# National Institutes of Standard and Technology

## Standard Building Plumbing System Models

Gaithersburg, Maryland

## Basis of Design

Arch Final Submission
LSY No. 21042

February 04, 2022


PREPARED BY:

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## 1.0 Executive Summary

**1.1.** NIST intends to produce a set of plumbing models to establish a baseline for standardization and uniformity in the sphere of water consumption in Residential and Commercial Buildings across the country. LSY has been tasked under work Order # 1333ND21FNB730248 to produce the design and calculations for NIST to achieve this goal.

We know that Buildings are one of the highest consumers of water resources but the industry and Builders lack guidelines and practices to streamline the use of this valuable natural resource. These designs are intended for reference and use by researchers, and, various private and public stakeholders to support standardized analysis of plumbing system performance in buildings for the future. This plumbing systems design will be published in the subsequent submissions.
The design is not specific to any particular region or location, but it is for general use and understanding only. This study will help to establish a process for comparative research, peer reviews and evaluation of comparable projects, and to make educated decisions in implementing water intensive building projects. These documents however, will not be used for actual construction nor for submission to permit departments for construction approvals. The design document is based on prevalent IRC, IBC-2018 for architectural design and the Plumbing Design is based on IPC International Plumbing Code 2018 (IPC-2018).

# 2.0 Architectural Basis of Design

## 2.1. Applicable Codes, Guidelines, and Standards

| | | |
|---|---|---|
| **a.** | IRC 2018 | International Residential Code |
| **b.** | IBC 2018 | International Building Code |
| **c.** | IPC 2018 | International Plumbing Code |
| **d.** | ADA 2010 | Americans with Disabilities Act Accessibility Guidelines |
| **e.** | NFPA 101-2018 | National Fire Protection Association |

## 2.2. New Work Scope

Architectural scope of the Project consists of determining the plumbing fixtures requirements, count and locations for all building types in a Revit model generated based on the conceptual schematic sketch of the building types provided in the NIST scope (see Appendix D).
The gross floor area of each building type has been provided in the concept sketches which is the occupiable floor areas plus the exterior wall, beyond the interior space. The interior wall is part of the given gross floor area.
Plumbing fixture types, location, and counts are designed per applicable code. A detailed plumbing design and calculation will be generated for the respective model for the study. See the Plumbing section for more detailed information.

The Building Types are as follows:

### 2.2.1. Residential:

- **a.** Single Family, detached home-Floor plan DH-A(7)
  (Total Floor Area: 1,152 sq ft).
- **b.** Single Family, detached home-Floor plan DH-F(4)
  (Total Floor Area: 3,546 sq ft).
- **c.** Mid-rise Apartment (Floors:4; Units/Floor:8: Floor area/Unit:702 sq ft,
  Total Floor Area: 24,780 sq ft).

### 2.2.2. Commercial:

- **a.** Medium Office (Floors:3)
  (Total Floor Area: 53,628 sq ft).

**b.** Stand-alone Retail (Floors:1)
(Total Floor Area: 24,692 sq ft).

**c.** Primary School (Floors:1)
(Total Floor Area: 73,958 sq ft)

**d.** Full-Service Restaurant (Floors:1)
(Total Floor Area: 5,500 sq ft)

## 2.3. Description of Building Types

### 2.3.1. RESIDENTIAL BUILDING TYPE

**a. Single Family detached - Single Story: (Total Floor Area: 1,152 sq ft).**
The house is a Residential type building consisting of three Bedrooms, Living room, Kitchen and Dining room. There is one common bathroom, and washer dryer unit in a closet. A mechanical closet with a water heater and a AHU are provided for the house The Garage is shown as optional.
The kitchen is equipped with a refrigerator with ice maker, oven with exhaust, dishwasher with disposal, and a countertop kitchen cabinet with sink.
There will be two outdoor hose bibs one in front and one at the back. The bedrooms will be provided with egress complaint windows per code requirement

**b. Single Family Detached - Multi Level: (Total Floor Area: 3,546 sq ft).**
The house is a Residential type building multi-level and it consists of three Bedrooms on second floor with a common Bathroom. The Living room, Kitchen, Dining room, and Powder room are on the first floor. The house consists of a Basement with a Bedroom, Family room, Den and a Bathroom. Washer and dryer will be located in the Basement along with the mechanical room with a water heater and an AHU.
Stairs connect the three floors is required for the multi-level house type.
The kitchen is equipped with a refrigerator with ice maker, oven with exhaust, dishwasher with disposal, and a countertop kitchen cabinet with sink. There will be two outdoor hose bibs one in front and one at the back.
Bedrooms will be provided with egress complaint windows per code requirement.

**c. Mid-rise Apartment Building Type- 4 Storied – R-2 (Total Floor Area: 24,913 sq ft).**

This building type is multi-storied with four floors and consists total of 31 dwelling units, eight units per floor and seven on the first floor. One unit in the first floor is dedicated for a common laundry room and mechanical/ electrical room.

Each unit has one Bedroom, Living room, Kitchen and a Bathroom.

The Kitchen is equipped with a refrigerator with ice maker, oven with exhaust, dishwasher with disposal, and a countertop kitchen cabinet with sink.

The laundry facility shall be common for all units and is located on the first floor. The laundry room shall have three pairs of washer/ dryer units.

The mechanical room for the building will also be located on the first floor adjacent to the laundry room. One elevator, service size, and ADA compliant is located at one end of the hallway and two exit stairways have been provided for egress, as per code. The bedroom windows shall be egress complaint per code as second means of exit at every level.

**ADA Adaptable Units**

Per ADA section 233.1.1 at least 5% of the dwelling units, but no fewer than one, shall provide for mobility features complying with 809.2 thru 809.4 with accessible route per 206 sections of ADA standards 2010. Two units in the building have been designed to fulfill this ADA requirement. The units are located on the first floor. These units, though constructed similarly to the rest of the units in the building, are adaptable and have provision to be convertible to ADA complaint units, as per above mentioned sections when the need arises for accommodating handicapped individual occupying the unit.

The ADA layout of the unit has been depicted in the drawing as an option in the Mid-Rise Apartment Building Type drawings. Wood Blockings in walls to be pre-installed ready for conversion so no major demolition will be necessary. The entry closet door will have to be removed along with closet back wall for the conversion. The bathroom lavatory and tub will have to be replaced with ADA complaint shower unit with head wall.

### 2.3.2. COMMERCIAL BUILDING TYPE

**a. Medium Office (Floors:3) (Total Floor Area: 53,607 sq ft).**

This is a medium sized office building located anywhere in the country and is classified as Business Occupancy, **B**. Each floors are open for one tenant with a core in the middle. The elevators, exit stairs, rest room and break room comprise the core of the building. Shown are two floors; one typical floor plan and the other is the first floor with entry foyers and exit pathway per code. There is only one break room per floor. The plumbing requirement for this facility per IPC/IBC Table 2902.1 is 3 WC and 3 Lavatory for Occupancy load of total 120 persons

(See Code Analysis on Drawings in Appendix 1 for more details).

**b. Stand-Alone Retail (Floors:1) (Total Floor Area: 24,697 sq ft).**

The Stand-Alone Retail Store is classified as Mercantile Occupancy **M**. It is a a basic typical small size Retail store, It has a front retail and main product display area. The back of the store is the warehouse area and is designed with a restroom facility for the occupancy load per code. No specific location or jurisdiction has been identified for the store location thus a generic layout of the building is envisioned. The plumbing requirement for this facility per IPC/IBC Table 2902.1 is 2 WC and 2 Lavatory for Occupancy load of total 360 persons

(See Code Analysis on Drawings in Appendix 1 for more details).

**c. Primary School (Floors:1) (Total Floor Area: 74,143 sq ft *)**

The Primary School is an educational facility, grades K-6 , classified Education, E occupancy. The classroom blocks and the main common area block comprise the school building. The classroom blocks consist of three sections or pods each housing students from grades K-6. The kindergarten and 6 grades of students each have 4 groups or classes totaling 28 classes of children. With an average of 25 students per class, the student population at the school will be approx.700 students.

**Note*** - The final Sq footage of the school footprint is slightly larger than the value in the building description provided by NIST by 145.0 sq.ft by nature of the room sizes and exterior wall layout of the building type.

The classes are distributed as follows:

- Pod 1 houses Kindergarten classes and First Graders
- Pod 2 houses Grade 2, 3, 4
- Pod 3 houses Grade 5 and 6 with Computer Lab located here.

Plumbing in primary schools is quite intensive. Kindergarten and Grade 1 will have a bathroom facility within each classroom with child sized water closet and a lavatory. All classrooms will have a hand washing sink located on the same side as the teacher's wall.

Teachers' lounges are located, one in each pod, with a breakroom and a toilet room for the teachers' exclusive use. Each pod will also have a common restroom facility in the hallway accessible to kids from the hallway.

The main block of the building consists of the shared program areas like the Library, Cafeteria and Kitchen, Gym, Administrative Offices, Mechanical Rooms and the main entry and lobby. The cafeteria kitchen is designed with a commercial kitchen and dishwashing facility along with additional commercial sinks in the food prep area. A locker room and bathroom facility with storage area are also provided for cafeteria staff in this area of the building.

The Gymnasium is designed with a large equipment storage room along with the PE Teacher and staff room with appropriate locker room and shower facility.

The school Administration Area is located next to the main Entry / Lobby and includes the Principal's office and other school administrative office. A conference room with break room is also provided with separate restrooms for the male and female occupants of the office area.

The Mechanical Rooms are in the middle of the building and surrounded by other program spaces. Typically, the Mechanical Rooms, are located on an outside wall for ease of utility connection and access to load/unload equipment for maintenance. A maintenance office and a bathroom/ locker are designed for maintenance personnel. A central restroom is located in the main block of the building next to the library, cafeteria, gym and the main hallway. All plumbing fixtures count are per Code with the associated janitorial room, staff and supplies.

The plumbing requirement for this facility per IPC/IBC Table 2902.1 is 29 WC and 29 Lavatory and 16 Drinking fountains around the school area for

Occupancy load of total 1399 persons including a school student population of around 700
(See Code Analysis on Drawings in Appendix 1 for more details).

**d. Full-Service Restaurant (Floors:1) (Total Floor Area: 5,570 sq ft)**
This Full-Service Restaurant is Assembly Occupancy, A-2. The Full-service Kitchen is located at the back of the building with required dishwashing area and dry dishes storage. Cold storage and dry storage area are located at the back service entrance and the main food preparation area is provided with multiple handwash sinks as required for good hygiene. The connection to the main dining area is thru a wide doorless opening for convenience and two-way traffic. A line-of-sight block screen wall provides privacy.

**e.** The plumbing requirement for this facility per IPC/IBC Table 2902.1 is 4 WC and 2 Lavatory for Occupancy load of total 275 persons
(See Code Analysis on Drawings in Appendix 1 for more details).
**Note** - The final Sq footage of each building type differ slightly within reasonable range between 10.0 sq. ft. to 70.0 sq. ft. by nature of the room sizes and exterior wall layout of the building type.

# 3.0 Plumbing Basis of Design

## 3.1. Applicable Codes, Guidelines, and Standards

| | | |
|---|---|---|
| **a.** | IRC 2018 | International Residential Code |
| **b.** | IBC 2018 | International Building Code |
| **c.** | ADAAAG 2016 | Americans with Disabilities Act Accessibility Guidelines |
| **d.** | IPC 2018 | International plumbing code |
| **e.** | NFPA 101-2018 | National Fire Protection Association |

### 3.1.2. RESIDENTIAL BUILDING TYPE

**a. Single family detached - Single Story: (Total Floor Area: 1,152 sq ft).**

#### A. General Requirements

All plumbing work shall be in accordance with 2018 International Plumbing Code, International Residential Code and the requirements of the Authority Having jurisdiction.

Plumbing fixture quantities, locations and types shall be in compliance with the referenced codes and the configuration shown on the Architectural plans.

#### B. Plumbing Fixtures:

Vitreous-china and enameled cast-iron plumbing fixtures shall be white. Exposed-to-view fixture trimmings, fittings, and fasteners shall be chrome plated. Supplies and stops for lavatories shall be brass with chrome plated finish. Lavatory faucets shall be maximum 2.2 GPM . Water Closets shall be floor mounted, 1.6 GPF maximum. All plumbing fixtures will be provided water service by the city domestic water service. Rubber compression type connections shall not be acceptable. Brass ferrule type fittings shall be required. See plumbing fixture list below and cut sheets in plumbing fixture section of the appendix.

Freeze proof hose bibs shall be provided one in front of the building and one in the back. Hose bibs shall be provided with vacuum breakers and shall have shut off valves inside the building in accessible locations.

Plumbing fixture flow rates shall comply with the requirements of IPC table 604.4.

| Table P1: Plumbing Fixture Schedule | |
|---|---|
| Description | BASIS OF DESIGN (OR EQUAL) |
| Water Closet | White, Vitreous China, Floor Mounted, Elongated Bowl, flush tank, solid plastic seats, closed front with a lid. 1.6 gpf max. |
| Lavatory | White, Vitreous China, undermount type, manual lever type faucets, 4” on center, 2.2 gpm max flow rate. Coordinate Lavatory Holes with Faucet Selection. |
| Kitchen Sink | 18 Gauge Top Mount Stainless Steel Single Sink, (1) Hole, gosseneck faucet, brass construction with chrome plated finish with pull-out hose and dihwashing soap dispenser. Garbage disposer shall be 1/2HP, 120v. 2.2 gpm max. |
| Service Sink | Service Sink, One Piece Precast Terazzo w/3” Chrome Plated Brass Drain Chrome Plated Service Faucet with Vacuum Breaker, Pail Hook and ¾” Hose Thread on Spout. |
| Tub/shower | Enameled cast iron tub with tub and shower trim, diverter valve, tub filler, shower arm, fixed shower head on the wall and grab bars. Provide pressure balance valve with replaceable ceramic cartridge. Shower head shall be 2.5 gpm max. |
| Laundry wash box | Plastic with 2” drain and with ¼ turn valves for hot and cold water and water hammer arrestors. |
| Ice maker valve box | Plastic with 1/2” water connectionwith ¼ turn valve forcold waterand water hammer arrestor. |
| Dishwasher | Provide 5/8” discharge pipe and connect to the garbage disposer dishwasher fitting, with an air gap loop.provide a ½” hot water piping with a shut off valve. |

### C. Plumbing Materials:

Domestic water piping: Above ground water piping shall conform to ASTM B 88, Type L hard-drawn copper. Fittings for connection to corporation cocks shall be cast bronze, flared type, conforming to ASME B16.26. Below ground domestic water piping shall be type ‘K” copper.

Sanitary piping: Soil, waste and vent piping shall be schedule 40 PVC, solid core to conform to ASTM D 2665 with fittings made to conform to ASTM D 3311 to fit schedule 40 PVC piping.

Storm piping: Storm piping shall be schedule 40 PVC, solid core to conform to ASTM D 2665 with fittings made to conform to ASTM D 3311 to fit schedule 40 PVC piping.

Cleanouts shall be gastight and watertight, sized to provide quick and easy access for plug removal and rodding tools in their specific location. Cleanouts shall be aesthetically located with respect to tile patterns, masonry bond, and alignment.

Necessary piping-system components and miscellaneous supporting elements shall be provided, including, but not limited to, building structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; and variable and constant supports. Supporting elements shall be suitable for stresses imposed by systems pressures and temperatures, and natural and other external forces. Supporting elements shall be in accordance with FM P7825 and be UL listed and shall conform to ASME B31.1, MSS SP-58, MSS SP-69.

Domestic hot and cold water-piping insulation shall be 1” closed cell type pipe insulation and shall have a Fire-Hazard Classification of flame-spread 25, smoke-developed 50. Wall penetrations shall be sleeved with foamed, flexible insulation, continuous through the sleeve.

Kitchen sink shall be provided with a 1/2HP, 120v, plug in garbage disposer with dishwasher discharge connection. Disposer shall have sound insulation.

**D. Domestic water system**

Domestic water service shall be 1” copper type “L”. Service entry shall be provided with a main shut off valve and backflow preventer of the type required by the Authority Having Jurisdiction. Piping throughout the building will be sized per IPC code and based on acceptable plumbing practices.

In jurisdictions requiring fire sprinkler system in residential occupancies, domestic service size shall be 2” (or as required based on hydraulic calculations).

Provide a water meter of a type required inside or outside the building in a meter crock, as required by the AHJ.

Provide pressure reducing valve when the incoming water pressure exceeds 80 psi. Provide pressure gauges at the service entry and after the pressure reducing valve (pressure gauge downstream of pressure reducing valve if such a valve is required).

Hot and cold-water piping shall be provided to the lavatories, tub/shower unit, kitchen sink and the laundry wash box. Hot water shall be provided to the dishwasher. Cold water piping shall be provided to the water closets and the ice maker in the refrigerator.

All plumbing fixtures shall be provided with isolation valves for servicing or replacing the fixture.

### E. Hot Water Supply

Domestic use hot water for the residence shall be generated by a nominal 40 gallon, 4.5 kw, 240v, 1 ph electric water heater, with a minimum uniform energy factor of 0.92. 1st hour recovery shall be 55 gallons minimum. Hot water shall be set to 120°F. Provide a plastic drain pan under the water heater with a 1" sch 40 PVC drain-pipe on the side of the pan, routed to a floor drain with indirect discharge, in the event the water heater develops a leak. Pressure and temperature relief valve from the water heater shall discharge into the drain pan. Provide a 5 gallon expansion tank tapped to the cold piping of the water heater. The above sizing is based on State Water Heater sizing software.

### F. Sanitary Waste System

Sanitary waste from toilets, lavatories, tub/showers, kitchen sinks and the laundry wash boxes shall be conveyed by gravity via a 4" sanitary main to underground exterior sewage piping.

Provide a 2" (or 3" if required by the AHJ) floor drain in the laundry room.

Provide a galvanized steel drain pan under the washer in the laundry with a 1" drain pipe piped to the floor drain in the same room, via indirect discharge and an air gap.

### G. Storm Drainage System

Rainwater from roof areas will be conveyed by gutters and downspouts exterior to the building system. Final method of storm drainage shall conform to the architectural features and the type of roofing.

Roof drainage system shall be designed for a 100 year storm return frequency and a 60 minute period of duration/concentration. Emergency drainage system shall be designed for a 100 year storm return frequency and a 60 minute period of duration/concentration. Drainage shall be conveyed to the designated on-site storm water management basins.

### H. Natural Gas System (where natural gas is available)

7" w.c. uninterruptible gas service shall be provided where natural gas is available to serve the gas fired HVAC systems and gas oven. Piping shall be sized for the maximum pressure drop of 0.5" to the farthest fixture.

Piping Material:
Natural Gas piping system; Schedule 40 black steel pipes with threaded and welded joints and fittings per NFPA 54. ASTM A 53; Type E or S; Grade B; Schedule 40.

**b. Single family detached - Multi Story: (Total Floor Area: 3,546 sq ft).**

**A. General Requirements**

All plumbing work shall be in accordance with 2018 International Plumbing Code, International Residential Code and the requirements of the Authority Having jurisdiction.

Plumbing fixture quantities, locations and types shall be in compliance with the referenced codes and the configuration shown on the Architectural plans.

**B. Plumbing Fixtures:**

Vitreous-china and enameled cast-iron plumbing fixtures shall be white. Exposed-to-view fixture trimmings, fittings, and fasteners shall be chrome plated. Supplies and stops for lavatories shall be brass with chrome plated finish. Lavatoryfaucets shall be maximum 2.2 GPM . Water Closets shall be floor mounted, flush tank, 1.6 GPF maximum. Shower heads shall be 2.5 gpm max. All plumbing fixtures will be provided water service by the city domestic water service. Rubber compression type connections shall not be acceptable. Brass ferrule type fittings shall be required. See plumbing fixture list below and cut sheets in plumbing fixture section of the appendix.

Freeze proof hose bibs shall be provided one in front of the building and one in the back. Hose bibs shall be provided with vacuum breakers and shall have shut off valves inside the building in accessible locations.

Plumbing fixture flow rates shall comply with the requirements of IPC table 604.4.

| Table P1: Plumbing Fixture Schedule | |
|---|---|
| Description | BASIS OF DESIGN (OR EQUAL) |
| Water Closet | White, Vitreous China, Floor Mounted, Elongated Bowl, flush tank, solid plastic seats, closed front with a lid. 1.6 gpf max. |

| | |
|---|---|
| Lavatory | White, Vitreous China, undermount type, manual lever type faucets, 4" on center, 2.2 gpm max flow rate. Coordinate Lavatory Holes with Faucet Selection. |
| Kitchen Sink | 18 Gauge Top Mount Stainless Steel Single Sink, (1) Hole, gosseneck faucet, brass construction with chrome plated finish with pull-out hose and dihwashing soap dispenser. Garbage disposer shall be 1/2HP, 120v. 2.2 gpm max. |
| Service Sink | Service Sink, One Piece Precast Terazzo w/3" Chrome Plated Brass Drain Chrome Plated Service Faucet with Vacuum Breaker, Pail Hook and ¾" Hose Thread on Spout. |
| Tub/shower | Enameled cast iron tub with tub and shower trim, diverter valve, tub filler, shower arm, fixed shower head on the wall and grab bars. Provide pressure balance valve with replaceable ceramic cartridge. Shower head shall be 2.5 gpm max. |
| Laundry wash box | Plastic with 2" drain and with ¼ turn valves for hot and cold water and water hammer arrestors. |
| Ice maker valve box | Plastic with 1/2" water connection and with ¼ turn valve for cold water and water hammer arrestor. |
| Dishwasher | Provide 5/8" discharge pipe and connect to the garbage disposer dishwasher fitting, with an air gap loop.provide a ½" hot water piping with a shut off valve. |

### C. Plumbing Materials:

Domestic water piping: Above ground water piping shall conform to ASTM B 88, Type L hard-drawn copper. Fittings for connection to corporation cocks shall be cast bronze, flared type, conforming to ASME B16.26. Below ground domestic water piping shall be type 'K" copper.

Sanitary piping: Soil, waste and vent piping shall be schedule 40 PVC, solid core to conform to ASTM D 2665 with fittings made to conform to ASTM D 3311 to fit schedule 40 PVC piping.

Storm piping: Storm piping shall be schedule 40 PVC, solid core to conform to ASTM D 2665 with fittings made to conform to ASTM D 3311 to fit schedule 40 PVC piping.

Cleanouts shall be gastight and watertight, sized to provide quick and easy access for plug removal and rodding tools in their specific location. Cleanouts

shall be aesthetically located with respect to tile patterns, masonry bond, and alignment.

