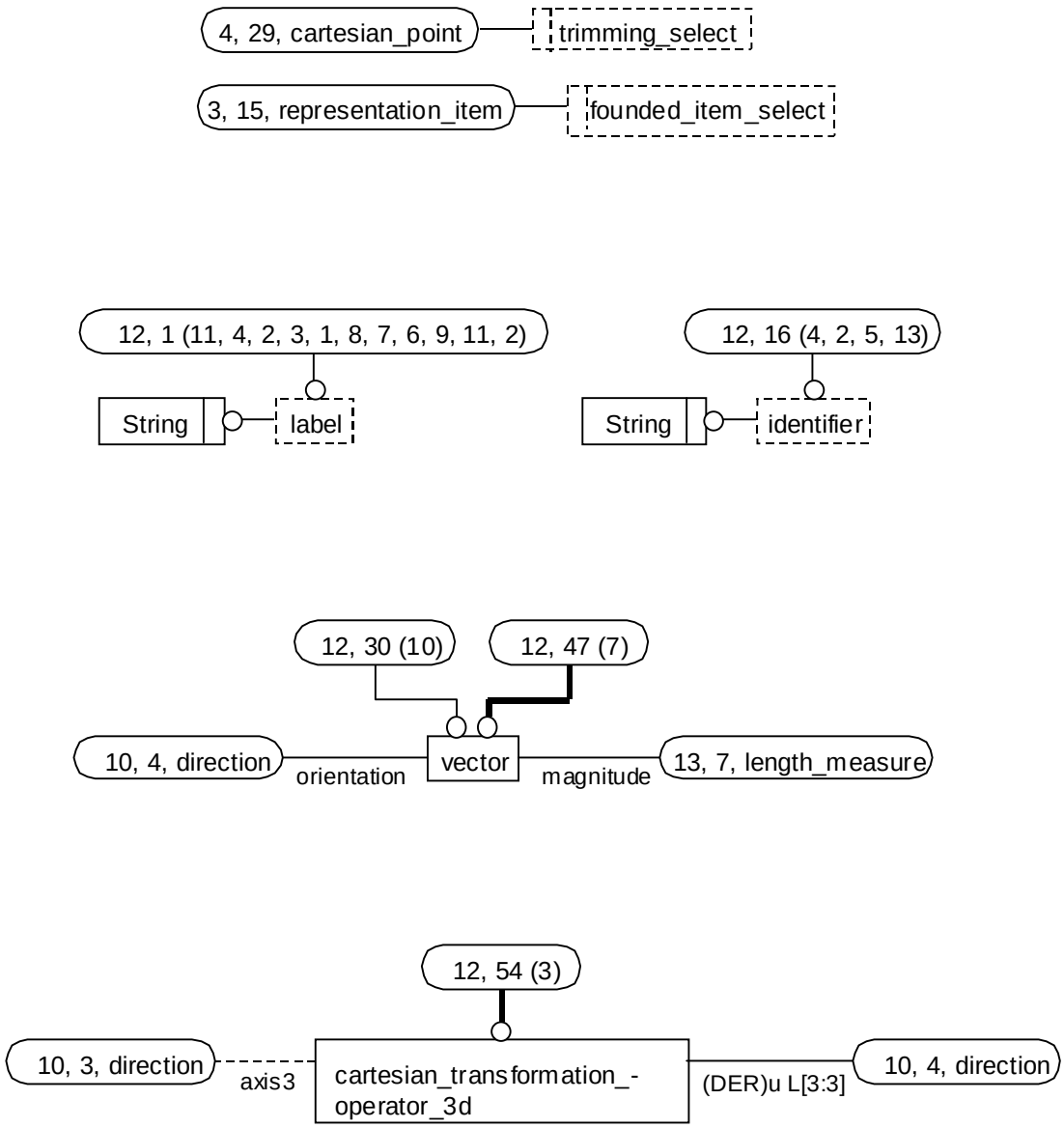

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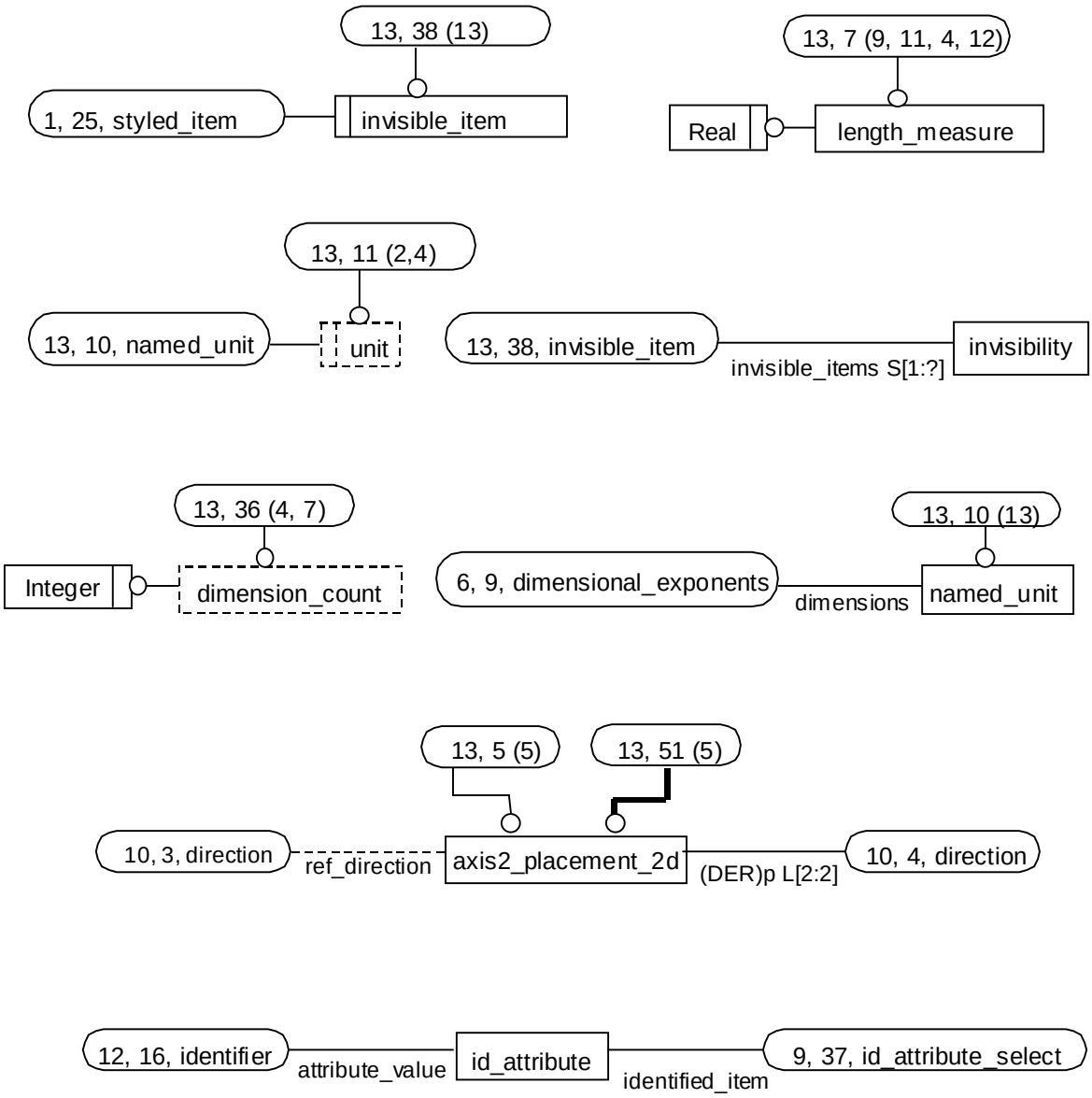

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Annex E
(informative)

AM ARM and MIM EXPRESS

This annex provides a listing of the EXPRESS for the ARM specified in clause 4 and EXPRESS schema specified in 5.2 of this part of ISO 10303 without comments or other explanatory text. The content of this annex is available in computer-interpretable form and can be found at the following URLs:

<http://www.nist.gov/sc4/nwi_pwi/nwi/step/part1001/appearance_assignment_arm.exp>

<http://www.nist.gov/sc4/nwi_pwi/nwi/step/part1001/appearance_assignment_mim.exp>

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Bibliography

[1] ISO 10303-1002:[1] *Industrial automation systems and integration — Product data representation and exchange — Application module: Colour.*

[2] ISO 10303-1003:[1] *Industrial automation systems and integration — Product data representation and exchange — Application module: Curve appearance.*

[3] ISO 10303-1004:[1] *Industrial automation systems and integration — Product data representation and exchange — Application module: Elemental shape.*

[4] ISO 10303-1005:[1] *Industrial automation systems and integration — Product data representation and exchange — Application module: Elemental topological shape.*

[5] ISO 10303-1006:[1] *Industrial automation systems and integration — Product data representation and exchange — Application module: Foundation representation.*

[6] ISO 10303-1007:[1] *Industrial automation systems and integration — Product data representation and exchange — Application module: General surface appearance.*

[7] ISO 10303-1008:[1] *Industrial automation systems and integration — Product data representation and exchange — Application module: Layer assignment.*

[8] ISO 10303-1009:[1] *Industrial automation systems and integration — Product data representation and exchange — Application module: Shape appearance and layers.*

[9] ISO TC 184/SC4 1997, *Proposed Standing Document — Guidelines for application module development, revision 0.6* <http://wg10step.aticorp.org/Deliverables/Guidelines/AMContent/Draft6/AMConGde06.html >.

[1] To be published

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