Necessary piping-system components and miscellaneous supporting elements shall be provided, including, but not limited to, building structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; and variable and constant supports. Supporting elements shall be suitable for stresses imposed by systems pressures and temperatures, and natural and other external forces. Supporting elements shall be in accordance with FM P7825 and be UL listed and shall conform to ASME B31.1, MSS SP-58, MSS SP-69.

Domestic hot and cold water-piping insulation shall be 1" closed cell insulation and shall have a Fire-Hazard Classification of flame-spread 25, smoke-developed 50. Wall penetrations shall be sleeved with foamed, flexible insulation, continuous through the sleeve.

Kitchen sink shall be provided with a 1/2HP, 120v, plug in garbage disposer with dishwasher discharge connection. Disposer shall have sound insulation.

### D. Domestic water system

Domestic water service shall be 1" copper type "L". Service entry shall be provided with a main shut off valve and backflow preventer of the type required by the Authority Having Jurisdiction. . Piping throughout the building will be sized per IPC code and based on acceptable plumbing practices.

In jurisdictions requiring fire sprinkler system in residential occupancies, domestic service size shall be 2" (or as required based on hydraulic calculations).

Provide a water meter of a type required inside or outside the building in a meter crock, as required by the AHJ.

Provide pressure reducing valve when the incoming water pressure exceeds 80 psi. Provide pressure gauges at the service entry and after the pressure reducing valve (pressure gauge downstream of pressure reducing valve if such a valve is required).

Hot and cold-water piping shall be provided to the lavatories, tub/shower unit, bathrooms, kitchen sink and the laundry wash box. Hot water shall be provided to the dishwasher. Cold water piping shall be provided to the ice maker in the refrigerator.

All plumbing fixtures shall be provided with isolation valves for servicing or replacing the fixture.

### E. Hot Water Supply

Domestic use hot water for the residence shall be generated by a nominal 50 gallon, 4.5 kw, 240v, 1 ph electric water heater, with a minimum uniform energy factor of 0.92. Hot water shall be set to 120°F. 1st hour recovery shall be 62 gallons minimum. Provide a plastic drain pan under the water heater with a 1" sch 40 PVC drain-pipe on the side of the pan, routed to a floor drain with indirect discharge, in the event the water heater develops a leak. Pressure and temperature relief valve from the water heater shall discharge into the drain pan. Provide a 5 gallon expansion tank tapped to the cold piping of the water heater. The above sizing is based on State Water Heater sizing software.

### F. Sanitary Waste System

Sanitary waste from toilets, lavatories, tub/showers, kitchen sinks and the laundry wash boxes shall be conveyed by gravity via a 4" sanitary main to underground exterior sewage piping.

Provide a 2" (or 3" if required by the AHJ) floor drain in the laundry room.

Provide a galvanized steel drain pan under the washer in the laundry with a 1" drain pipe piped to the floor drain in the same room, via indirect discharge and an air gap.

### G. Storm Drainage System

Rainwater from roof areas will be conveyed by gutters and downspouts exterior to the building system.

Roof drainage system shall be designed for a 100 year storm return frequency and a 60 minute period of duration/concentration. Emergency drainage system shall be designed for a 100 year storm return frequency and a 60 minute period of duration/concentration. Drainage shall be conveyed to the designated on-site storm water management basins.

### H. Natural Gas System (where natural gas is available)

7" w.c. uninterruptible gas service shall be provided where natural gas is available to serve the gas fired HVAC systems and gas oven. Piping shall be sized for the maximum pressure drop of 0.5" to the farthest fixture.

Piping Material:

Natural Gas piping system; Schedule 40 black steel pipes with threaded and welded joints and fittings per NFPA 54. ASTM A 53; Type E or S; Grade B; Schedule 40.

**c. Multi-family Midrise Apartment Building Type 4 storied – R-2**
(Floors:4; Units/Floor:8: Floor area/Unit:702 sq ft,
Total Floor Area: 24,780 sq ft).

## A. General Requirements

All plumbing work shall be in accordance with 2018 International Plumbing Code, International Building Code and the requirements of the Authority Having jurisdiction.

Plumbing fixture quantities, locations and types shall be in compliance with the referenced codes and the configuration shown on the Architectural plans.

## B. Plumbing Fixtures:

Vitreous-china and enameled cast-iron plumbing fixtures shall be white. Exposed-to-view fixture trimmings, fittings, and fasteners shall be chrome plated. Supplies and stops for lavatories shall be brass with chrome plated finish. Lavatory faucets shall be maximum 2.2 GPM . Water Closets shall be floor mounted, flush tank, 1.6 GPF maximum. All plumbing fixtures will be provided water service by the city domestic water service. Rubber compression type connections shall not be acceptable. Brass ferrule type fittings shall be required. See plumbing fixture list below and cut sheets in plumbing fixture section of the appendix.

Freeze proof wall hydrants in lockable cast iron valve boxes one on each of the 4 sides of the building. Wall hydrants shall be provided with vacuum breakers and shall have shut off valves inside the building in accessible locations.

Provide an elevator sump pump, rated for 50 gpm and 20’ of head. Discharge indirectly to storm or sanitary sewer as required by the AHJ.

Plumbing fixture flow rates shall comply with the requirements of IPC table 604.4.

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**Table P1: Plumbing Fixture Schedule**

| Description | BASIS OF DESIGN (OR EQUAL) |
|---|---|
| Water Closet | White, Vitreous China, Floor Mounted, Elongated Bowl, flush tank, solid plastic seats, closed front with a lid. 1.6 gpf max. |
| Lavatory | White, Vitreous China, undermount type, manual lever type faucets, 4” on center, 1.5 gpm max flow rate. Coordinate Lavatory Holes with Faucet Selection. 2.2 gpm max. |

| | |
|---|---|
| Kitchen Sink | 18 Gauge Top Mount Stainless Steel Single Sink, (1) Hole, gosseneck faucet, brass construction with chrome plated finish with pull-out hose and dihwashing soap dispenser. Garbage disposer shall be 1/2HP, 120v. 2.2 gpm max. |
| Service Sink | Service Sink, One Piece Precast Terazzo w/3" Chrome Plated Brass Drain Chrome Plated Service Faucet with Vacuum Breaker, Pail Hook and ¾" Hose Thread on Spout. |
| Tub/shower | Enameled cast iron tub with tub and shower trim, diverter valve, tub filler, shower arm, fixed shower head on the wall and grab bars. Provide pressure balance valve with replaceable ceramic cartridge and high temperature limit control. Shower head shall be 2.5 gpm max. |
| Laundry wash box | Plastic with 2" drain and with ¼ turn valves for hot and cold water and water hammer arrestors. |
| Ice maker valve box | Plastic with 1/2" water connection and with ¼ turn valve for cold water and water hammer arrestor. |
| Dishwasher | Provide 5/8" discharge pipe and connect to the garbage disposer dishwasher fitting, with an air gap loop.provide a ½" hot water piping with a shut off valve. |

**C. Plumbing Materials:**

Domestic water piping: Above ground water piping shall conform to ASTM B 88, Type L hard-drawn copper. Fittings for connection to corporation cocks shall be cast bronze, flared type, conforming to ASME B16.26. Below ground domestic water piping shall be type 'K" copper.

Sanitary piping: Soil, waste and vent piping shall be schedule 40 PVC, solid core to conform to ASTM D 2665 with fittings made to conform to ASTM D 3311 to fit schedule 40 PVC piping.

Storm piping: Storm piping shall be schedule 40 PVC, solid core to conform to ASTM D 2665 with fittings made to conform to ASTM D 3311 to fit schedule 40 PVC piping.

Cleanouts shall be gastight and watertight, sized to provide quick and easy access for plug removal and rodding tools in their specific location. Cleanouts

shall be aesthetically located with respect to tile patterns, masonry bond, and alignment.

Necessary piping-system components and miscellaneous supporting elements shall be provided, including, but not limited to, building structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; and variable and constant supports. Supporting elements shall be suitable for stresses imposed by systems pressures and temperatures, and natural and other external forces. Supporting elements shall be in accordance with FM P7825 and be UL listed and shall conform to ASME B31.1, MSS SP-58, MSS SP-69.

Domestic hot and cold water-piping insulation shall be 1” fiberglass with factory-applied jacket conforming to ASTM C 547. Composite UL-listed jacket and insulation shall have a Fire-Hazard Classification of flame-spread 25, smoke-developed 50. Wall penetrations shall be sleeved with foamed, flexible insulation, continuous through the sleeve.

Kitchen sink shall be provided with a 1/2HP, 120v, plug in garbage disposer with dishwasher discharge connection. Disposer shall have sound insulation.

**D. Domestic water system**

Domestic water service shall be 2” copper type “L”. Service entry shall be provided with a main shut off valve and backflow preventer (BFP) of the type required by the Authority Having Jurisdiction (DCVA type BFP ASSE-1015 or RPZ type BFP ASSE-1013). Estimated domestic water demand load is 65 gpm, based on 183 Supply Fixture Units. Piping throughout the building will be sized per IPC code and based on acceptable plumbing practices.

Maximum velocity in the cold water piping shall be 8 FPS and maximum velocity in the hot water system shall be 5 FPS.

Provide a water meter of a type required inside or outside the building in a meter crock, as required by the AHJ.

Provide pressure reducing valve when the incoming water pressure exceeds 80 psi. Provide pressure gauges at the service entry and after the pressure reducing valve (pressure gauge downstream of pressure reducing valve if such a valve is required).

Hot and cold-water piping shall be provided to the lavatories, tub/shower units, bathrooms, kitchen sink and the laundry wash boxes in the common laundry room. Hot water shall be provided to the dishwasher. Cold water piping shall be provided to the ice maker in the refrigerator.

All plumbing fixtures shall be provided with isolation valves for servicing or replacing the fixture.

Ensure a minimum water pressure of 40 psi on the 4th floor, for proper operation of the showers. If the incoming water pressure on the first floor is less than 75 psi, provide a duplex domestic booster pump, sized for 50 gpm per pump (100 gpm total) and adequate boost pressure to provide the 40 psi pressure on the 4th floor. Domestic booster pump shall be 208v, 3 ph

### E. Hot Water Supply

Domestic use hot water for the bathrooms, kitchen sinks, dishwashers and the common laundry shall be generated by two high efficiency, condensing type natural gas water heaters, each 100 gallon, 199 MBH, with a minimum thermal efficiency of 95% Hot water shall be set to 140°F. Provie a master thermostatic mixing valve, high/low type with discharge temperature set to 120°F.

Provide a single 35 gallon expansion tank (such as ST-35-CL or equal). Connect to the cold water pipe serving the water heaters with a check valve in the cold water pipe.

### F. Sanitary Waste System

Sanitary waste from toilets, lavatories, tub/showers, kitchen sinks and the laundry wash boxes shall be conveyed by gravity via a 6” sanitary main to underground exterior sewage piping. Estimated demand load is 229 Drainage Fixture Units (DFU).

Provide a 4” floor drain with trap primer in the common laundry room.

### G. Storm Drainage System

Rainwater from roof areas will be conveyed interior roof drains and rain leaders or by gutters and downspouts exterior to the building system. . Final method of storm drainage shall conform to the architectural features and the type of roofing.

Roof drainage system shall be designed for a 100 year storm return frequency and a 60 minute period of duration/concentration. Emergency drainage system shall be designed for a 100 year storm return frequency and a 60 minute period of duration/concentration. Drainage shall be conveyed to the designated on-site storm water management basins.

If interior drainage is utilized, storm lateral shall be minimum of 8” sized for 6,250 sq ft.

### H. Natural Gas System (where natural gas is available)

7” w.c. or 2.0 psi uninterruptible gas service shall be provided to serve the gas fired HVAC systems and the gas fired water heaters. Piping shall be sized for the maximum pressure drop of 0.5” to the farthest fixture. Piping shall be sized

for the maximum pressure drop of 0.5” to the farthest fixture for 7” w.c system and for 1.0 psi pressure drop for 2.0 psi system.

Piping Material:
Natural Gas piping system; Schedule 40 black steel pipes with threaded and welded joints and fittings per NFPA 54. ASTM A 53; Type E or S; Grade B; Schedule 40.

### 3.1.3. COMMERCIAL BUILDING TYPE

#### a. Medium Office (Floors:3) (Total Floor Area: 53,628 sq ft).

**A. General Requirements**

All plumbing work shall be in accordance with 2018 International Plumbing Code, International Building Code and the requirements of the Authority Having jurisdiction.

Plumbing fixture quantities, locations and types shall be in compliance with the referenced codes and the configuration shown on the Architectural plans. All plumbing fixtures shall be type.

**B. Plumbing Fixtures:**

Vitreous-china and enameled cast-iron plumbing fixtures shall be white. Exposed-to-view fixture trimmings, fittings, and fasteners shall be chrome plated. Supplies and stops for lavatories shall be brass with chrome plated finish. Lavatories shall have auto sensor type faucets, battery operated. Water Closets shall be wall mounted, flush valve, (1.60 GPF maximum), with auto flush sensors, battery operated and heavy-duty, cast-iron wall supports. All plumbing fixtures will be provided water service by the city domestic water service. Rubber compression type connections shall not be acceptable. Brass ferrule type fittings shall be required. See plumbing fixture list below and cut sheets in plumbing fixture section of the appendix.

Freeze proof wall hydrants in lockable cast iron valve boxes one on each of the 4 sides of the building. Wall hydrants shall be provided with vacuum breakers and shall have shut off valves inside the building in accessible locations.

Provide an elevator sump pump, rated for 100 gpm and 20’ of head. Discharge indirectly to storm or sanitary sewer as required by the AHJ.

Plumbing fixture flow rates shall comply with the requirements of IPC table 604.4.

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| Table P1: Plumbing Fixture Schedule | |
|---|---|
| Description | BASIS OF DESIGN (OR EQUAL) |
| Water Closet | ADA and non-ADA, White, Vitreous China, Wall- Mounted, Elongated Bowl, flush valves, auto flush sensors, battery operated with solid plastic seats, open front without a lid. Max. 1.6 gpf |
| Urinal | ADA and non-ADA, White, Vitreous China, Wall- Mounted, flush valves, auto flush sensors, battery operated. Max. 1.0 gpf |
| Lavatory | White, Vitreous China, undermount type, auto sensor, battery operated faucets, center, single hole, 0.25 gallon maximum metering per cycle. |
| Kitchen Sink | 18 Gauge Top Mount Stainless Steel Single Sink, (1) Hole, gosseneck faucet, brass construction with chrome plated finish with pull-out hose and dishwashing soap dispenser. Garbage disposer shall be 1/2HP, 120v. 2.2 gpm max. |
| Service Sink | Service Sink, One Piece Precast Terazzo w/3” Chrome Plated Brass Drain Chrome Plated Service Faucet with Vacuum Breaker, Pail Hook and ¾” Hose Thread on Spout. |
| Electric water cooler | ADA, bi-level, stainless steel |
| Ice maker valve box | Plastic with 1/2” water connection and with ¼ turn valve for cold water and water hammer arrestor. |

### C. Plumbing Materials:

Domestic water piping: Above ground water piping shall conform to ASTM B 88, Type L hard-drawn copper. Fittings for connection to corporation cocks shall be cast bronze, flared type, conforming to ASME B16.26. Below ground domestic water piping shall be type ‘K” copper.

Sanitary piping: above-ground Soil, waste and vent piping shall be hubless Cast Iron Pipe, No Hub type shall conform to ASTM A 74 underground piping shall be hub and spigot cast iron, service class piping.

Storm piping: Storm piping shall be hubless Cast Iron Pipe, No Hub type shall conform to ASTM A 74 underground piping shall be hub and spigot cast iron, service class piping. All roof drains and horizontal storm drainage piping shall be insulated with 1" fiberglass pipe insulation with all service jacket.

Cleanouts shall be gastight and watertight, sized to provide quick and easy access for plug removal and rodding tools in their specific location. Cleanouts shall be aesthetically located with respect to tile patterns, masonry bond, and alignment.

Necessary piping-system components and miscellaneous supporting elements shall be provided, including, but not limited to, building structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; and variable and constant supports. Supporting elements shall be suitable for stresses imposed by systems pressures and temperatures, and natural and other external forces. Supporting elements shall be in accordance with FM P7825 and be UL listed and shall conform to ASME B31.1, MSS SP-58, MSS SP-69.

Domestic hot and cold water-piping insulation shall be 1" fiberglass with factory-applied jacket conforming to ASTM C 547. Composite UL-listed jacket and insulation shall have a Fire-Hazard Classification of flame-spread 25, smoke-developed 50. Wall penetrations shall be sleeved with foamed, flexible insulation, continuous through the sleeve.

Kitchen sink shall be provided with a 1/2HP, 120v, plug in garbage disposer with dishwasher discharge connection. Disposer shall have sound insulation.

**D. Domestic water system**

Domestic water service shall be 3" copper type "L". Service entry shall be provided with a main shut off valve and backflow preventer (BFP) of the type required by the Authority Having Jurisdiction (DCVA type BFP ASSE-1015 or RPZ type BFP ASSE-1013). Estimated domestic water demand load is 90 gpm, based on 204 Supply Fixture Units. Piping throughout the building will be sized per IPC code and based on acceptable plumbing practices.

Maximum velocity in the cold water piping shall be 8 FPS and maximum velocity in the hot water system shall be 5 FPS.

Provide a water meter of a type required inside or outside the building in a meter crock, as required by the AHJ.

Provide pressure reducing valve when the incoming water pressure exceeds 80 psi. Provide pressure gauges at the service entry and after the pressure reducing valve (pressure gauge downstream of pressure reducing valve if such a valve is required).

Hot and cold-water piping shall be provided to the lavatories and break room sinks. Cold water piping shall be provided to the flush valve water closets, urinals and ice maker in the refrigerator.

All plumbing fixtures shall be provided with isolation valves for servicing or replacing the fixture.

Ensure a minimum water pressure of 40 psi on the 3rd floor, for proper operation of the flush valve water closets. If the incoming water pressure on the first floor is less than 70 psi, provide a duplex domestic booster pump, sized for 65 gpm per pump (130 gpm total) and adequate boost pressure to provide the 40 psi pressure on the 3rd floor. Domestic booster pump shall be 208v, 3 ph (or 460v, 3 ph, based on the electric service available).

### E. Hot Water Supply

Domestic use hot water for the bathrooms, mop sinks and the break room sinks shall be generated by a 100 gallon, 36 kw, 208v, 3 ph l electric water heater, with a minimum uniform energy factor of 0.92. Hot water shall be set to 140°F.

Provide a single 35 gallon expansion tank tapped to the cold piping of the water heater with a check valve in the cold water pipe.

If natural gas is available, provide a gas fired water heater, 100 gallons and 150,000 MBH, high efficiency (95%+) sealed combustion water heater. Set hot water to 140°F. Provide a 35 gallon expansion tank (such as ST-35-CL or equal). Provide a thermostatic mixing valve with discharge temperature set to 120°F. Provide a hot water recirculating pump, sized for 10 gpm and 30 ft head for temperature maintenance of the hot water system.

### F. Sanitary Waste System

Sanitary waste from toilets, urinals, lavatories, kitchen sinks, electric water coolers, and the floor drains shall be conveyed by gravity via a 6” sanitary main to underground exterior sewage piping. Estimated demand load is 75 Drainage Fixture Units (DFU). 6” Sanitary sewer will allow adequate capacity for any future expansion and addition of fixtures, even though a 4” sanitary sewer would be adequate for the current load.

Provide 4” floor drains with trap primers in the mechanical room as well as in each bathroom.

### G. Storm Drainage System

Rainwater from roof areas will be conveyed interior roof drains and rain leaders.

Roof drainage system shall be designed for a 100 year storm return frequency and a 60 minute period of duration/concentration. Emergency drainage system

shall be designed for a 100 year storm return frequency and a 60 minute period of duration/concentration. Drainage shall be conveyed to the designated on-site storm water management basins.

Storm lateral shall be minimum of 10” sized for 18,000 sq ft.

**H. Natural Gas System (wh natural gas is available)**

7” w.c. or 2.0 psi uninterruptible gas service shall be provided where natural gas is available to serve the gas fired HVAC systems and the water heaters. Piping shall be sized for the maximum pressure drop of 0.5” to the farthest fixture for 7” w.c system and for 1.0 psi pressure drop for 2.0 psi system.

Piping Material: Natural Gas piping system; Schedule 40 black steel pipes with threaded and welded joints and fittings per NFPA 54. ASTM A 53; Type E or S; Grade B; Schedule 40.

**b. Stand-alone Retail (Floors:1) (Total Floor Area: 24,692 sq ft).**

**A. General Requirements**

All plumbing work shall be in accordance with 2018 International Plumbing Code, International Building Code and the requirements of the Authority Having jurisdiction.

Plumbing fixture quantities, locations and types shall be in compliance with the referenced codes and the configuration shown on the Architectural plans. All plumbing fixtures shall be type..

**B. Plumbing Fixtures:**

Vitreous-china and enameled cast-iron plumbing fixtures shall be white. Exposed-to-view fixture trimmings, fittings, and fasteners shall be chrome plated. Supplies and stops for lavatories shall be brass with chrome plated finish. Lavatories shall have auto sensor faucets, battery operated maximum 0.25 gallons per metering cycle. Water Closets shall be wall mounted, flush valve (1.6 GPF maximum), with auto flush sensors, battery- operated and heavy-duty, cast-iron wall supports. All plumbing fixtures will be provided water service by the city domestic water service. Rubber compression type connections shall not be acceptable. Brass ferrule type fittings shall be required. See plumbing fixture list below and cut sheets in plumbing fixture section of the appendix.

Freeze proof wall hydrants in lockable cast iron valve boxes one on each of the 4 sides of the building. Wall hydrants shall be provided with vacuum breakers and shall have shut off valves inside the building in accessible locations.

Plumbing fixture flow rates shall comply with the requirements of IPC table 604.4.

| Table P1: Plumbing Fixture Schedule | |
|---|---|
| Description | BASIS OF DESIGN (OR EQUAL) |
| Water Closet | ADA and non-ADA, White, Vitreous China, Floor- Mounted, Elongated Bowl, flush tanks with solid plastic seats, open front without a lid. Max. 1.6 gpf |
| Urinal | ADA and non-ADA, White, Vitreous China, Wall- Mounted, flush valves, auto flush sensors, battery operated. Max. 1.0 gpf |
| Lavatory | White, Vitreous China, undermount type, auto sensor, battery operated faucets, center, single hole, 0.25 gallon maximum per metering<br>cycle. |
| Service Sink | Service Sink, One Piece Precast Terazzo w/3" Chrome Plated Brass Drain Chrome Plated Service Faucet with Vacuum Breaker, Pail Hook and ¾" Hose Thread on Spout. |
| Electric water cooler | ADA, bi-level, stainless steel |

### C. Plumbing Materials:

Domestic water piping: Above ground water piping shall conform to ASTM B 88, Type L hard-drawn copper. Fittings for connection to corporation cocks shall be cast bronze, flared type, conforming to ASME B16.26. Below ground domestic water piping shall be type 'K" copper.

Sanitary piping: above-ground Soil, waste and vent piping shall be hub less Cast Iron Pipe, No Hub type shall conform to ASTM A 74 underground piping shall be hub and spigot cast iron, service class piping.

Storm piping: Storm piping shall be hub less Cast Iron Pipe, No Hub type shall conform to ASTM A 74 underground piping shall be hub and spigot cast iron, service class piping. All roof drains and horizontal storm drainage piping shall be insulated with 1" fiberglass pipe insulation with all service jacket.

Cleanouts shall be gastight and watertight, sized to provide quick and easy access for plug removal and rodding tools in their specific location. Cleanouts shall be aesthetically located with respect to tile patterns, masonry bond, and alignment.

Necessary piping-system components and miscellaneous supporting elements shall be provided, including, but not limited to, building structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; and variable and constant supports. Supporting elements shall be suitable for stresses imposed by systems pressures and temperatures, and natural and other external forces. Supporting elements shall be in accordance with FM P7825 and be UL listed and shall conform to ASME B31.1, MSS SP-58, MSS SP-69.

Domestic hot and cold water-piping insulation shall be 1" fiberglass with factory-applied jacket conforming to ASTM C 547. Composite UL-listed jacket and insulation shall have a Fire-Hazard Classification of flame-spread 25, smoke-developed 50. Wall penetrations shall be sleeved with foamed, flexible insulation, continuous through the sleeve.

**D. Domestic water system**

Domestic water service shall be 2" copper type "L". Service entry shall be provided with a main shut off valve and backflow preventer (BFP) of the type required by the Authority Having Jurisdiction (DCVA type BFP ASSE-1015 or RPZ type BFP ASSE-1013). Estimated domestic water demand load is 75 gpm. Piping throughout the building will be sized per IPC code and based on acceptable plumbing practices.

Maximum velocity in the cold-water piping shall be 8 FPS and maximum velocity in the hot water system shall be 5 FPS.

Provide a water meter of a type required inside or outside the building in a meter crock, as required by the AHJ.

Provide pressure reducing valve when the incoming water pressure exceeds 80 psi. Provide pressure gauges at the service entry and after the pressure reducing valve (pressure gauge downstream of pressure reducing valve if such a valve is required).

Hot and cold-water piping shall be provided to the lavatories, and break room sinks. Cold water piping shall be provided to the flush vavle water closets. Also six 1-1/2" taps, valved and capped shall be provided in the ceiling of the retail space for connection to future retail store fixtures.

All plumbing fixtures shall be provided with isolation valves for servicing or replacing the fixture.

**E. Hot Water Supply**

Domestic use hot water for the bathrooms, mop sinks and the break room sinks shall be generated by individually placed water heater in each future retail space. Water heaters shall be sized based on the demand of each retail space.

A 30 gallon, 4.5 kw electric water heater shall be provided for the public bathrooms and the mop sink. Set the hot water at the water heater to 120°F.

### F. Sanitary Waste System

Sanitary waste from toilets, urinals, lavatories, kitchen sinks, electric water coolers, and the floor drains shall be conveyed by gravity via a 4" sanitary main to underground exterior sewage piping.

Provide a 4" floor drains with trap primers in the mechanical room as well as in each bathroom.

Several cleanouts shall be provided for future connection of plumbing fixtures from the future retail stores.

Provide four 4" VTRs for future retail spaces

### G. Storm Drainage System

Rainwater from roof areas will be conveyed interior roof drains and rain leaders.

Roof drainage system shall be designed for a 100 year storm return frequency and a 60 minute period of duration/concentration. Emergency drainage system shall be designed for a 100 year storm return frequency and a 60 minute period of duration/concentration. Drainage shall be conveyed to the designated on-site storm water management basins.

Storm lateral shall be minimum of 12" sized for 25,000 sq ft.

### H. Natural Gas System (where natural gas is available)

7" w.c. or 2.0 psi uninterruptible gas service shall be provided where natural gas is available to serve the gas fired HVAC systems. Piping shall be sized for the maximum pressure drop of 0.5" to the farthest fixture for 7" w.c system and for 1.0 psi pressure drop for 2.0 psi system.

Piping Material:

Natural Gas piping system; Schedule 40 black steel pipes with threaded and welded joints and fittings per NFPA 54. ASTM A 53; Type E or S; Grade B; Schedule 40.

### c. Primary School (Floors:1) (Total Floor Area: 73,958 sq ft)

#### A. General Requirements

All plumbing work shall be in accordance with 2018 International Plumbing Code, International Building Code and the requirements of the Authority Having jurisdiction.

Plumbing fixture quantities, locations and types shall be in compliance with the referenced codes and the configuration shown on the Architectural plans. All plumbing fixtures shall be type.

#### B. Plumbing Fixtures:

Vitreous-china and enameled cast-iron plumbing fixtures shall be white. Exposed-to-view fixture trimmings, fittings, and fasteners shall be chrome plated. Supplies and stops for lavatories shall be brass with chrome plated finish. Lavatories shall have auto sensor faucets, battery-operated maximum 0.25 gallons per metering cycle. Water Closets shall be wall mounted, flush valve (1.6 GPF maximum), with auto flush sensors, battery-operated and heavy-duty, cast-iron wall supports. All plumbing fixtures will be provided water service by the city domestic water service. Rubber compression type connections shall not be acceptable. Brass ferrule type fittings shall be required. See plumbing fixture list below and cut sheets in plumbing fixture section of the appendix.

Freeze proof wall hydrants in lockable cast iron valve boxes one on each side of the building. Wall hydrants shall be provided with vacuum breakers and shall have shut off valves inside the building in accessible locations.

Plumbing fixture flow rates shall comply with the requirements of IPC table 604.4.

**Table P1: Plumbing Fixture Schedule**

| Description | BASIS OF DESIGN (OR EQUAL) |
|---|---|
| Water Closet | ADA and non-ADA, White, Vitreous China, Wall- Mounted, Elongated Bowl, flush valves, auto flush sensors, battery operated with solid plastic seats, open front without a lid. Max. 1.6 gpf. Kid's height water closets and lavs shall be provided in the Kindergarten and 1-st grade wing |
| Urinal | ADA and non-ADA, White, Vitreous China, Wall- Mounted, flush valves, auto flush sensors, battery operated. Max. 1.0 gpf |
| Lavatory | White, Vitreous China, undermount type in the group bathrooms and wall mounted in the individual bathrooms, auto sensor, battery |

| | |
|---|---|
| | operated faucets, center, single hole, 0.25 gallons max per metering cycleflow rate. Thermostatic mixing valves shall be provided at each lav with discharge set to 105 F. |
| Sink | Classroom sinks shall be 18 Gauge Top Mount Stainless Steel Single Sink, (1) Hole, gosseneck faucet, brass construction with chrome plated finish. Thermostatic mixing valves shall be provided at each sink with discharge set to 105 F. 2.2 gpm max. |
| Service Sink | Service Sink, One Piece Precast Terazzo w/3" Chrome Plated Brass Drain Chrome Plated Service Faucet with Vacuum Breaker, Pail Hook and ¾" Hose Thread on Spout. |
| Electric water cooler | ADA, bi-level, stainless steel |
| Ice maker valve box | Plastic with 1/2" water connection with ¼ turn valve for cold water and water hammer arrestor. |

**C. Plumbing Materials:**

Domestic water piping: Above ground water piping shall conform to ASTM B 88, Type L hard-drawn copper. Fittings for connection to corporation cocks shall be cast bronze, flared type, conforming to ASME B16.26. Below ground domestic water piping shall be type 'K" copper.

Sanitary piping: above-ground Soil, waste and vent piping shall be hubless Cast Iron Pipe, No Hub type shall conform to ASTM A 74 underground piping shall be hub and spigot cast iron, service class piping.

Storm piping: Storm piping shall be hubless Cast Iron Pipe, No Hub type shall conform to ASTM A 74 underground piping shall be hub and spigot cast iron, service class piping. All roof drains and horizontal storm drainage piping shall be insulated with 1" fiberglass pipe insulation with all service jacket.

Cleanouts shall be gastight and watertight, sized to provide quick and easy access for plug removal and rodding tools in their specific location. Cleanouts shall be aesthetically located with respect to tile patterns, masonry bond, and alignment.

Necessary piping-system components and miscellaneous supporting elements shall be provided, including, but not limited to, building structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; and variable and constant supports. Supporting elements shall be suitable for stresses imposed by systems pressures and temperatures, and natural and other external forces.

Supporting elements shall be in accordance with FM P7825 and be UL listed and shall conform to ASME B31.1, MSS SP-58, MSS SP-69.

Domestic hot and cold water-piping insulation shall be 1” fiberglass with factory-applied jacket conforming to ASTM C 547. Composite UL-listed jacket and insulation shall have a Fire-Hazard Classification of flame-spread 25, smoke-developed 50. Wall penetrations shall be sleeved with foamed, flexible insulation, continuous through the sleeve.

### D. Domestic water system

Domestic water service shall be 4” copper type “L”. Service entry shall be provided with a main shut off valve and backflow preventer (BFP) of the type required by the Authority Having Jurisdiction (DCVA type BFP ASSE-1015 or RPZ type BFP ASSE-1013). Estimated domestic water demand load is 160 gpm, based on approximately 700 Supply Fixture Units. Piping throughout the building will be sized per IPC code and based on acceptable plumbing practices.

Maximum velocity in the cold water piping shall be 8 FPS and maximum velocity in the hot water system shall be 5 FPS.

Provide a water meter of a type required inside or outside the building in a meter crock, as required by the AHJ.

Provide pressure reducing valve when the incoming water pressure exceeds 80 psi. Provide pressure gauges at the service entry and after the pressure reducing valve (pressure gauge downstream of pressure reducing valve if such a valve is required).

Hot and cold-water piping shall be provided to the bathrooms, classroom sinks, water coolers, mop sinks and the fixtures in the kitchen.

All plumbing fixtures shall be provided with isolation valves for servicing or replacing the fixture.

### E. Hot Water Supply

Domestic use hot water for the bathrooms, mop sinks and classroom sinks shall be generated by two high efficiency, condensing type natural gas water heaters, each 100 gallon, 199 MBH, with a minimum thermal efficiency of 95% Hot water shall be set to 140°F. Provie a master thermostatic mixing valve, high/low type with discharge temperature set to 120°F. Provide point of use thermostatic mixing valve at each lavatory and sink to provide 105°F.

Provide 1-1/4” hot water recirculating piping and hot water recirculation pump, sized for 10 gpm and 30 ft head for temperature maintenance of the hot water system.

Provide a single 53 gallon expansion tank tapped to the cold piping of the water heater (similar to Amtrol ST-447-C) with a check valve in the cold water.

For the kitchen provide an independent natural gas fired high efficiency, condensing type water heater, 100 gallon, 199 MBH, with a minimum efficiency of 95% Hot water shall be set to 140°F. Three compartment sink and the kitchen sinks and the dishwasher shall be served with 140°F hot water. Hand sinks shall be served by the two water heaters which also serve the classroom sinks and the bathrooms at 120°F. Provide a thermostatic mixing valve with discharge temperature set to 120°F to the hand sinks.

Provide a 3/4” hot water recirculating piping and hot water recirculation pump, sized for 3 gpm and 20 ft head for temperature maintenance of the kitchen hot water system.

Provide a single 35 gallon expansion tank tapped to the cold piping of the water heater (similar to Amtrol ST-35CL) with a check valve in the cold water.

## F. Sanitary Waste System

Sanitary waste from toilets, urinals, lavatories, kitchen sinks, electric water coolers, and the floor drains shall be conveyed by gravity via a 6” sanitary main to underground exterior sewage piping. Depending on the invert elevation of the site sewer piping, multiple laterals may have to be utilized. Estimated demand load is 320 Drainage Fixture Units (DFU).

Provide 4” floor drains with trap primers in the mechanical room as well as in each bathroom.

Provide 3” and 4” sanitary floor sinks with half grates in the kitchen to accept indirect waste from the vegetable sink and other fixtures which come into contact with food.

Provide a 1500 gallon concrete, underground grease interceptor for the kitchen,
Located outside of the building. Final size of the grease interceptor shall be coordinated with the requirements of the local jurisdiction.

## G. Storm Drainage System

Rainwater from roof areas will be conveyed interior roof drains and rain leaders.

Roof drainage system shall be designed for a 100-year storm return frequency and a 60-minute period of duration/concentration. Emergency drainage system shall be designed for a 100-year storm return frequency and a 60-minute

period of duration/concentration. Drainage shall be conveyed to the designated on-site storm water management basins.

Storm laterals shall be three 12” pipes sized for 75,000 sq ft total.

**H. Natural Gas System (where natural gas is available)**

7” w.c. or 2.0 psi uninterruptible gas service shall be provided where natural gas is available to serve the gas fired HVAC systems and the water heaters. Piping shall be sized for the maximum pressure drop of 0.5” to the farthest fixture for 7” w.c system and for 1.0 psi pressure drop for 2.0 psi system.

Piping Material: Natural Gas piping system; Schedule 40 black steel pipes with threaded and welded joints and fittings per NFPA 54. ASTM A 53; Type E or S; Grade B; Schedule 40.

### a. Full-Service Restaurant (Floors:1) (Total Floor Area: 5,500 sq ft)

**A. General Requirements**

All plumbing work shall be in accordance with 2018 International Plumbing Code, International Building Code and the requirements of the Authority Having jurisdiction.

Plumbing fixture quantities, locations and types shall be in compliance with the referenced codes and the configuration shown on the Architectural plans. All plumbing fixtures shall be type.

**B. Plumbing Fixtures:**

Vitreous-china and enameled cast-iron plumbing fixtures shall be white. Exposed-to-view fixture trimmings, fittings, and fasteners shall be chrome plated. Supplies and stops for lavatories shall be brass with chrome plated finish. Lavatories shall have auto sensor faucets, battery-operated maximum 0.25 gallons per metering cycle Water Closets shall be wall mounted, flush valve (1.6 GPF maximum), with auto flush sensors, battery-operated and heavy-duty, cast-iron wall supports. All plumbing fixtures will be provided water service by the city domestic water service. Rubber compression type connections shall not be acceptable. Brass ferrule type fittings shall be required. See plumbing fixture list below and cut sheets in plumbing fixture section of the appendix.

Freeze proof wall hydrants in lockable cast iron valve boxes one on each side of the building. Wall hydrants shall be provided with vacuum breakers and shall have shut off valves inside the building in accessible locations.

Plumbing fixture flow rates shall comply with the requirements of IPC table 604.4.

| Table P1: Plumbing Fixture Schedule | |
|---|---|
| Description | BASIS OF DESIGN (OR EQUAL) |
| Water Closet | ADA and non-ADA, White, Vitreous China, Wall- Mounted, Elongated Bowl, flush valves, auto flush sensors, battery operated with solid plastic seats, open front without a lid. Max. 1.6 gpf. |
| Urinal | ADA, White, Vitreous China, Wall- Mounted, flush valves, auto flush sensors, battery operated. Max. 1,0 gpf |
| Lavatory | White, Vitreous China, undermount type, auto sensor, battery operated faucets, center, single hole, 0.25 gallons maximum per metering cycle. Thermostatic mixing valves shall be provided at each lav with discharge set to 105 F. |
| Sink | 3 compartment sink for grease laden pots and pans and two compartment sink for the venetables. Sinks shall be 18 gauge stainless steel with 3- Hole, gosseneck faucets, brass construction with chrome plated finish. Hand sinks shall be wall mounted and shall be provided with thermostatic mixing valves with discharge set to 105 F. |
| Service Sink | Service Sink, One Piece Precast Terazzo w/3” Chrome Plated Brass Drain Chrome Plated Service Faucet with Vacuum Breaker, Pail Hook and ¾” Hose Thread on Spout. |
| Electric water cooler | ADA, bi-level, stainless steel |
| 3-compartment sink | 18 ga, type 304 stainless stell min, three 16”x20”, 12” deep with wall mounted lever type faucets. |
| Hand sink | Wall mounted, 18 ga, type 304 stainless steel with wall mounted level type faucets |

**C. Plumbing Materials:**

Domestic water piping: Above ground water piping shall conform to ASTM B 88, Type L hard-drawn copper. Fittings for connection to corporation cocks shall be cast bronze, flared type, conforming to ASME B16.26. Below ground domestic water piping shall be type ‘K” copper.

Sanitary piping: Soil, waste and vent piping shall be schedule 40 PVC, solid core to conform to ASTM D 2665 with fittings made to conform to ASTM D 3311 to fit schedule 40 PVC piping.

Storm piping: Storm piping shall be schedule 40 PVC, solid core to conform to ASTM D 2665 with fittings made to conform to ASTM D 3311 to fit schedule 40 PVC piping.

Cleanouts shall be gastight and watertight, sized to provide quick and easy access for plug removal and rodding tools in their specific location. Cleanouts shall be aesthetically located with respect to tile patterns, masonry bond, and alignment.

Necessary piping-system components and miscellaneous supporting elements shall be provided, including, but not limited to, building structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; and variable and constant supports. Supporting elements shall be suitable for stresses imposed by systems pressures and temperatures, and natural and other external forces. Supporting elements shall be in accordance with FM P7825 and be UL listed and shall conform to ASME B31.1, MSS SP-58, MSS SP-69.

Domestic water-piping insulation shall be 1” fiberglass with factory-applied jacket conforming to ASTM C 547. Composite UL-listed jacket and insulation shall have a Fire-Hazard Classification of flame-spread 25, smoke-developed 50. Wall penetrations shall be sleeved with foamed, flexible insulation, continuous through the sleeve.

### D. Domestic water system

Domestic water service shall be 2” copper type “L”. Service entry shall be provided with a main shut off valve and backflow preventer (BFP) of the type required by the Authority Having Jurisdiction (DCVA type BFP ASSE-1015 or RPZ type BFP ASSE-1013). Estimated domestic water demand load is 56 gpm, based on approximately 64 Supply Fixture Units. Piping throughout the building will be sized per IPC code and based on acceptable plumbing practices.

Maximum velocity in the cold-water piping shall be 8 FPS and maximum velocity in the hot water system shall be 5 FPS.

Provide a water meter of a type required inside or outside the building in a meter crock, as required by the AHJ.

Provide pressure reducing valve when the incoming water pressure exceeds 80 psi. Provide pressure gauges at the service entry and after the pressure reducing valve (pressure gauge downstream of pressure reducing valve if such a valve is required).

Hot and cold-water piping shall be provided to the bathrooms, mop sink and the fixtures in the kitchen.

All plumbing fixtures shall be provided with isolation valves for servicing or replacing the fixture.

### E. Hot Water Supply

Domestic use hot water for the bathroom, mop sink, kitchen sinks and the dish machine shall be generated by a high efficiency, condensing type natural gas water heater, 100 gallon, 199 MBH, with a minimum thermal efficiency of 95% Hot water shall be set to 140°F. Provide a high/low type thermostatic mixing valve with discharge temperature set to 120°F for the lavatories and the kitchen hand sinks. Provide point of use thermostatic mixing valve at each lavatory and hand sink to provide 105°F

Provide a 12 gallon expansion tank tapped to the cold piping of the water heater.

Provide 3/4” hot water recirculating piping and hot water recirculation pump, sized for 5 gpm and 15 ft head for temperature maintenance of the hot water system.

### F. Sanitary Waste System

Sanitary waste from toilets, urinals, lavatories, kitchen sinks, electric water coolers, and the floor drains shall be conveyed by gravity via a 4” sanitary main to underground exterior sewage piping.

Provide 4” floor drains with trap primers in the mechanical room as well as in each bathroom.

Provide 3” and 4” sanitary floor sinks with half grates in the kitchen to accept indirect waste from the vegetable sink and other fixtures which come into contact with food.

Provide a 1500 gallon concrete, underground grease interceptor for the kitchen,
Located outside of the building. Final size of the grease interceptor shall be coordinated with the requirements of the local jurisdiction.

### G. Storm Drainage System

Rainwater from roof areas will be conveyed interior roof drains and rain leaders.

Roof drainage system shall be designed for a 100 year storm return frequency and a 60 minute period of duration/concentration. Emergency drainage system shall be designed for a 100 year storm return frequency and a 60 minute period

of duration/concentration. Drainage shall be conveyed to the designated on-site storm water management basins.

Storm laterals shall be an 8” pipe sized for 5,500 sq ft total.

**H. Natural Gas System (where natural gas is available)**

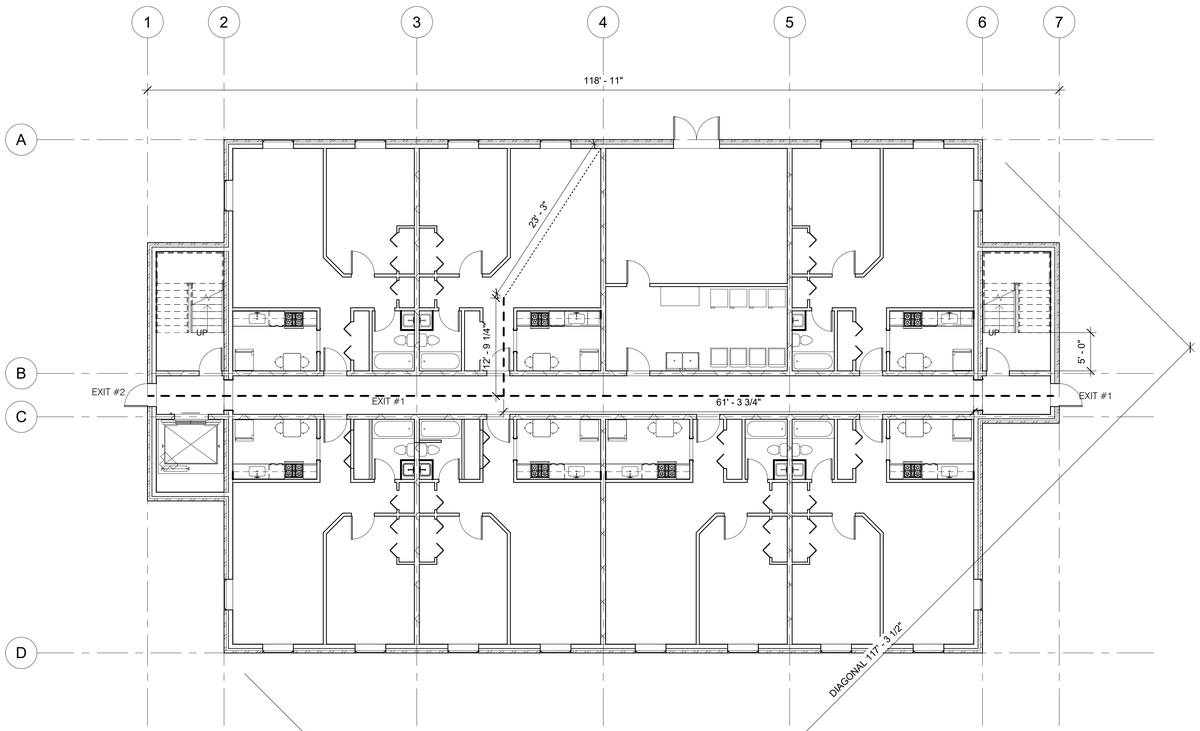
7” w.c. or 2.0 psi uninterruptible gas service shall be provided where natural gas is available to serve the gas fired HVAC systems and the water heaters. Piping shall be sized for the maximum pressure drop of 0.5” to the farthest fixture for 7” w.c system and for 1.0 psi pressure drop for 2.0 psi system.

Piping Material: Natural Gas piping system; Schedule 40 black steel pipes with threaded and welded joints and fittings per NFPA 54. ASTM A 53; Type E or S; Grade B; Schedule 40.

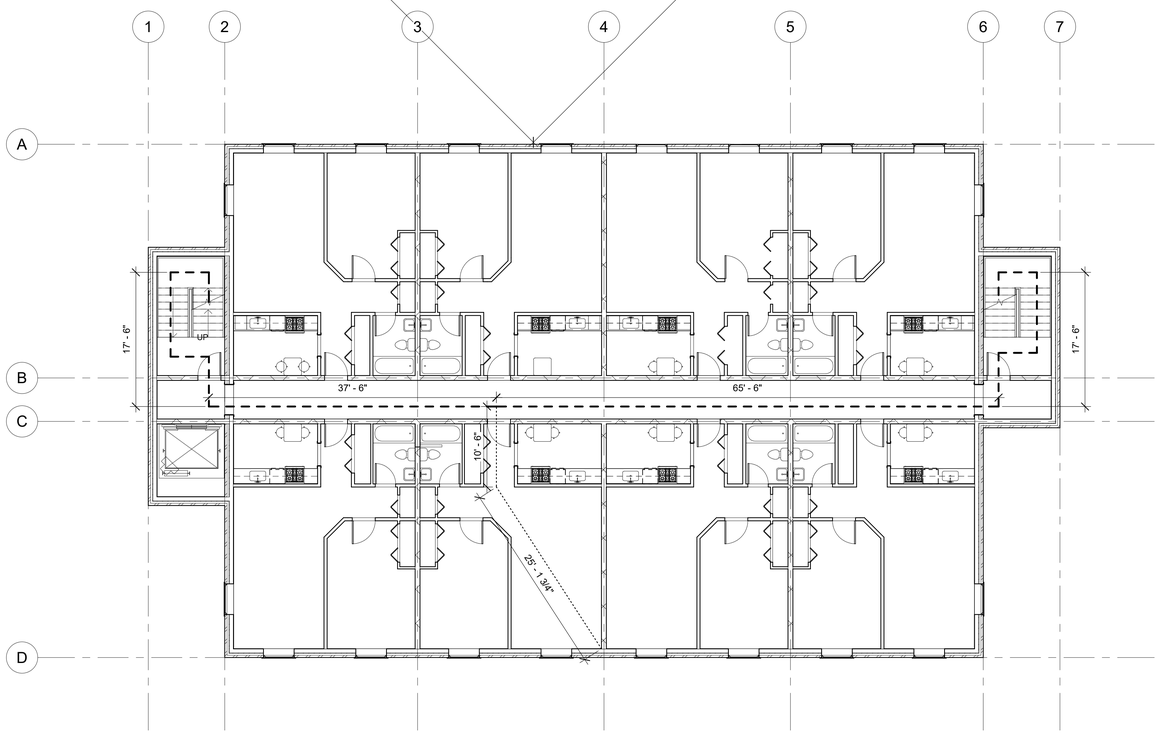
# Appendixes

# Appendix A

# Architectural Code Analysis




1 G-003 FIRST FLOOR PLAN LIFE SAFETY PLAN
1/8" = 1'-0"




3 G-003 SECOND, THIRD, FOURTH (TYP.) FLOOR LIFE SAFETY PLAN
1/8" = 1'-0"

# CODE ANALYSIS

## GOVERNING CODES & STANDARDS

- *IRC 2018* *International Residential Code*
- *IBC 2018* *International Building Code*
- *IPC 2018* *International Plumbing Code*
- *ADA 2010* *Americans with Disabilities Act Accessibility Guidelines*
- *NFPA 101-2018* *National Fire Protection Association*

## BUILDING DESIGN

| | EXISTING | PROJECT | REQUIRED/ALLOWED | REFERENCE |
|---|---|---|---|---|
| OCCUPANCY | | RESIDENTIAL R-2 | | IBC 304.1 |
| CONSTRUCTION TYPE | | V | | IBC 602 |
| HIGHRISE | | NA | | IBC 403.1 |
| SPRINKLERS | | NFPA13 | | IBC 403.2 |
| ALARM SYSTEM | | NA | | IBC 403.5, 403.6, 403.7 |
| HEIGHT | | NA | | IBC T 503 |
| FLOOR AREA | | 24,913 SQ.FT. | | IBC T 503 |
| EXTERIOR WALLS | | R-19 | | IBC 705 |
| FIRE WALLS | | NA | | IBC 706 |
| FIRE BARRIER ASSEMBLIES | | NA | | IBC 707.3.9 |
| INTERIOR COLUMNS | | NA | | IBC T 601 |
| STRUCT. WALL SUPPORTS | | NA | | IBC T 601 |
| FLOOR CONSTRUCTION | | NA | | IBC T 601 |
| ROOF CONSTRUCTION | | NA | | IBC T 601 |
| INTERIOR FINISHES - EXITS | | NA | | IBC T 803.9 |
| EXIT ACCESS CORRIDORS | | NA | | IBC T 803.9 |
| OTHER SPACES | | | | IBC T 803.9 |

## MEANS OF EGRESS

| | | | | |
|---|---|---|---|---|
| OCCUPANT LOAD | | 125 | | LSC T 7.3.1.2 |
| NUMBER OF EXITS/STORY | | 8/4 | 8 | LSC 4.5.3.1, 7.4.1.1 |
| EGRESS CAPACITY STAIRWAYS | | NA | | LSC T 7.3.3.1 |
| OTHER EGRESS COMPONENTS | | NA | | LSC T 7.3.3.1 |
| COMMON PATH OF TRAVEL | | XXX | 75' - 0" | LSC 18.2.5.3, 38.2.5.3.1 |
| DEAD END CORRIDOR | | NONE | 50' - 0" | LSC T 40.2.6.1 |

## FIRE PROTECTION

| | | | | |
|---|---|---|---|---|
| SPRINKLER SYSTEMS | | NFPA-13 | | LSC 9.7.1 |
| STANDPIPES | | NA | | LSC 9.10 |
| FIRE ALARM SYSTEM | | NA | | LSC 9.6 |

## EGRESS LEGEND:

TRAVEL DISTANCE

COMMON PATH OF TRAVEL

| Plumbing Fixture Schedule | | |
|---|---|---|
| Family and Type | Count | Room: Name |
| FIRST FLOOR PLAN | | |
| 2-COMPARTMENT SINK: 2 COMPARTMENT SINK 3 | 1 | LAUNDRY ROOM |
| LSY_Sink_1A: 25"W x 15"D | 8 | KITCHEN |
| Tub-Rectangular-3D: Tub-Rectangular-3D | 1 | LAUNDRY ROOM |
| SECOND FLOOR PLAN | | |
| LSY_Sink_1A: 25"W x 15"D | 8 | KITCHEN |
| THIRD FLOOR PLAN | | |
| LSY_Sink_1A: 25"W x 15"D | 8 | KITCHEN |
| FOURTH FLOOR PLAN | | |
| LSY_Sink_1A: 25"W x 15"D | 8 | KITCHEN |

| REVISION | DESCRIPTION | BY | DATE |
|---|---|---|---|
| | | | |

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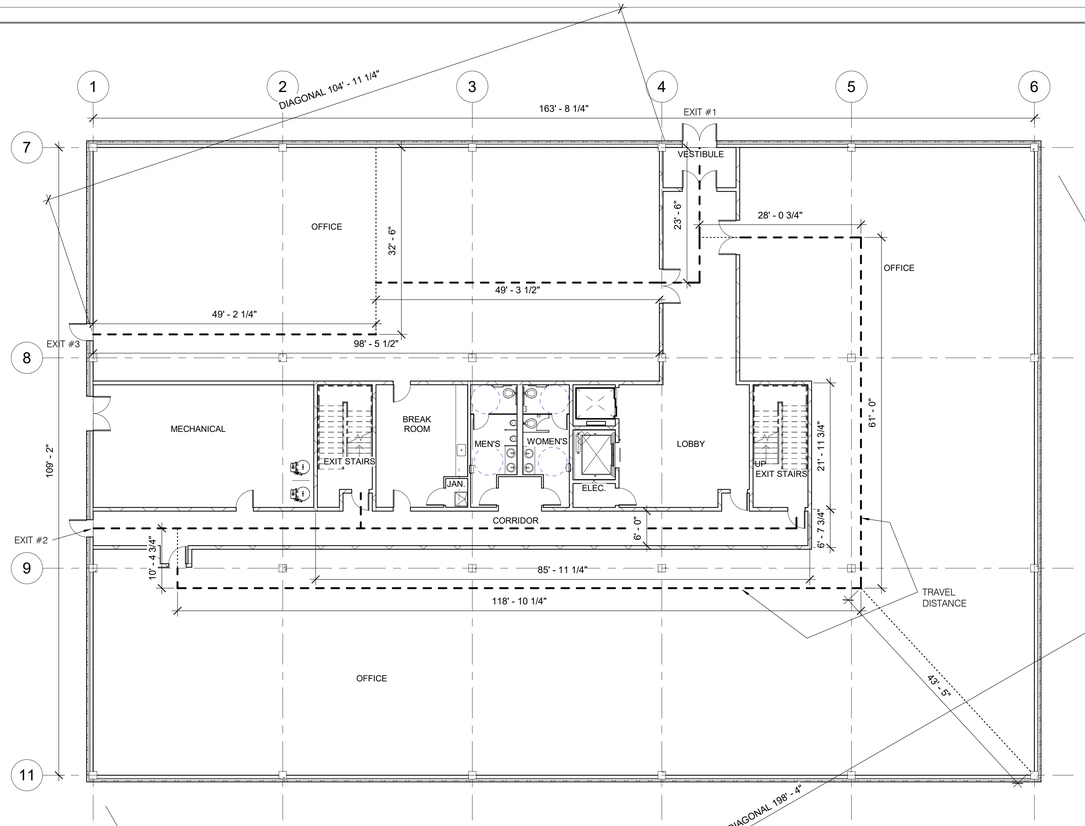
NIST STD. BLDG. PLUMBING SYSTEM MODELS

LIFE SAFETY PLAN &
CODE COMPLIANCE-MID
RISE APARTMENT

G-003

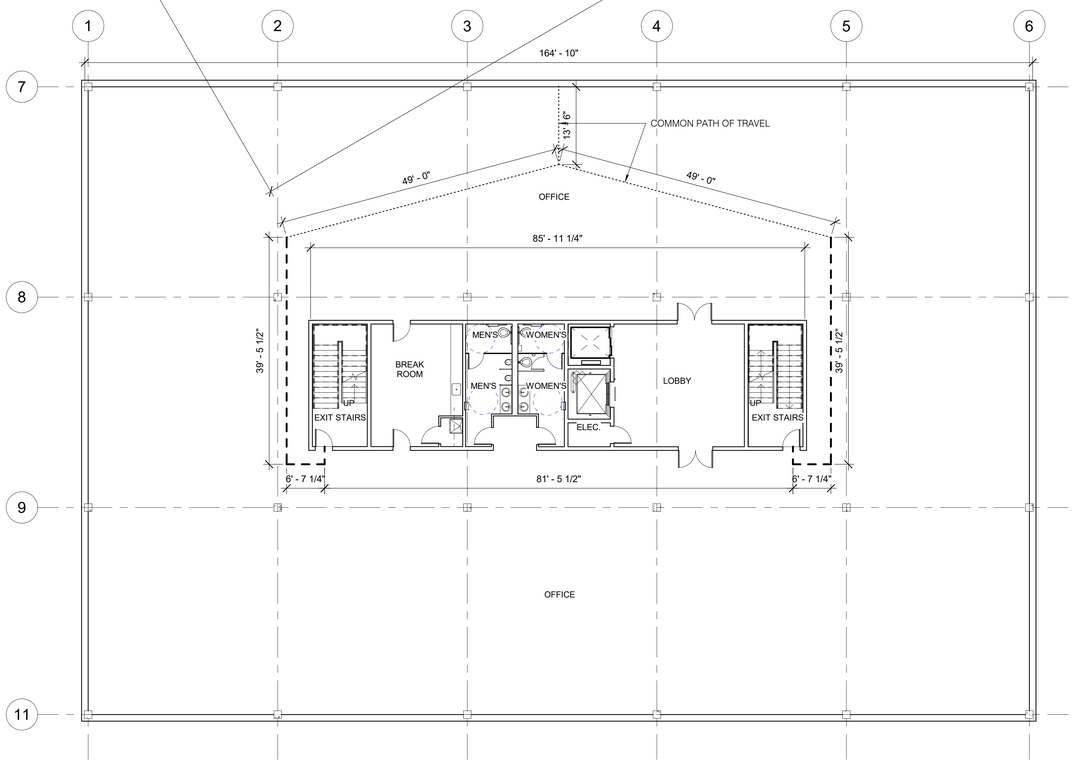
| APPROVED BY | DATE | SPONSOR | DATE | MAINTENANCE ENG. OFF. | DATE | ENVIRONMENTAL MANAGEMENT | DATE | SAFETY | DATE | SHED - NIST FIRE MARSHAL/AHJ | DATE | FACILITIES ENGR. OFF. | DATE | PROJECT LEADER | DATE | DRAWN BY | DATE | PROJECT/ W.O. # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | TT | 02/04/22 | SG | 02/04/22 | 21042 |

SH. NO.___OF___ DWG. G-003




2 G-004 FIRST FLOOR- LIFE SAFETY PLAN

3/32" = 1'-0"




3 G-004 SECOND & THIRD FLOOR (TYP)- LIFE SAFETY PLAN

3/32" = 1'-0"

# CODE ANALYSIS

## GOVERNING CODES & STANDARDS

- *IRC 2018* — *International Residential Code*
- *IBC 2018* — *International Building Code*
- *IPC 2018* — *International Plumbing Code*
- *ADA 2010* — *Americans with Disabilities Act Accessibility Guidelines*
- *NFPA 101-2018* — *National Fire Protection Association*

## BUILDING DESIGN

| | EXISTING | PROJECT | REQUIRED/ALLOWED | REFERENCE |
|---|---|---|---|---|
| OCCUPANCY | | MERCANTILE | | IBC 304.1 |
| CONSTRUCTION TYPE | | B2 | | IBC 602 |
| HIGHRISE | | NA | | IBC 403.1 |
| SPRINKLERS | | NFPA13 | | IBC 403.2 |
| ALARM SYSTEM | | NA | | IBC 403.5, 403.6, 403.7 |
| HEIGHT | | NA | | IBC T 503 |
| FLOOR AREA | | 53,607 SQ.FT. | | IBC T 503 |
| EXTERIOR WALLS | | R-19 | | IBC 705 |
| FIRE WALLS | | NA | | IBC 706 |
| FIRE BARRIER ASSEMBLIES | | NA | | IBC 707.3.9 |
| INTERIOR COLUMNS | | NA | | IBC T 601 |
| STRUCT. WALL SUPPORTS | | NA | | IBC T 601 |
| FLOOR CONSTRUCTION | | NA | | IBC T 601 |
| ROOF CONSTRUCTION | | NA | | IBC T 601 |
| INTERIOR FINISHES -EXIT ENCLOSURES | | NA | | IBC T 803.9 |
| - EXIT ACCESS CORRIDORS | | NA | | IBC T 803.9 |
| - OTHER SPACES | | | | IBC T 803.9 |
| **MEANS OF EGRESS** | | | | |
| OCCUPANT LOAD | | 360 | | LSC T 7.3.1.2 |
| NUMBER OF EXITS/STORY | | 3 | 2 | LSC 4.5.3.1, 7.4.1.1 |
| EGRESS CAPACITY STAIRWAYS | | NA | | LSC T 7.3.3.1 |
| OTHER EGRESS COMPONENTS | | NA | | LSC T 7.3.3.1 |
| COMMON PATH OF TRAVEL | | 43'-5" | 75' - 0" | LSC 18.2.5.3, 38.2.5.3.1 |
| DEAD END CORRIDOR | | NONE | 50' - 0" | LSC T 40.2.6.1 |
| **FIRE PROTECTION** | | | | |
| SPRINKLER SYSTEMS | | NFPA-13 | | LSC 9.7.1 |
| STANDPIPES | | NA | | LSC 9.10 |
| FIRE ALARM SYSTEM | | NA | | LSC 9.6 |

## PLUMBING FIXTURE COUNTS IPC 403/IBC Table 2902.1

PER IBC 2009, THE FULL-FLOOR OCCUPANT LOAD = 360
(ANTICIPATED FULL-FLOOR OCCUPANT LOAD IS NA)
IPC 403.1.1 50% WOMEN/ 50% MEN = 180 WOMEN/ 180 MEN

| FIXTURE TYPE | EXISTING FIXTURES | | FIXTURES PROVIDED | |
|---|---|---|---|---|
| | MEN | WOMEN | MEN | WOMEN |
| WATER CLOSETS | | | 3 | 6 |
| URINALS | | | 6 | |
| LAVATORIES | | | 6 | 6 |
| DRINKING FOUNTAINS | | | 1 | |
| SERVICE SINKS | | | 1 | |

Plumbing Fixture Schedule

| Family and Type | Count | Room: Name |
|---|---|---|
| 1ST FLR. | | |
| LSY_Sink Lab: 24" x 18" x 10" | 1 | BREAK ROOM |
| Sink-Mop: Sink-Mop- | 1 | JAN. |
| 2ND FLR. | | |
| LSY_Sink Lab: 24" x 18" x 10" | 1 | BREAK ROOM |
| Sink-Mop: Sink-Mop- | 1 | JAN. |
| 3RD FLR. | | |
| LSY_Sink Lab: 24" x 18" x 10" | 1 | BREAK ROOM |
| Sink-Mop: Sink-Mop- | 1 | JAN. |

## EGRESS LEGEND:

- - - - - - TRAVEL DISTANCE

..... COMMON PATH OF TRAVEL

| REVISION | DESCRIPTION | BY | DATE |
|---|---|---|---|
| | | | |

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OFFICE OF FACILITIES & PROPERTY MANAGEMENT

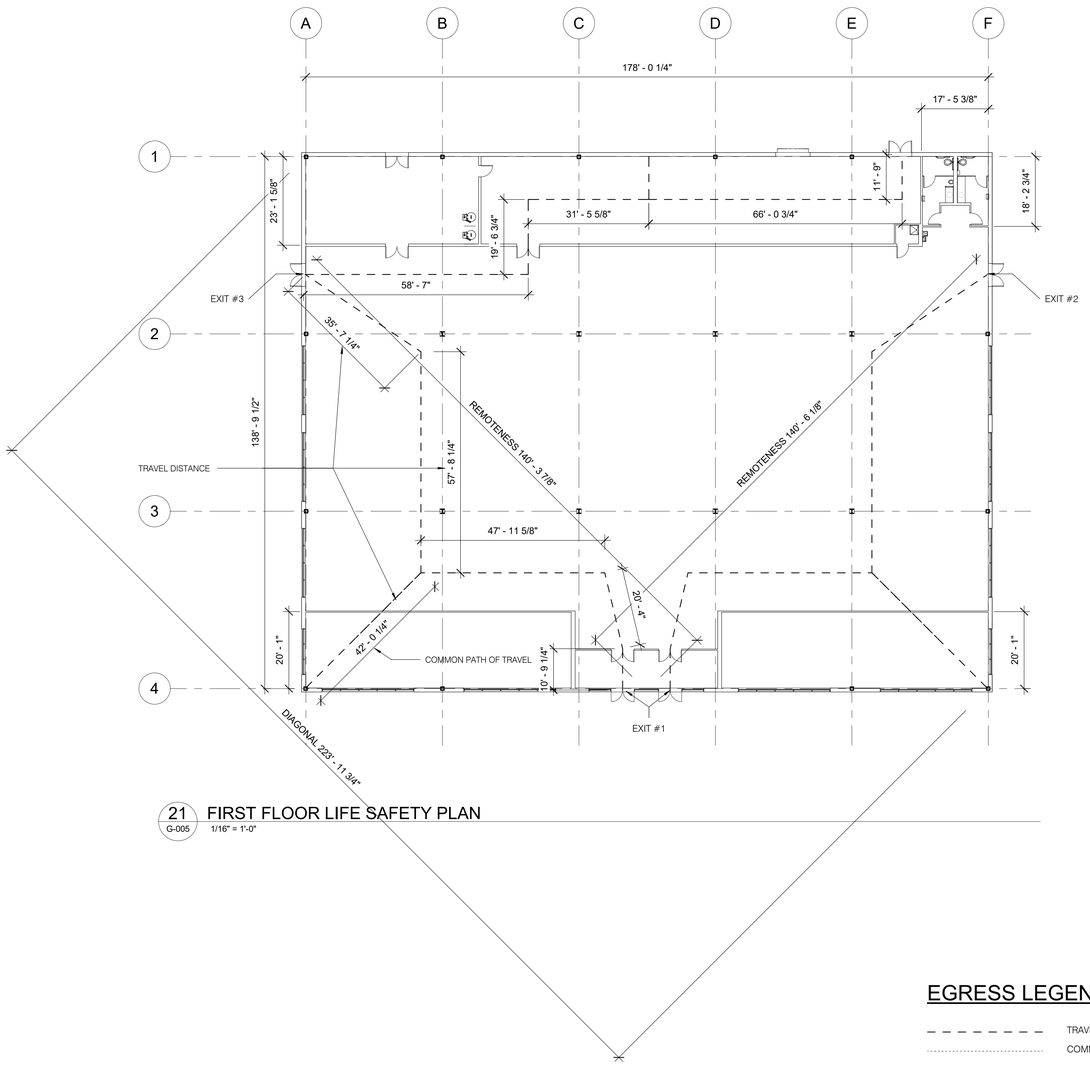
NIST STD. BLDG. PLUMBING SYSTEM MODELS

LIFE SAFETY PLAN & CODE COMPLIANCE – MEDIUM OFFICE

G-004

SH. NO. ___ OF ___ DWG. G-004

| APPROVED BY | DATE | SPONSOR | DATE | MAINTENANCE ENG. OFF. | DATE | ENVIRONMENTAL MANAGEMENT | DATE | SAFETY | DATE | SHED – NIST FIRE MARSHAL/AHJ | DATE | FACILITIES ENGR. OFF. | DATE | PROJECT LEADER | DATE | DRAWN BY | DATE | PROJECT/ W.O. # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | TT | 02/04/22 | SG/RS | 02/04/22 | 21042 |




21 G-005 FIRST FLOOR LIFE SAFETY PLAN

1/16" = 1'-0"

## EGRESS LEGEND:

- – – – – – – – TRAVEL DISTANCE
- ..... COMMON PATH OF TRAVEL

# CODE ANALYSIS

## GOVERNING CODES & STANDARDS

- *IRC 2018* *International Residential Code*
- *IBC 2018* *International Building Code*
- *IPC 2018* *International Plumbing Code*
- *ADA 2010* *Americans with Disabilities Act Accessibility Guidelines*
- *NFPA 101-2018* *National Fire Protection Association*

## BUILDING DESIGN

| | EXISTING | PROJECT | REQUIRED/ALLOWED | REFERENCE |
|---|---|---|---|---|
| OCCUPANCY | | MERCANTILE | | IBC 304.1 |
| CONSTRUCTION TYPE | | B2 | | IBC 602 |
| HIGHRISE | | NA | | IBC 403.1 |
| SPRINKLERS | | NFPA13 | | IBC 403.2 |
| ALARM SYSTEM | | NA | | IBC 403.5, 403.6, 403.7 |
| HEIGHT | | NA | | IBC T 503 |
| FLOOR AREA | | 24,697 SQ.FT. | | IBC T 503 |
| EXTERIOR WALLS | | R-19 | | IBC 705 |
| FIRE WALLS | | NA | | IBC 706 |
| FIRE BARRIER ASSEMBLIES | | NA | | IBC 707.3.9 |
| INTERIOR COLUMNS | | NA | | IBC T 601 |
| STRUCT. WALL SUPPORTS | | NA | | IBC T 601 |
| FLOOR CONSTRUCTION | | NA | | IBC T 601 |
| ROOF CONSTRUCTION | | NA | | IBC T 601 |
| INTERIOR FINISHES - EXITS | | NA | | IBC T 803.9 |
| EXIT ACCESS CORRIDORS | | NA | | IBC T 803.9 |
| OTHER SPACES | | | | IBC T 803.9 |

## MEANS OF EGRESS

| | | | | |
|---|---|---|---|---|
| OCCUPANT LOAD | | 360 | | LSC T 7.3.1.2 |
| NUMBER OF EXITS/STORY | | 3 | 2 | LSC 4.5.3.1, 7.4.1.1 |
| EGRESS CAPACITY STAIRWAYS | | NA | | LSC T 7.3.3.1 |
| OTHER EGRESS COMPONENTS | | NA | | LSC T 7.3.3.1 |
| COMMON PATH OF TRAVEL | | 42' - 1/4" | 75' - 0" | LSC 18.2.5.3, 38.2.5.3.1 |
| DEAD END CORRIDOR | | NONE | 50' - 0" | LSC T 40.2.6.1 |

## FIRE PROTECTION

| | | | | |
|---|---|---|---|---|
| SPRINKLER SYSTEMS | | NFPA-13 | | LSC 9.7.1 |
| STANDPIPES | | NA | | LSC 9.10 |
| FIRE ALARM SYSTEM | | NA | | LSC 9.6 |

## PLUMBING FIXTURE COUNTS IPC 403

PER IBC 2009, THE FULL-FLOOR OCCUPANT LOAD = 360
(ANTICIPATED FULL-FLOOR OCCUPANT LOAD IS NA)
IPC 403.1.1 50% WOMEN/ 50% MEN = 180 WOMEN/ 180 MEN
ACPC 419.2 NUMBER OF URINALS FOR MEN = 50% OF THE TOTAL NUMBER OF WATER CLOSETS

| FIXTURE TYPE | EXISTING FIXTURES | | REQ'D FIXTURES PER ACPC | | FIXTURES PROVIDED | |
|---|---|---|---|---|---|---|
| | MEN | WOMEN | MEN | WOMEN | MEN | WOMEN |
| WATER CLOSETS | | | 1 | 1 | 1 | 1 |
| URINALS | | | 1 | | 1 | |
| LAVATORIES | | | 1 | 1 | 1 | 1 |
| DRINKING FOUNTAINS | | | 1 | | 1 | |
| SERVICE SINKS | | | 1 | | 1 | |

| Plumbing Fixture Schedule | | |
|---|---|---|
| Family and Type | Count | Room: Name |
| Drinking Fountain-Hi-Lo-3D: Drinking Fountain-Hi-Lo-3D | 1 | CORE RETAIL |
| Sink-Mop: Sink-Mop- | 1 | JAN. |

| REVISION | DESCRIPTION | BY | DATE |
|---|---|---|---|
| | | | |

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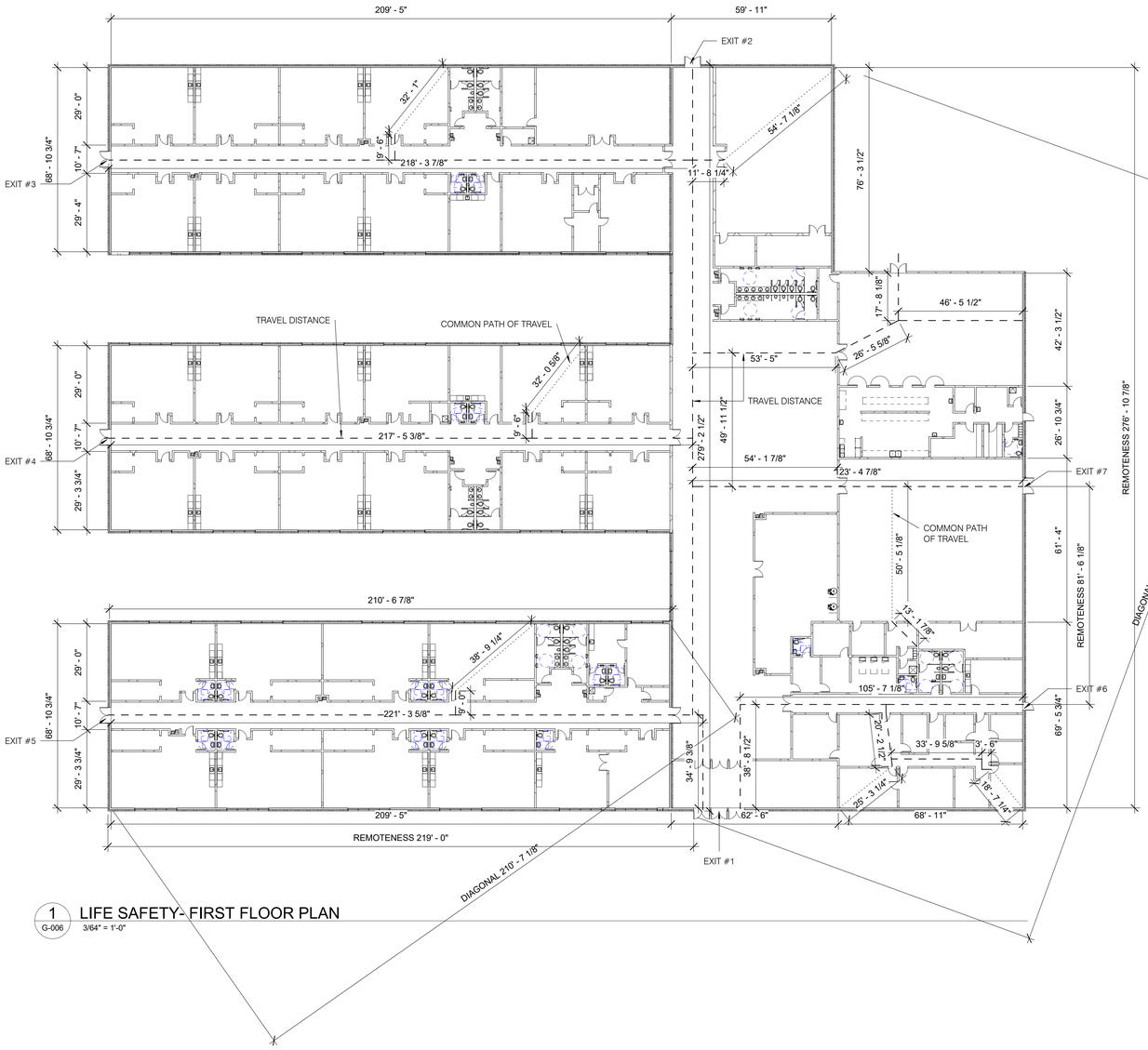
NIST STD. BLDG. PLUMBING SYSTEM MODELS

LIFE SAFETY PLAN &
CODE COMPLIANCE –
STAND ALONE RETAIL

G-005

SH. NO.___OF___ DWG. G-005

| APPROVED BY | DATE | SPONSOR | DATE | MAINTENANCE ENG. OFF. | DATE | ENVIRONMENTAL MANAGEMENT | DATE | SAFETY | DATE | SHED – NIST FIRE MARSHAL/AHJ | DATE | FACILITIES ENGR. OFF. | DATE | PROJECT LEADER | DATE | DRAWN BY | DATE | PROJECT/ W.O. # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | TT | 02/04/22 | TT/RS | 02/04/22 | 21042 |




1 G-006 LIFE SAFETY- FIRST FLOOR PLAN
3/64" = 1'-0"

## EGRESS LEGEND:

- – – – – – – – – TRAVEL DISTANCE
- ..... COMMON PATH OF TRAVEL

# CODE ANALYSIS

## GOVERNING CODES & STANDARDS

- *IRC 2018* *International Residential Code*
- *IBC 2018* *International Building Code*
- *IPC 2018* *International Plumbing Code*
- *ADA 2010* *Americans with Disabilities Act Accessibility Guidelines*
- *NFPA 101-2018* *National Fire Protection Association*

## BUILDING DESIGN

| | EXISTING | PROJECT | REQUIRED/ALLOWED | REFERENCE |
|---|---|---|---|---|
| OCCUPANCY | | EDUCATIONAL | | IBC 304.1 |
| CONSTRUCTION TYPE | | 2B | | IBC 602 |
| HIGHRISE | | NA | | IBC 403.1 |
| SPRINKLERS | | NFPA13 | | IBC 403.2 |
| ALARM SYSTEM | | NA | | IBC 403.5, 403.6, 403.7 |
| HEIGHT | | NA | | IBC T 503 |
| FLOOR AREA | | 74,307.5 SQ.FT. | | IBC T 503 |
| EXTERIOR WALLS | | R-19 | | IBC 705 |
| FIRE WALLS | | NA | | IBC 706 |
| FIRE BARRIER ASSEMBLIES | | NA | | IBC 707.3.9 |
| INTERIOR COLUMNS | | NA | | IBC T 601 |
| STRUCT. WALL SUPPORTS | | NA | | IBC T 601 |
| FLOOR CONSTRUCTION | | NA | | IBC T 601 |
| ROOF CONSTRUCTION | | NA | | IBC T 601 |
| INTERIOR FINISHES - EXITS | | NA | | IBC T 803.9 |
| EXIT ACCESS CORRIDORS | | NA | | IBC T 803.9 |
| OTHER SPACES | | | | IBC T 803.9 |
| **MEANS OF EGRESS** | | | | |
| OCCUPANT LOAD | | 1399 | | LSC T 7.3.1.2 |
| NUMBER OF EXITS/STORY | | 6 | 4 | LSC 4.5.3.1, 7.4.1.1 |
| EGRESS CAPACITY STAIRWAYS | | NA | | LSC T 7.3.3.1 |
| OTHER EGRESS COMPONENTS | | NA | | LSC T 7.3.3.1 |
| COMMON PATH OF TRAVEL | | 42' - 1/4" | 75' - 0" | LSC 18.2.5.3, 38.2.5.3.1 |
| DEAD END CORRIDOR | | NONE | 50' - 0" | LSC T 40.2.6.1 |
| **FIRE PROTECTION** | | | | |
| SPRINKLER SYSTEMS | | NFPA-13 | | LSC 9.7.1 |
| STANDPIPES | | NA | | LSC 9.10 |
| FIRE ALARM SYSTEM | | NA | | LSC 9.6 |

## PLUMBING FIXTURE COUNTS IBC Table 2901.1/ IPC 403

PER IBC 2018, THE FULL-FLOOR OCCUPANT LOAD = 1399
(ANTICIPATED FULL-FLOOR OCCUPANT LOAD IS NA)
IPC 403.1.1 50% WOMEN/ 50% MEN = 700 WOMEN/ 699 MEN
ACPC 419.2 NUMBER OF URINALS FOR MEN = 50% OF THE TOTAL NUMBER OF WATER CLOSETS

| FIXTURE TYPE | EXISTING FIXTURES | | FIXTURES PROVIDED | |
|---|---|---|---|---|
| | MEN | WOMEN | MEN | WOMEN |
| WATER CLOSETS | NA | NA | 10 | 16 |
| URINALS | NA | NA | 8 | |
| LAVATORIES | | | 12 | 12 |
| DRINKING FOUNTAINS | NA | | 16 | |
| SERVICE SINKS | NA | | 4 | |

Plumbing Fixture Schedule

| Family and Type | Count | Room: Name |
|---|---|---|
| 2-COMPARTMENT SINK: 2 COMPARTMENT SINK 3 | 1 | KITCHEN |
| 3-COMPARTMENT SINK: 3 COMPARTMENT SINK | 1 | WASH |
| Drinking Fountain-Hi-Lo-3D: Drinking Fountain-Hi-Lo-3D | 4 | HALLWAY |
| Drinking Fountain-Hi-Lo-3D: Drinking Fountain-Hi-Lo-3D | 4 | POD-1 |
| Drinking Fountain-Hi-Lo-3D: Drinking Fountain-Hi-Lo-3D | 4 | POD-2 |
| Drinking Fountain-Hi-Lo-3D: Drinking Fountain-Hi-Lo-3D | 4 | POD-3 |
| FB_plumb_sink_ss_casework: CS140 | 1 | BREAK RM |
| Kohler ADA sink: Kohler ADA sink | 4 | KITCHEN |
| Shower%20Base-3D: 36" x 36" | 1 | SHWR |
| Sink Kitchen-Island: 18" x 18" | 4 | GRADE 5 |
| Sink Kitchen-Island: 18" x 18" | 4 | GRADE-1 |
| Sink Kitchen-Island: 18" x 18" | 4 | GRADE-2 |
| Sink Kitchen-Island: 18" x 18" | 4 | GRADE-3 |
| Sink Kitchen-Island: 18" x 18" | 4 | GRADE-4 |
| Sink Kitchen-Island: 18" x 18" | 4 | GRADE-6 |
| Sink Kitchen-Island: 18" x 18" | 4 | KINDERGARTEN |
| Sink Kitchen-Island: 18" x 18" | 1 | SPECIAL ED. CLASS RM |
| Sink Kitchen-Island: 18" x 18" | 1 | TEACHER'S LOUNGE |
| Sink Kitchen-Island: 18" x 18" | 1 | TEACHER'S'S LOUNGE |
| Sink Kitchen-Island: 18" x 18" | 1 | WORK ROOM |
| Sink-Mop: Sink-Mop- | 2 | JAN |
| Sink-Mop: Sink-Mop- | 2 | JAN. |

| REVISION | DESCRIPTION | BY | DATE |
|---|---|---|---|
| | | | |

NIST

FOR OFFICIAL USE ONLY

U.S. DEPARTMENT OF COMMERCE

OFFICE OF FACILITIES & PROPERTY MANAGEMENT

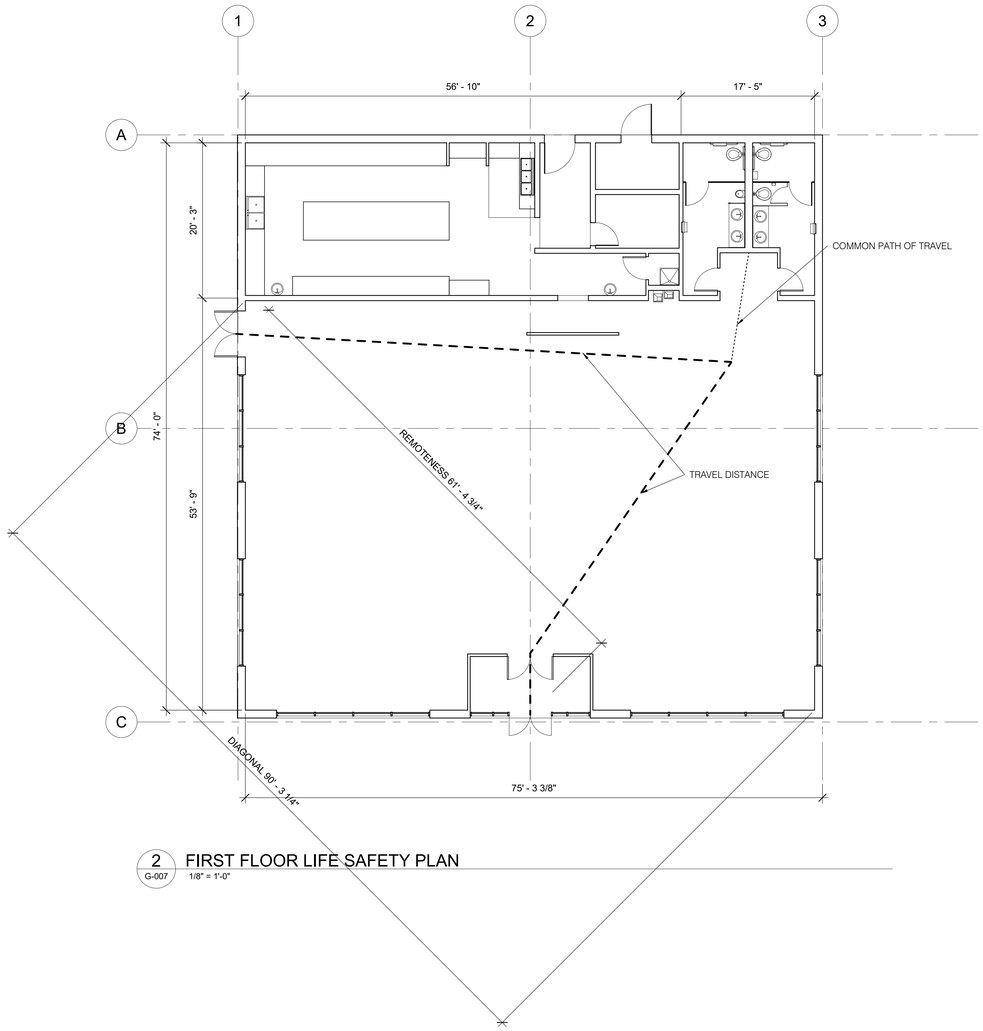
NIST STD. BLDG. PLUMBING SYSTEM MODELS

LIFE SAFETY PLAN &
CODE COMPLIANCE–
PRIMARY SCHOOL

G–006

| APPROVED BY | DATE | SPONSOR | DATE | MAINTENANCE ENG. OFF. | DATE | ENVIRONMENTAL MANAGEMENT | DATE | SAFETY | DATE | SHED – NIST FIRE MARSHAL/AHJ | DATE | FACILITIES ENGR. OFF. | DATE | PROJECT LEADER | DATE | DRAWN BY | DATE | PROJECT/ W.O. # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | TT | 02/04/22 | SG | 02/04/22 | 21042 |

SH. NO.___OF___ DWG. G-006




2 G-007 FIRST FLOOR LIFE SAFETY PLAN
1/8" = 1'-0"

# CODE ANALYSIS

## GOVERNING CODES & STANDARDS

- *IRC 2018* *International Residential Code*
- *IBC 2018* *International Building Code*
- *IPC 2018* *International Plumbing Code*
- *ADA 2010* *Americans with Disabilities Act Accessibility Guidelines*
- *NFPA 101-2018* *National Fire Protection Association*

## BUILDING DESIGN

| | EXISTING | PROJECT | REQUIRED/ALLOWED | REFERENCE |
|---|---|---|---|---|
| OCCUPANCY | | BUSINESS | | IBC 304.1 |
| CONSTRUCTION TYPE | | 2B | | IBC 602 |
| HIGHRISE | | NA | | IBC 403.1 |
| SPRINKLERS | | NFPA13 | | IBC 403.2 |
| ALARM SYSTEM | | NA | | IBC 403.5, 403.6, 403.7 |
| HEIGHT | | NA | | IBC T 503 |
| FLOOR AREA | | 5,570.SQ.FT. | | IBC T 503 |
| EXTERIOR WALLS | | R-19 | | IBC 705 |
| FIRE WALLS | | NA | | IBC 706 |
| FIRE BARRIER ASSEMBLIES | | NA | | IBC 707.3.9 |
| INTERIOR COLUMNS | | NA | | IBC T 601 |
| STRUCT. WALL SUPPORTS | | NA | | IBC T 601 |
| FLOOR CONSTRUCTION | | NA | | IBC T 601 |
| ROOF CONSTRUCTION | | NA | | IBC T 601 |
| INTERIOR FINISHES - EXITS ENCLOSURES | | NA | | IBC T 803.9 |
| - EXIT ACCESS CORRIDORS | | NA | | IBC T 803.9 |
| - OTHER SPACES | | | | IBC T 803.9 |

## MEANS OF EGRESS

| | | | | |
|---|---|---|---|---|
| OCCUPANT LOAD | | 275 | | LSC T 7.3.1.2 |
| NUMBER OF EXITS/STORY | | 1 | | LSC 4.5.3.1, 7.4.1.1 |
| EGRESS CAPACITY STAIRWAYS | | NA | | LSC T 7.3.3.1 |
| OTHER EGRESS COMPONENTS | | NA | | LSC T 7.3.3.1 |
| COMMON PATH OF TRAVEL | | XXXX | 75' - 0" | LSC 18.2.5.3, 38.2.5.3.1 |
| DEAD END CORRIDOR | | NONE | 50' - 0" | LSC T 40.2.6.1 |

## FIRE PROTECTION

| | | | | |
|---|---|---|---|---|
| SPRINKLER SYSTEMS | | NFPA-13 | | LSC 9.7.1 |
| STANDPIPES | | NA | | LSC 9.10 |
| FIRE ALARM SYSTEM | | NA | | LSC 9.6 |

## PLUMBING FIXTURE COUNTS IPC 403

PER IBC 2009, THE FULL-FLOOR OCCUPANT LOAD = 360
(ANTICIPATED FULL-FLOOR OCCUPANT LOAD IS NA)
IPC 403.1.1 50% WOMEN/ 50% MEN = 180 WOMEN/ 180 MEN
ACPC 419.2 NUMBER OF URINALS FOR MEN = 50% OF THE TOTAL NUMBER OF WATER CLOSETS

| FIXTURE TYPE | EXISTING FIXTURES | | REQ'D FIXTURES PER ACPC | | FIXTURES PROVIDED | |
|---|---|---|---|---|---|---|
| | MEN | WOMEN | MEN | WOMEN | MEN | WOMEN |
| WATER CLOSETS | | | 1 | 2 | 1 | 2 |
| URINALS | | | 1 | | 1 | |
| LAVATORIES | | | 1 | 1 | 1 | 1 |
| DRINKING FOUNTAINS | | | 1 | | 1 | |
| SERVICE SINKS | | | 1 | | 1 | |

## EGRESS LEGEND:

- – – – – – – – TRAVEL DISTANCE
- ..... COMMON PATH OF TRAVEL

Plumbing Fixture Schedule

| Family and Type | Count | Room: Name |
|---|---|---|
| Drinking Fountain-Hi-Lo-3D: Drinking Fountain-Hi-Lo-3D | 1 | MAIN DINING |
| Sink-Mop: Sink-Mop- | 1 | JAN |
| 3-COMPARTMENT SINK: 3 COMPARTMENT SINK | 1 | WASH |
| M_Sink Vanity-Round: 482 x 482mm | 1 | KITCHEN |
| M_Sink Vanity-Round: 482 x 482mm | 1 | KITCHEN |
| 2-COMPARTMENT SINK: 2 COMPARTMENT SINK 3 | 1 | KITCHEN |

1/16" = 1'-0" 8' 4' 0' 8'

| REVISION | DESCRIPTION | BY | DATE |
|---|---|---|---|
| | | | |

NIST

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OFFICE OF FACILITIES & PROPERTY MANAGEMENT

NIST STD. BLDG. PLUMBING SYSTEM MODELS

LIFE SAFETY PLAN &
CODE COMPLIANCE–
FULL SERVICE
RESTAURANT

G–007

SH. NO.___OF___ DWG. G–007

| APPROVED BY | DATE | SPONSOR | DATE | MAINTENANCE ENG. OFF. | DATE | ENVIRONMENTAL MANAGEMENT | DATE | SAFETY | DATE | SHED – NIST FIRE MARSHAL/AHJ | DATE | FACILITIES ENGR. OFF. | DATE | PROJECT LEADER | DATE | DRAWN BY | DATE | PROJECT/ W.O. # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | TT | 02/04/22 | SG | 02/04/22 | 21042 |

# Appendix B

# Cut-sheets

# Cut Sheets

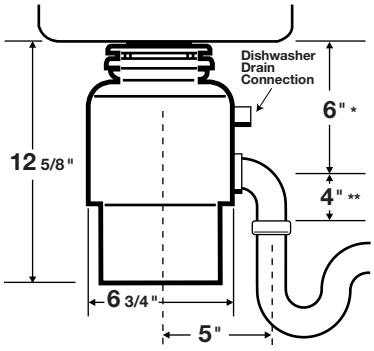
# Plumbing Fixtures

IN SINK ERATOR®

*FOOD WASTE DISPOSERS*

# Badger 5®


## Dimensions




*Distance from bottom of sink to center line of disposer outlet. Add 1/2" when stainless steel sinks are used.

**Length of tailpipe from center line of disposer outlet to end of tailpipe.

NOTE: Plumb waste line to prevent standing water in disposer motor housing.

## Job Specifications

## Submittal Sheet

This popular model offers you these features and benefits:

- 1/2 Horsepower Heavy Duty Motor (Quiet Dura-Drive® Induction Motor)
- 2-Year *We Come To You*™ In-Home Parts And Labor Service Warranty
- Rugged Galvanized Steel Construction (For Disposer Durability)
- Space-Saving Compact Design

## Sample Specification

Food Waste Disposer(s) shall be In-Sink-Erator Badger 5, continuous feed, with 1/2 H.P. motor, galvanized steel grinding elements with two stainless steel 360° swivel lugs. Self-service wrench. Warranty - 2 year parts and in-home service.

*The complete In-Sink-Erator warranty is included in the Care & Use Booklet, packed with each unit.

## Specifications

| | |
|---|---|
| Type of Feed | Continuous |
| On/Off Control | Wall Switch |
| Motor | Single Phase |
| HP | 1/2 |
| Volts | 120 |
| HZ | 60 |
| RPM | 1725 |
| Amp. (Avg. Load) | 6.9 |
| Time Rating | Intermittent |
| Lubrication | Permanently Lubricated Upper & Lower Bearings |
| Shipping Weight (Approx.) | 14 lbs. 11 oz. |
| Unit Finish | Waterborne Grey Enamel |
| Overall Height | 12-5/8" |
| Grind Chamber Capacity | 26 oz. |
| Motor Protection | Manual reset Overload |
| Average Water Usage | 1/4 Gallon Per Person Per Day |
| Average Electrical Usage | 1/2 KWH Per Month |
| Drain Connection | 1-1/2" Cushioned Slip Joint |
| Dishwasher Drain Connection | Yes |

EMERSON™
Appliance Solutions





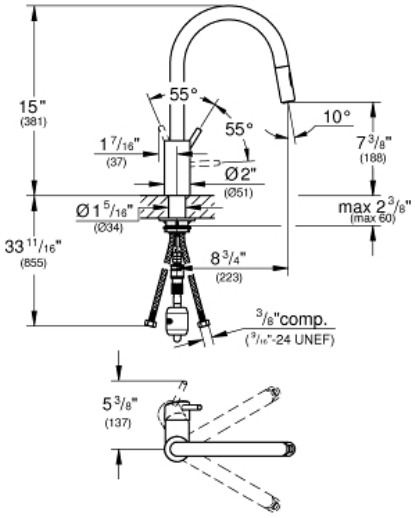
Printed in USA

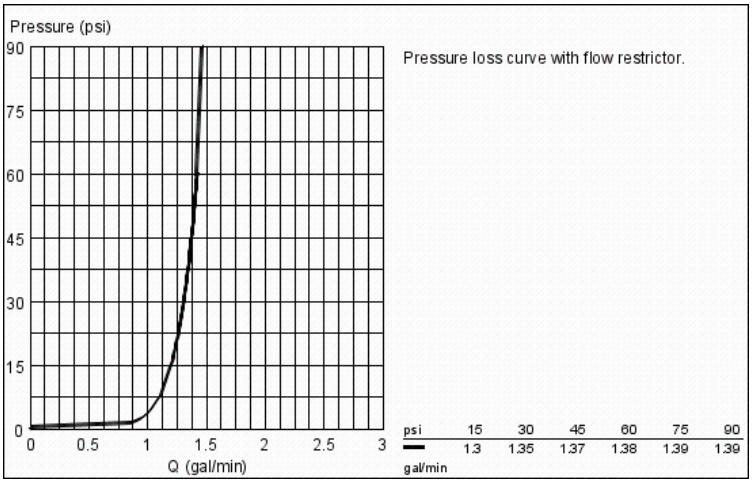
Form No. H534-03J-02

# CONCETTO
## Single-Handle Kitchen Faucet
MODEL # 3134910E

Pure Freude an Wasser

GROHE




**Product Description:**
**CONCETTO**
**Single-Handle Kitchen Faucet**

**Standard Specification:**
- High spout
- Single hole installation
- **GROHE StarLight** finish
- **GROHE SilkMove** 1.4" (35 mm) ceramic cartridge
- **GROHE EcoJoy** 1.5 gpm (5.7 l/min) flow restrictor
- GROHE Zero isolated inner water ways - lead and nickel free
- Flow strainer
- Swivel spout
- Integrated non-return valve
- Check valve included to prevent backflow
- Stainless steel flex lines
- **GROHE QuickFix** rapid installation system
- GROHE Limited Lifetime Warranty

**Applicable Codes & Standards:**
- Energy Policy Act of 1992
- NSF 61
- ASME A112.18.1/CSA B125.1
- US Federal and State material regulations
- ICC/ANSI A117.1
- CalGreen
- LOGO CEC

**Color:**
❑ 3134910E StarLight Chrome

ELKAY®
SPECIFICATIONS

# Elkay Lustertone Classic Stainless Steel 25" x 22" x 10-3/8" Single Bowl Drop-in Sink
## Model(s) DLR252210

## PRODUCT SPECIFICATIONS

Elkay Lustertone™ Classic Stainless Steel 25" x 22" x 10-3/8", Single Bowl Drop-in Sink. Sink is manufactured from 18 gauge 304 Stainless Steel with a Lustrous Satin finish, Center drain placement, and Sides and Bottom pads.

| | |
|---|---|
| **Installation Type:** | Drop-in |
| **Material:** | 304 Stainless Steel |
| **Finish:** | Lustrous Satin |
| **Gauge:** | 18 |
| **Sound Deadening:** | Sides and Bottom pads |
| **Number of Bowls:** | 1 |
| **Sink Dimensions:** | 25" x 22" x 10-3/8" |
| **Bowl 1 Dimensions:** | 21" x 15-3/4" x 10" |
| **Drain Size:** | 3-1/2" (89mm) |
| **Drain Location:** | Center |
| **Minimum Cabinet Size:** | 30" |
| **Mounting Hardware:** | Part # 64090012 included for countertops up to 3/4" (19mm) thick |
| **Cutout Template #:** | 1000001188 |

*Template is available for download at elkay.com. CAD software will be required to open the template.*

**Cutout Dimensions for Drop-in Installation:**
24-3/8" x 21-3/8" (619mm x 543mm) with 1-1/2" (38mm) corner radius

| **Custom Options** | |
|---|---|
| □ Type 316 Stainless Steel | |
| **Drain Location** | |
| □ Right Rear | □ Left Rear |
| □ Center | □ Center Rear |
| **Overflow Location** | |
| □ Front | □ Rear |
| **Alternate Punching** | |
| □ Faucet Model: | □ Punch Required: |
| **Sink Size** | |
| □ Bowl Depth: | □ Drainboard Width: |

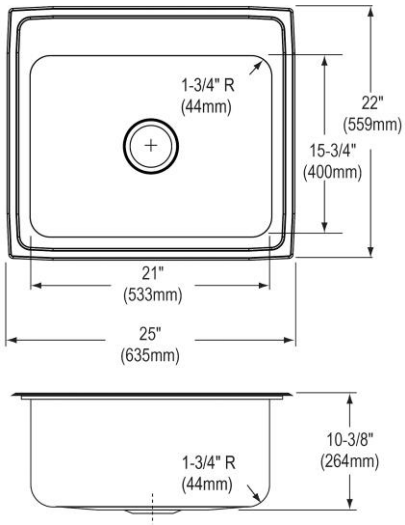
AMERICAN PRIDE. A LIFETIME TRADITION.
Like your family, the Elkay family has values and traditions that endure. For almost a century, Elkay has been a family-owned and operated company, providing thousands of jobs that support our families and communities.

**Product Compliance:** ASME A112.19.3/CSA B45.4
BUY AMERICAN ACT

Sinks are listed by IAPMO® as meeting the applicable requirements of the Uniform Plumbing Code®, International Plumbing Code®, and National Plumbing Code of Canada.

Clean and Care Manual (PDF)
Installation Instructions (PDF)
Warranty (PDF)

**Similar models are available with:** Perfect Drain, Quick-Clip Mounting System




PART:_____QTY: _____

PROJECT:_____

CONTACT:_____

DATE:_____

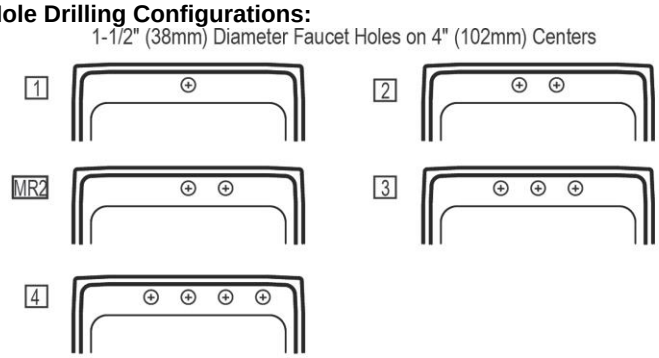
NOTES:_____

APPROVAL:_____

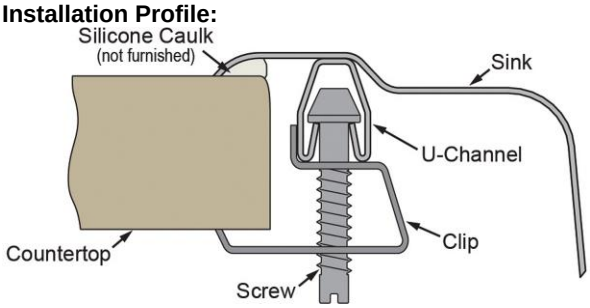
*In keeping with our policy of continuing product improvement, Elkay reserves the right to change product specifications without notice. Please visit elkay.com for the most current version of Elkay product specification sheets. This specification describes an Elkay product with design, quality, and functional benefits to the user. When making a comparison of other producers' offerings, be certain these features are not overlooked.*

# Elkay Lustertone Classic Stainless Steel 25" x 22" x 10-3/8" Single Bowl Drop-in Sink
## Model(s) DLR252210

**Hole Drilling Configurations:**




**Installation Profile:**



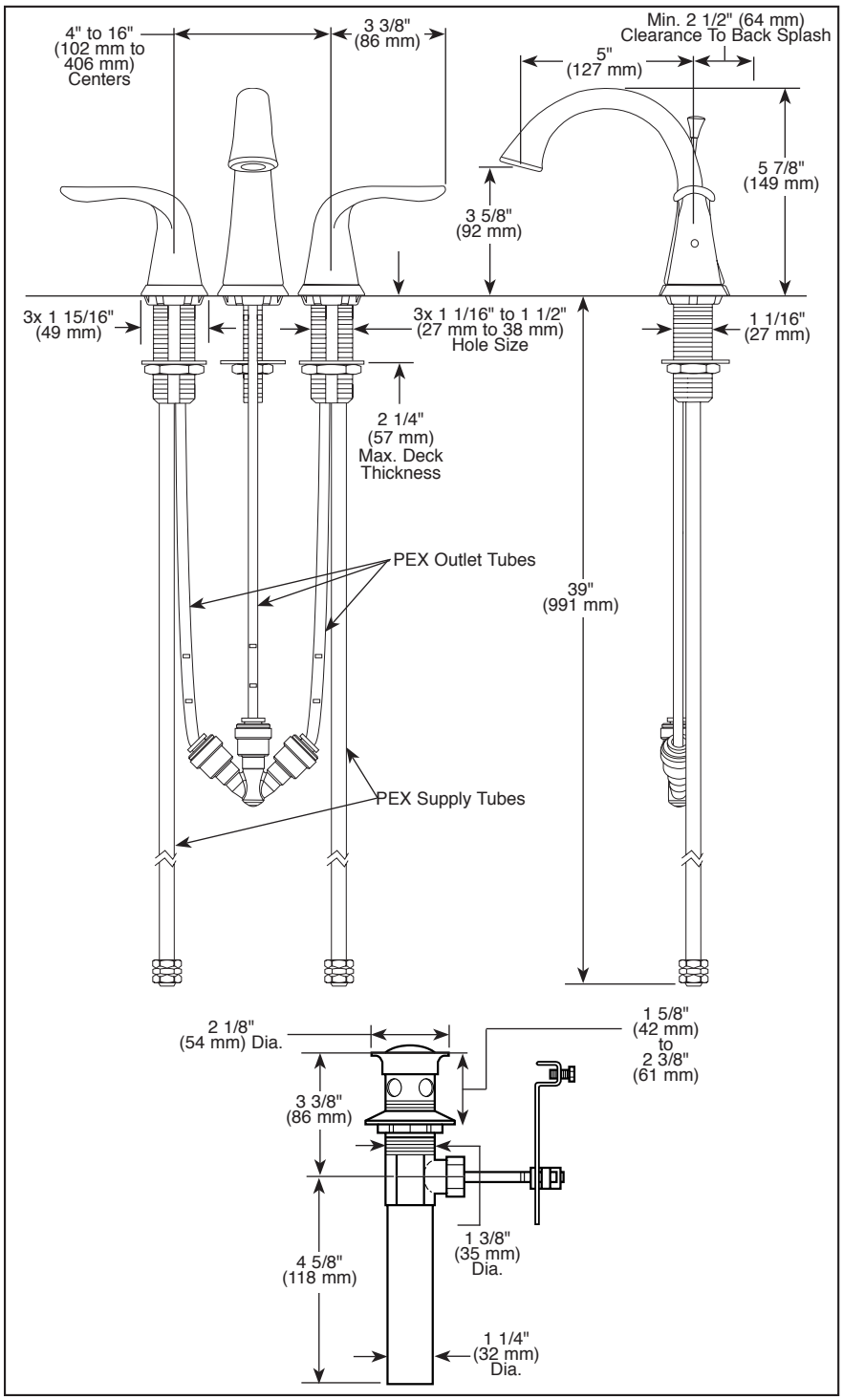

## OPTIONAL ACCESSORIES

| | |
|---|---|
| **Bottom Grid:** | LKWBG2115SS |
| **Cutting Board:** | CB1516 |
| **Drain:** | LK99 |
| **Faucet:** | LKGT1041CR, LKGT1041NK, LKGT1041RB |
| **Hardware:** | LK364, LK463 |
| **Soap Dispenser:** | LKGT1054 |

**3538-▲MPU-DST**

**Submitted Model No.:**_____

**Specific Features:**_____




▲ Designate proper finish suffix

Delta reserves the right (1) to make changes in specifications and materials, and (2) to change or discontinue models, both without notice or obligation. Dimensions are for reference only. See current full-line price book or www.deltafaucet.com for finish options and product availability.

DSP-L-3538-MPU-DST Rev. C

# LAVATORY FAUCETS

■ Lahara® Bath Collection
■ Two Handle Widespread Deck Mount

## FEATURES:

- DIAMOND Seal® Technology

## STANDARD SPECIFICATIONS:

- Max. 1.20 gpm @ 60 psi, 4.54 L/min @ 414 kPa
- Three hole mount
- Solid brass fabricated end valve
- 1/4 turn stops
- Diamond coated ceramic cartridge
- 3/8" O.D. straight PEX supply tubes
- Models with suffix "MPU" have metal drain with pop-up type fitting with plated flange and stopper

## WARRANTY

- Lifetime limited warranty on parts (other than electronic parts and batteries) and finishes: or, for commercial users, for 5 years from date of purchase.
- 5 year limited warranty on electronic parts (other than batteries); or, for commercial users, for 1 year from the date of purchase. No warranty is provided on batteries.

## COMPLETE VALVE COMPLIES WITH:

- ASME A112.18.1 / CSA B125.1
- ASME A112.18.2 / CSA B125.2
- ASME A112.18.6

Indicates compliance to ICC/ANSI A117.1

- EPA WaterSense®
- Verified compliant with .25% weighted average Pb content regulations.

DELTA FAUCET COMPANY

55 E. 111th Street, Indianapolis, Indiana 46280
350 South Edgeware Road, St. Thomas, ON N5P 4L1

American Standard
Style That Works Better

BARRIER FREE

# OVALYN™ UNDERCOUNTER SINK
VITREOUS CHINA

## OVALYN™ UNDERCOUNTER SINK

- Classic oval undermount sink
- Made from vitreous china
- Front overflow
- Supplied with mounting kit (047194-0070A) and template

❑ **0495.221 Unglazed rim**
435 x 359mm
(17-1/8" x 14-1/8")

❑ **0495.300 Glazed underside**

**Bowl size:**
382mm (15-1/16") wide
306mm (12-1/16") front to back
140mm (5-1/2") deep

❑ **0496.221 Unglazed rim**
489 x 413mm
(19-1/4" x 16-1/4")

❑ **0496.300 Glazed underside**

**Bowl size:**
432mm (17") wide
356mm (14") front to back
140mm (5-1/2") deep

❑ **0497.221 Unglazed rim**
546 x 441mm
(21-1/2" x 17-3/8")

❑ **0497.300 Glazed underside**

**Bowl size:**
483mm (19") wide
391mm (15-3/8") front to back
140mm (5-1/2") deep

SEE REVERSE FOR ROUGHING-IN DIMENSIONS

**Compliance Certifications -**
**Meets or Exceeds the Following Specifications:**
- ASME A112.19.2M for Vitreous China Fixtures
- CAN/CSA B45 series

**To Be Specified:**
❑ Color: ❑ White ❑ Bone ❑ Linen
❑ Silver ❑ Fawn Beige ❑ Black
❑ Faucet*:
❑ Faucet Finish:
❑ Supplies:
❑ 1-1/4" Trap:

* See faucet section for additional models available

American Standard

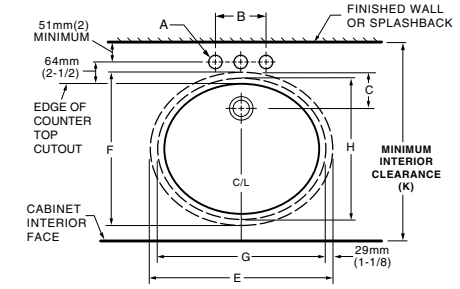
Style That Works Better

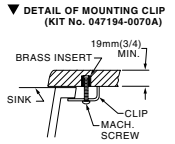
**BARRIER FREE**

# OVALYN™ UNDERCOUNTER SINK

**VITREOUS CHINA**

## 0496/0497

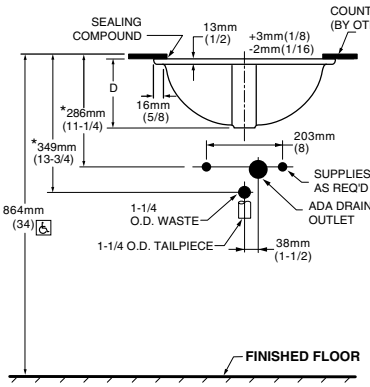


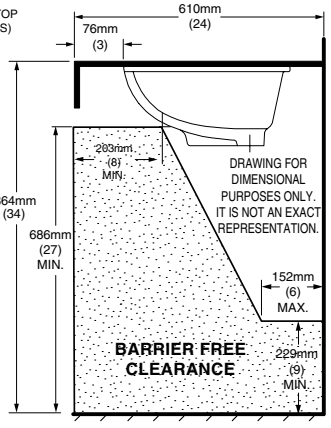




REFER TO INSTRUCTIONS PROVIDED WITH KIT FOR ADDITIONAL INFORMATION

**NOTES:**
***** DIMENSIONS SHOWN FOR LOCATION OF SUPPLIED AND "P" TRAP ARE SUGGESTED.
▼ UNDERCOUNTER MOUNTING KIT SUPPLIED WITH SINK.
**PLEASE NOTE MINIMUM INTERIOR CLEARANCE DIMENSION (K).**
FITTINGS NOT INCLUDED AND MUST BE ORDERED SEPARATELY.
USE ENCLOSED TEMPLATE FOR COUNTERTOP CUTOUT
SEALING COMPOUND SUPPLIED BY OTHERS.

**IMPORTANT:** Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.



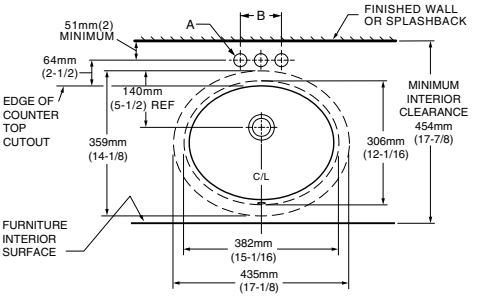



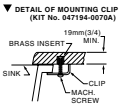

**MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 ACCESSIBLE AND USEABLE BUILDINGS AND FACILITIES - CHECK LOCAL CODES.**
Countertop 864mm (34") from finished floor. Lavatory installed 76mm (3") from front edge of countertop. Countertop thickness to be 25mm (1") maximum.

| FITTING | A | B |
|---|---|---|
| CENTERSET | 1-1/4 (32mm) | 4 (102mm) |
| SPREAD | 1-3/8 (35mm) | 8 (203mm) |

| CAT. NO. | E | F | G | H | C | D | J | K |
|---|---|---|---|---|---|---|---|---|
| 0496.221 | 489mm (19-1/4) | 413mm (16-1/4) | 432mm (17) | 356mm (14) | 103mm (4-1/16) | 182mm (7-3/16) | 16mm (5/8) | 500mm (19-11/16) |
| 0497.221 | 546mm (21-1/2) | 441mm (17-3/8) | 483mm (19) | 391mm (15-3/8) | 95mm (3-3/4) | 191mm (7-1/2) | 19mm (3/4) | 534mm (21-1/16) |

## 0495



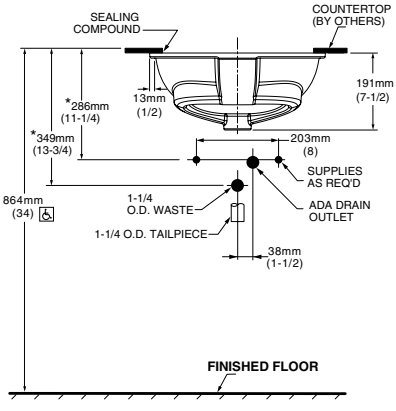



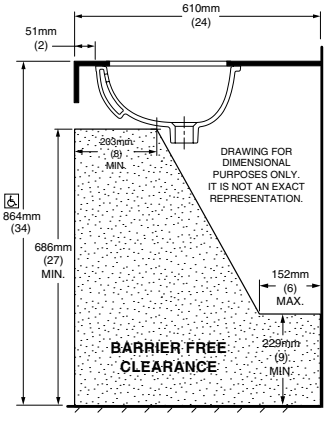

REFER TO INSTRUCTIONS PROVIDED WITH KIT FOR ADDITIONAL INFORMATION

| FITTING | A | B |
|---|---|---|
| CENTERSET | 1-1/4 (32mm) | 4 (102mm) |
| SPREAD | 1-3/8 (35mm) | 8 (203mm) |

**NOTES:**
USE ENCLOSED TEMPLATE FOR COUNTER TOP CUTOUT.
FITTINGS NOT INCLUDED WITH FIXTURE AND MUST BE ORDERED SEPARATELY.
***** DIMENSIONS SHOWN FOR LOCATION OF SUPPLIED AND "P" TRAP ARE SUGGESTED.
▼ UNDERCOUNTER MOUNTING KIT SUPPLIED WITH SINK.
**PLEASE NOTE MINIMUM INTERIOR CLEARANCE DIMENSION (K).**
SEALING COMPOUND SUPPLIED BY OTHERS.

**IMPORTANT:** Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages




**MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 ACCESSIBLE AND USABLE BUILDINGS AND FACILITIES - CHECK LOCAL CODES.**
Countertop 864mm (34") from finished floor. Lavatory installed 51mm (2") from front edge of countertop. Countertop thickness to be 25mm (1") maximum.

# DECORUM®
# WALL-HUNG LAVATORY WITH EVERCLEAN®
**VITREOUS CHINA**

**BARRIER FREE**

## DECORUM® WALL-HUNG LAVATORY WITH EVERCLEAN®

- 20" x 18" vitreous china lavatory with EverClean included
- Available with rear overflow or less overflow
- Recessed self-draining deck with minimal backsplash
- For concealed arm or wall support (wall hanger included)
- ADA and TAS compliant
- Shown with Serin faucets (sold separately)
- Shown with drain grid (sold separately)

❏ **9024.000EC** No faucet holes
❏ **9024.001EC** Center hole only (CHO)
❏ **9024.021EC** CHO with left hand soap dispenser
❏ **9024.011EC** CHO with right hand soap dispenser
❏ **9024.901EC** CHO less overflow
❏ **9024.921EC** CHO with left hand soap dispenser less overflow
❏ **9024.911EC** CHO with right hand soap dispenser less overflow
❏ **9024.004EC** 4" centers
❏ **9024.024EC** 4" centers with left hand soap dispenser
❏ **9024.014EC** 4" centers with right hand soap dispenser
❏ **9024.904EC** 4" centers less overflow
❏ **9024.924EC** 4" centers with left hand soap dispenser less overflow
❏ **9024.914EC** 4" centers with right hand soap dispenser less overflow
❏ **9024.008EC** 8" centers
❏ **9024.908EC** 8" centers less overflow

**Nominal Dimensions:**
464mm (18-1/4") deep, 508mm (20") wide

**Bowl sizes:**
354mm (13-15/16") wide, 325mm (12-13/16") front to back, 127mm (5") deep

9024.001EC shown with 2064 Series Serin Faucet

9024.000EC shown with R350 & T064 Series Serin Faucet

SEE NEXT PAGE FOR ROUGHING-IN DIMENSIONS

**To Be Specified:**
❏ Color: ❏ White
❏ Faucet*:
❏ Faucet Finish:
❏ Supplies:
❏ 1-1/4" Trap:
❏ Suggested carriers include Jay R. Smith models 0801 and 0700

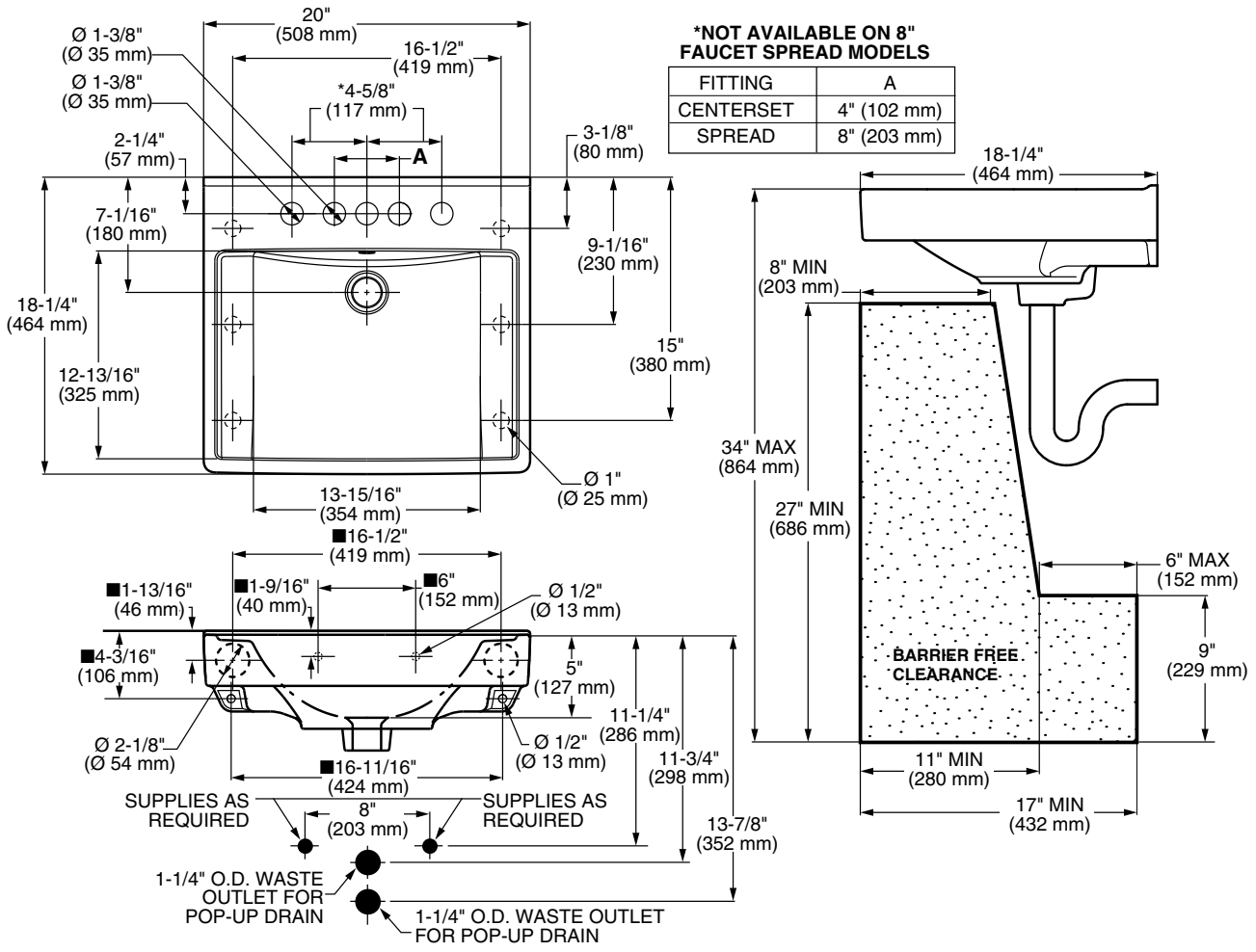
* See faucet section for additional models available

**Compliance Certifications -**
**Meets or Exceeds the Following Specifications:**
• ASME A112.19.2 for Vitreous China Fixtures

**MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 ACCESSIBLE AND USABLE BUILDINGS AND FACILITIES - CHECK LOCAL CODES.**
Top of front rim mounted 864mm (34") from finished floor.

# DECORUM®
# WALL-HUNG LAVATORY WITH EVERCLEAN®
**VITREOUS CHINA**

**BARRIER FREE**




***NOT AVAILABLE ON 8" FAUCET SPREAD MODELS**

| FITTING | A |
|---|---|
| CENTERSET | 4" (102 mm) |
| SPREAD | 8" (203 mm) |

**NOTES:**
● LOOSE KEY ANGLE STOPS, LESS WALL ESCUTCHEONS. SUPPLIES REQUIRED.
DIMENSIONS SHOWN FOR LOCATION OF SUPPLIES AND "P" TRAP ARE SUGGESTED.
■ SUITABLE FOR REINFORCEMENT ONLY, ACTUAL DIMENSIONS MUST BE TAKEN FROM FIXTURE.
FITTINGS NOT INCLUDED AND MUST BE ORDERED SEPARATELY.
PROVIDE SUITABLE REINFORCEMENT FOR ALL WALL SUPPORTS.
INSTALLATION INSTRUCTIONS SUPPLIED WITH LAVATORY.
**IMPORTANT:** Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

# DECORUM®
# WALL-HUNG LAVATORY WITH EVERCLEAN®
**VITREOUS CHINA**

**BARRIER FREE**

**Model 9024.000EC**
No Faucet Holes

**Model 9024.001EC**
Center Hole Only (CHO)

**Model 9024.004EC**
4" Centers

**Model 9024.008EC**
8" Centers

**Model 9024.011EC**
CHO With Right Hand Soap Dispenser

**Model 9024.014EC**
4" Centers With Right Hand Soap Dispenser

**Model 9024.021EC**
CHO With Left Hand Soap Dispenser

**Model 9024.024EC**
4" Centers With Left Hand Soap Dispenser

**Model 9024.901EC**
CHO Less Overflow

**Model 9024.904EC**
4" Centers Less Overflow

**Model 9024.908EC**
8" Centers Less Overflow

**Model 9024.911EC**
CHO With Right Hand Soap Dispenser
Less Overflow

**Model 9024.914EC**
4" Centers With Right Hand Soap Dispenser
Less Overflow

**Model 9024.921EC**
CHO With Left Hand Soap Dispenser
Less Overflow

**Model 9024.924EC**
4" Centers With Left Hand Soap Dispenser
Less Overflow

# Company


| | |
|---|---|
| **Company** | Leonard Valve Company |
| **Address** | 1360 Elmwood Avenue, Cranston, RI 02910 |
| **Phone** | (800) 222-1208 |
| **Fax** | (401) 941-5310 |
| **Email** | info@leonardvalve.com |
| **Site** | www.leonardvalve.com |


# Recommended Model

### PNV-125-LF - Proton Electronic Mixing Valve

In support of various states Low Lead laws, Leonard is pleased to offer the new Nucleus line of electronic mixing valves. These valves have all been certified as meeting the lead free requirements. Note: Lead Free is defined as “not more than a weighted average of 0.25 percent when used with respect to the wetted surfaces of pipes and pipe fittings, plumbing fittings, and fixtures”. In addition, these valves are all listed to the stringent performance requirements of the ASSE 1017 Standard. Leonard’s Proton models give plumbing engineers outlet temperature control within +/- 2F from set point, regardless of demand. Features include user programmable set point, integral daily sweep.

https://www.leonardvalve.com/products/lines/228/product/4728

# Alternative Models

### Megatron PNV-125-LF - Proton Electronic Mixing Valve

https://www.leonardvalve.com/products/lines/228/product/4872

# Information

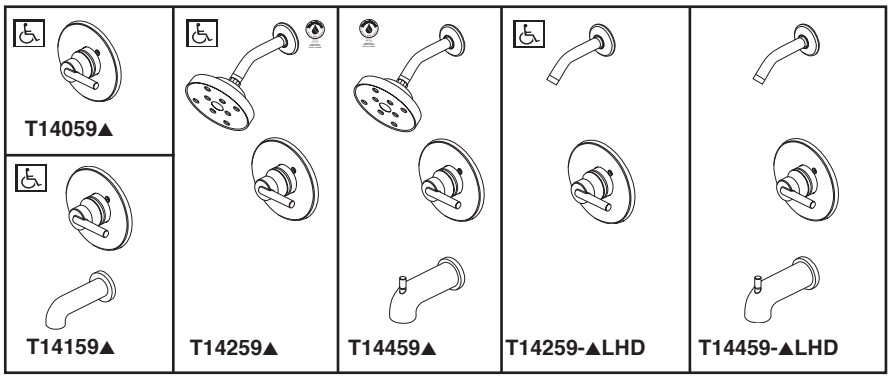
| | |
|---|---|
| **Technology** | Digital |
| **Facility** | School |
| **Job Name** | null |
| **Units** | Standard |

# Fixtures

| | |
|---|---|
| **Commercial Washing Machine** | 2 |
| **Lavatory: Private - LEED (0.5 GPM)** | 16 |
| **Lavatory: Public - LEED (0.5 GPM)** | 18 |
| **Sink: Classroom** | 29 |
| **Sink: Slop** | 2 |

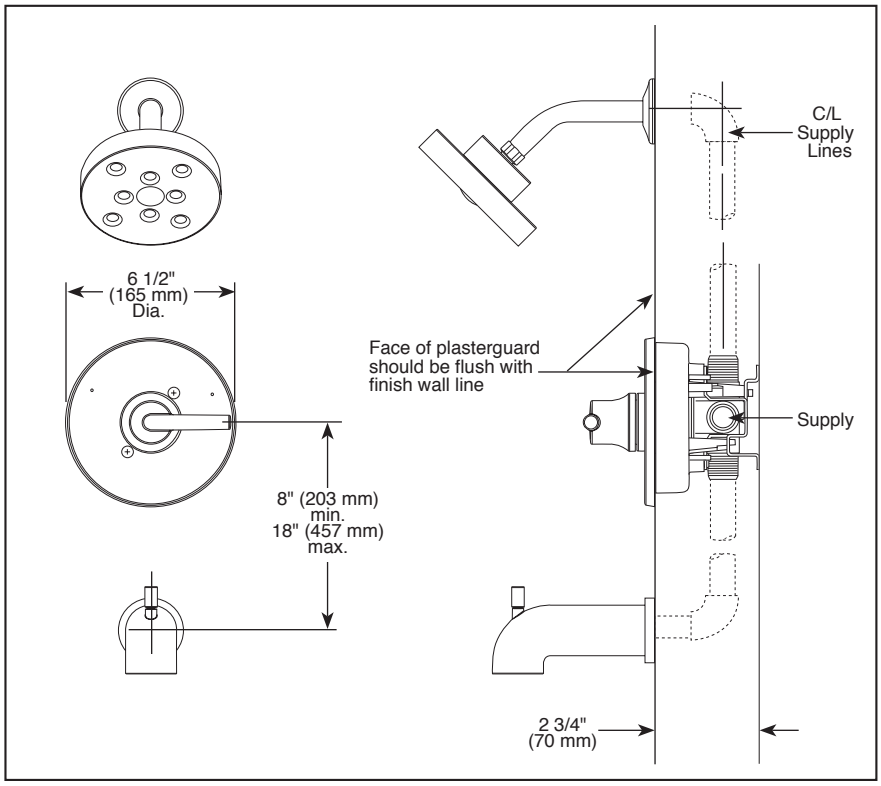
# Parameters

| | |
|---|---|
| **Max Flow** | 20.12 |
| **Pressure Drop** | 5 |
| **Minimal Flow** | 20 |
| **Additional Flow** | 0 |

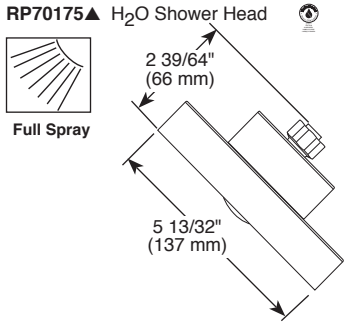



**Submitted Model No.:**_____

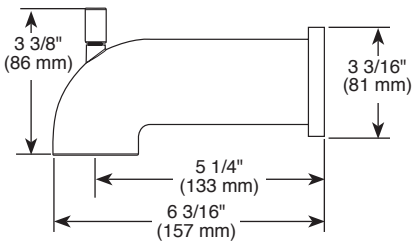
**Specific Features:** _____



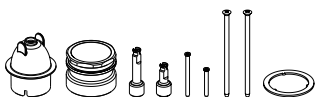

**RP70175▲** $H_2O$ Shower Head



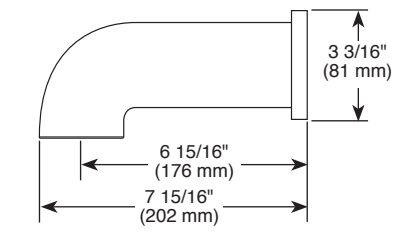

**RP73371▲** Pull-Up Diverter




**RP77991** Available Extension Kit



**RP77350▲** No Diverter




▲ Designate Proper Finish Suffix

Delta reserves the right (1) to make changes in specifications and materials, and (2) to change or discontinue models, both without notice or obligation. Dimensions are for reference only. See current full-line price book or www.deltafaucet.com for finish options and product availability.

DSP-B-T14059 Rev. L

see what Delta can do™

# TUB AND SHOWER FAUCET TRIM

- Trinsic® Bath Collection
- Valve Only (T14059)
- Tub Only (T14159)
- Shower Only (T14259)
- Tub/Shower (T14459)

## FEATURES:

- Monitor® 14 Series pressure balanced single handle bath mixing valve trim
- Single function $H_2O$kinetic® Technology shower head

## STANDARD SPECIFICATIONS:

- Maintains a balanced pressure of hot and cold water even when a valve is turned on or off elsewhere in the system
- For use with MultiChoice® Universal rough valve body (R10000 Series)
- Temperature only controlled with handle
- Field adjustable means to limit handle rotation into hot water zone
- 120° maximum handle rotation
- Maximum 1.75 gpm @ 80 psi, 6.6 L/min @ 550 kPa
- Tub port maximum flow rate 6.0 gpm @ 60 psi with R10000-UNBX
- Shower arm overall horizontal length = 5 1/2" (138 mm), including threaded ends
- Red/blue pad print temperature indicators on escutcheon
- "-LHD" models indicate less showerhead
- 1/2" CWT slip-on spout adapter
- Stem extension kit RP77991 can be ordered to allow for an additional 1 3/4" wall thickness. RP77991 ships with chrome escutcheon screws. For special finishes also order RP12630 escutcheon screws in desired finish.

## WARRANTY

- Parts and Finish - Lifetime limited warranty; or for commercial purchasers, 10 years for multi-family residential (apartments and condominiums) and 5 years for all other commercial uses, in each case from the date of purchase.
- Electronic Parts and Batteries (if applicable) - 5 years from the date of purchase; or for commercial purchasers, 1 year from the date of purchase. No warranty is provided on batteries.

## COMPLIES WITH:

- ASME A112.18.1 / CSA B125.1
- ASSE 1016
- Indicates compliance to ICC/ANSI A117.1 - Valve control only
- EPA WaterSense®

**Delta Faucet Company**
55 E. 111th Street, Indianapolis, IN 46280
350 South Edgeware Road, St. Thomas, ON N5P 4L1

American Standard

Style That Works Better

BARRIER FREE

# PRINCETON™ RECESS BATH

**AMERICAST® BRAND ENGINEERED MATERIAL**

## PRINCETON™ RECESS BATH

Americast® brand engineered material

- Acid resistant porcelain finish
- Recess bath with integral apron and tiling flange
- Integral lumbar support
- Beveled headrest
- Full slip-resistant coverage
- End drain outlet
- Integral base

❑ **2390.202** Left Hand Outlet

❑ **2390.202TC** Same as above with Tub Cover

❑ **2391.202** Right Hand Outlet

❑ **2391.202TC** Same as above with Tub Cover

### With Integral Overflow

- Lift and turn drain stopper assembly included with bath
- Escutcheon included and installed on bath

❑ **2390.202 ICH** (Chrome Trim) Left Hand Outlet

❑ **2390.202 ICHTC** Same as above with Tub Cover

❑ **2391.202 ICH** (Chrome Trim) Right Hand Outlet

❑ **2391.202 ICHTC** Same as above with Tub Cover

### For Above Floor Rough Installation

❑ **2392.202** Left Hand Outlet for above floor installation

❑ **2392.202TC** Same as above with Tub Cover

❑ **2393.202** Right Hand Outlet for above floor installation

❑ **2393.202TC** Same as above with Tub Cover

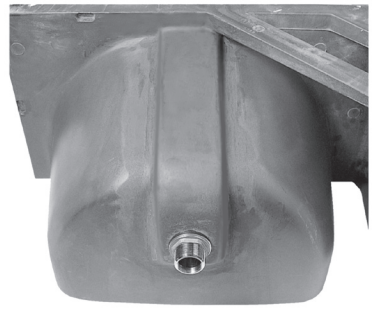
**Nominal Dimensions:**
1524 x 762 x 356mm
(60" x 30" x 14")

**Above Floor Rough Dimensions:**
1524 x 762 x 445mm
(60" x 30" x 17-1/2")

**Bathing Well Dimensions:**
1423 x 635 x 337mm
(56" x 25" x 13-1/4")

**Compliance Certifications -**
**Meets or Exceeds the Following Specifications:**
- ASME A112.19.4 for Americast Plumbing Fixtures
- ASTM F-462 for Slip-resistant Bathing Facilities
- ANSI Z124.1 Ignition Test
- ASTM E162 for Flammability
- NFPA 258 for Smoke Density

**With Integral Overflow**



Photograph details integral overflow and drain assembly. Drain assembly included with bath.

**To Be Specified:**
❑ Color:
❑ Bath Filler: (specify finish)
❑ Bath Drain: (included)

To Be Specified - Optional:
❑ Pressure Test Kit†: 791363-0070A for integral overflow models only

*See faucet section for additional models available

† When system pressure test is required, the pressure test kit is necessary to seal overflow and perform test.

Americast® brand engineered material is a composition of porcelain bonded to enameling grade metal, bonded to a patented structural composite.

**MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 REQUIREMENTS FOR ACCESSIBLE AND USEABLE BUILDING FACILITIES-CHECK LOCAL CODES. INSTALL WITH SEAT AT HEAD END.**

SEE REVERSE FOR PRODUCT DIMENSIONS AND SPECIFICATIONS





Revised 8/12

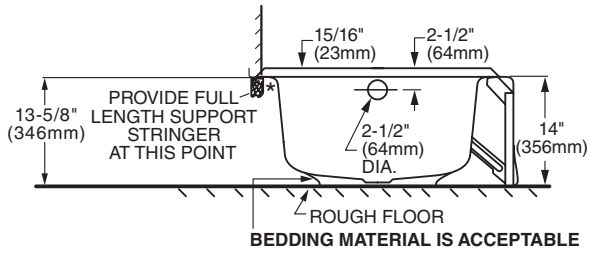
American Standard

Style That Works Better

BARRIER FREE

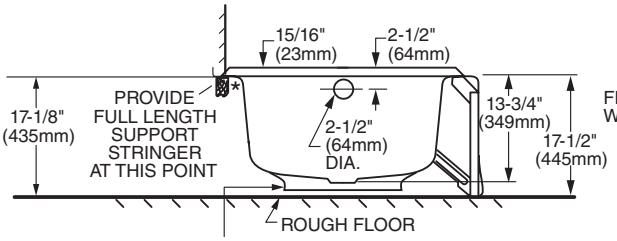
# PRINCETON™ RECESS BATH

**AMERICAST® BRAND ENGINEERED MATERIAL**




**BEDDING MATERIAL IS ACCEPTABLE**

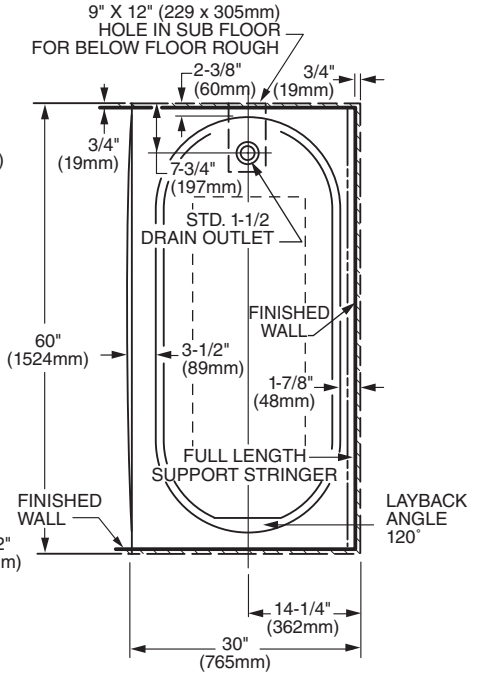
**BELOW FLOOR ROUGH**
**2390.202 2391.202**




**BEDDING MATERIAL IS ACCEPTABLE**

**ABOVE FLOOR ROUGH**
**2392.202 2393.202**

***PLUMBER NOTE:** PROVIDE FULL LENGTH SUPPORT STRINGER AT THIS POINT



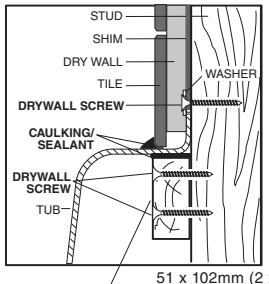

**LEFT HAND TUB ILLUSTRATED**
**RIGHT HAND TUB IS REVERSED**

| *GENERAL SPECIFICATIONS FOR 2390/2391 BATHING POOL* | |
|---|---|
| INSTALLED SIZE | 60 x 30 x 14 In. (1524 x 762 x 356mm) |
| WEIGHT | 110 Lbs. (50 Kg.) |
| WEIGHT w/WATER | 460 Lbs. (209 Kg.) |
| GAL. TO OVERFLOW | 42 Gal. (159 L) |
| BATHING WELL AT SUMP | 42 x 19 In. (1067 x 483mm) |
| BATHING WELL AT RIM | 56 x 25 In. (1423 x 635mm) |
| WATER DEPTH TO OVERFLOW | 9-1/2 In. (241mm) |
| FLOOR LOADING | 37 Lbs./Sq.Ft. (175 Kgs./Sq.m) |
| (PROJECTED AREA) | |
| PTS. | 6.2 |
| CUBE ($FT^3$) | 18.1 |

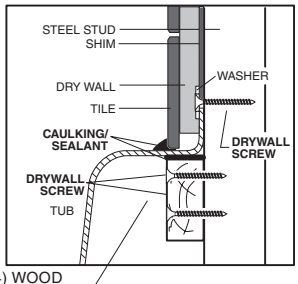
| *GENERAL SPECIFICATIONS FOR 2392/2393 BATHING POOL* | |
|---|---|
| INSTALLED SIZE | 60 x 30 x 17-1/2 In. (1524 x 762 x 445mm) |
| WEIGHT | 119 Lbs. (54 Kg.) |
| WEIGHT w/WATER | 469 Lbs. (213 Kg.) |
| GAL. TO OVERFLOW | 42 Gal. (159 L) |
| BATHING WELL AT SUMP | 42 x 19 In. (1067 x 483mm) |
| BATHING WELL AT RIM | 56 x 25 In. (1423 x 635mm) |
| WATER DEPTH TO OVERFLOW | 9-1/2 In. (241mm) |
| FLOOR LOADING | 38 Lbs./Sq.Ft. (182 Kgs./Sq.m) |
| (PROJECTED AREA) | |
| PTS. | 7.4 |
| CUBE ($FT^3$) | 21.2 |

*Below is shown typical cross sections of the tub rim showing typical wall constructions.*

**WOOD STUDS**




**STEEL STUDS**




51 x 102mm (2 x 4) WOOD
STRINGER FULL LENGTH

**NOTES:**

LEFT HAND OUTLET SHOWN, RIGHT HAND REVERSE DIMENSIONS. (2391.202.ICH).

DRAIN AND OVERFLOW ESCUTCHEON INCLUDED WITH BATH. REFER TO INSTALLATION INSTRUCTIONS SUPPLIED WITH BATH FOR DRAIN INSTALLATION.

BATH FAUCET NOT INCLUDED AND MUST BE ORDERED SEPARATELY.

REFER TO INSTALLATION INSTRUCTIONS SUPPLIED WITH FITTING.

CONCEALED PIPING NOT FURNISHED.

PROVIDE SUITABLE REINFORCEMENT FOR ALL WALL SUPPORTS.

■ REFER TO INSTALLATION INSTRUCTIONS SUPPLIED WITH BATH.

**IMPORTANT:** Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.4 These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided leaflet.

# SELECTRONIC® SENSOR-OPERATED URINAL FLUSH VALVE, 0.125 GPF
## BATTERY POWERED

**GENERAL DESCRIPTION:**
Exposed, sensor-operated Selectronic® Urinal Flush Valve for 3/4" top spud urinals. CR-P2 lithium battery powered.

**PRODUCT FEATURES:**
- **Factory-Installed CR-P2 Lithium Battery**
- **Pressure Compensation** feature ensures accurate flush volume regardless of inlet water pressure
- **Self-Cleaning Piston** with integral wiper spring significantly reduces clogging and maintenance
- **No Routine Maintenance** no diaphragms to replace; no filters to clean
- **Selectronic® Proximity System** with universal sensor provides hygienic, "hands free" operation
- **State-of-the-Art Electronics** prevent ghost flushing
- **Dezincification Resistant** brass alloy
- **Fully Mechanical Manual Override Button** can flush the valve without power
- **Fail-Safe:** Valve automatically closes upon loss of power or water pressure and does not need to be reset
- **Adjustable Sanitary Flush** cleans the fixture & maintains the trap seal.
- **Stadium Feature:** Valve automatically switches to water savings mode during periods of heavy usage
- **Chemical Resistant EPDM Seals** for extended life
- **High Back Pressure Vacuum Breaker**
- **Adjustable Tailpiece**
- **Range can be adjusted manually or with optional remote control**
- **No external volume adjustment.**
- **Can be installed left or right handed**

**MODEL NUMBER:**

❑ **6063.013.002** Exposed, sensor-operated flush valve for 3/4" top spud urinals, 0.125 gpf.

Inlet includes 3/4" sweat solder kit and angle stop with back flow protection and vandal-resistant cap.

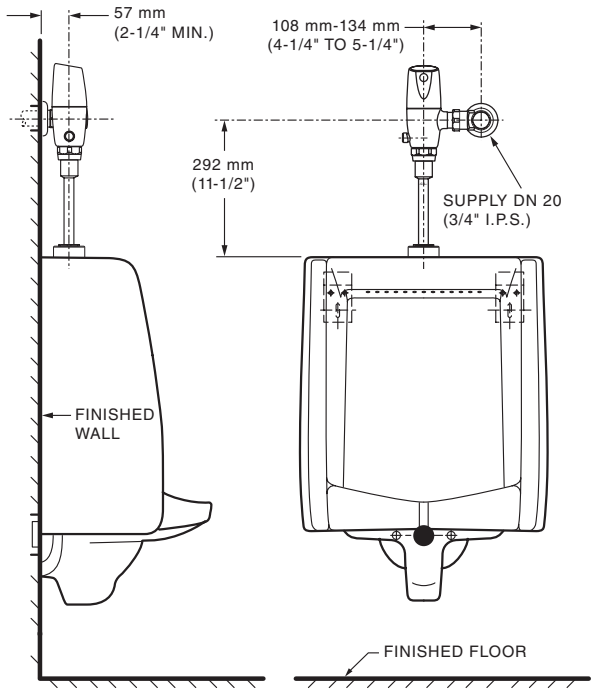
Outlet includes 3/4" high back pressure vacuum breaker with spud coupling and flange.

**OPERATING PRESSURE:**
20 psi (flowing) - 80 psi (static)

**FLOW REQUIREMENT:**
10 gpm (37.9 L/min.)

**BATTERY LIFE:**
4 years @ 4,000 flushes per month

**OPTIONAL ACCESSORY:**
- Cast wall flange with set screw (6065816.002)
- 12-1/2" long vacuum breaker (M964446-0020A) - 4" longer than standard

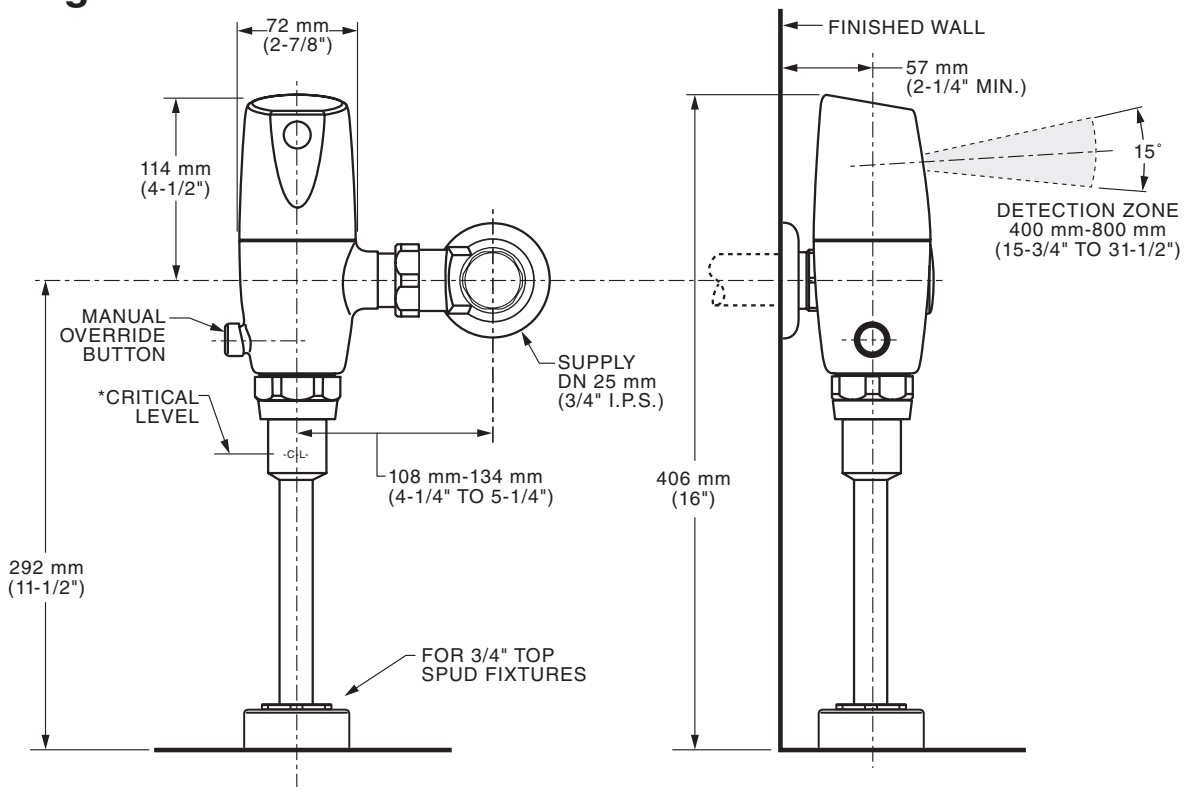



**RECOMMENDED SPECIFICATION:**
Electronic, sensor activated urinal flush valve shall feature self-cleaning piston valve with integral wiper spring in refill orifice to prevent clogging. Includes a factory-installed CR-P2 lithium battery and fully mechanical manual override that can flush the valve without power. Includes dezincification-resistant brass valve body and metal cover with chrome finish. Includes angle stop with back-flow protection & vandal-resistant cap. Sweat solder kit and high back pressure vacuum breaker also included. 0.125 gpf / 0.5 Lpf flush valve shall be American Standard Model # 6063.013.002.

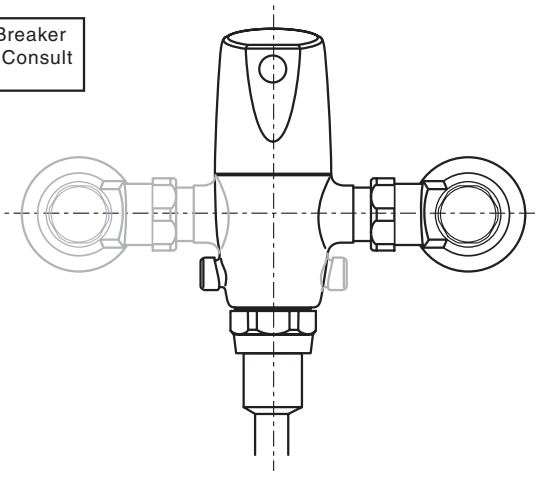
# SELECTRONIC® SENSOR-OPERATED URINAL FLUSH VALVE, 0.125 GPF
## BATTERY POWERED

**LISTINGS:**
- ASSE 1037
- ANSI/ASME A112.19.2
- ADA Compliant

## Roughing-in Dimensions




*Note: The Critical Line (-C-L-) on Vacuum Breaker must typically be 6" (152mm) above fixture. Consult Codes for details.



**Right or Left Hand Installation**

**MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 REQUIREMENTS FOR ACCESSIBLE AND USABLE BUILDING FACILITIES-CHECK LOCAL CODES**

PART OF LIXIL

American Standard

BARRIER FREE

# WASHBROOK® FloWise® UNIVERSAL URINAL
VITREOUS CHINA WITH EVERCLEAN®

## WASHBROOK® FloWise® UNIVERSAL URINAL WITH EVERCLEAN®

- Vitreous china
- **Permanent EverClean® surface inhibits the growth of stain and odor causing bacteria, mold and mildew on the surface**
- Ultra High Efficiency, Low Consumption. Operates in the range of 0.125gpf to 1.0gpf (0.5 Lpf to 3.8 Lpf)
- Flushing rim
- Elongated 14" rim from finished wall
- Washout flush action
- Extended sides for privacy
- 3/4" inlet spud
- Outlet connection threaded 2" inside (NPTF)
- 2 wall hangers
- Fixture only
- Strainer included
- Meets ASME flush requirements at 0.125 to 1.0 gpf

❏ **6590.001EC** Universal Top spud with EverClean

**Nominal Dimensions:**
360 x 480 x 664mm
(14-1/8" x 18-7/8" x 26-1/8")

Recommended working pressure – between 20 psi at valve when flushing and 80 psi static

**Compliance Certifications -**
**Meets or Exceeds the Following Specifications:**
- ASME A112.19.2-2008/CSA B45.1-08 for Vitreous China Fixtures

SEE REVERSE FOR ROUGHING-IN DIMENSIONS

**To Be Specified:**
❏ Color: ❏ White
❏ Flush Valve:

1.0 gpf Flush Valve: Sensor-Operated:
❏ American Standard Selectronic® #6063.101.002 DC Power (Top Spud)

1.0 gpf Flush Valve: Manual-Operated:
❏ American Standard # 6045.101.002

0.5 gpf Flush Valve: Sensor-Operated:
❏ American Standard Selectronic® #6063.051.002 DC Power (Top Spud)

0.5 gpf Flush Valve: Manual-Operated:
❏ American Standard #6045.051.002

0.125 gpf Flush Valve: Sensor-Operated:
❏ American Standard Selectronic® #6063.013.002 DC Power (Top Spud)

0.125 gpf Flush Valve: Manual-Operated:
❏ American Standard #6045.013.002

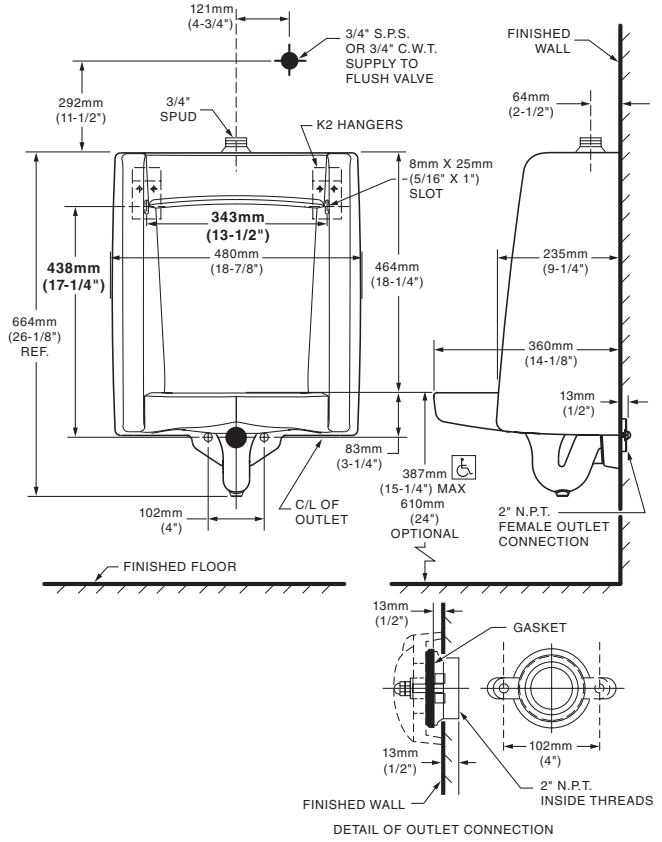
WaterSense Meets EPA Criteria
Certified by IAPMO R&T
When used with 0.125 gpf or 0.5 gpf urinal flush valves

EVERCLEAN® Surface

# WASHBROOK® FloWise® UNIVERSAL URINAL

**VITREOUS CHINA WITH EVERCLEAN®**

## 6590.001EC TOP SPUD




DETAIL OF OUTLET CONNECTION

**MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 ACCESSIBLE AND USABLE BUILDINGS AND FACILITIES - CHECK LOCAL CODES.**

- When installed so top of rim is 387mm (15-1/4") from finished floor.

**NOTES:**
FLUSH VALVE NOT INCLUDED AND MUST BE ORDERED SEPARATELY.
PROVIDE SUITABLE REINFORCEMENT FOR ALL WALL SUPPORTS.

**IMPORTANT**: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

American Standard

BARRIER FREE

# AFWALL® MILLENNIUM™ FloWise® ELONGATED FLUSHOMETER TOILET

**VITREOUS CHINA with EVERCLEAN®**

## AFWALL® MILLENIUM™ FloWise® ELONGATED FLUSHOMETER TOILET with EVERCLEAN®

- Wall-mounted flushometer valve toilet
- Vitreous china
- High Efficiency, Low Consumption. Operates in the range of 1.1 gpf to 1.6 gpf (4.2 Lpf to 6.0 Lpf)
- Meets definition of HET (High Efficiency Toilet) when used with a high efficiency flush valve (1.1 gpf - 1.6 gpf or 1.28/1.1 gpf dual flush)
- Maximum Performance (MaP) score of 1,000 grams at 1.1 gpf - 1.6 gpf
- Permanent EverClean® antimicrobial surface inhibits the growth of stain- and odor-causing bacteria, mold, and mildew on the surface
- Condensation channel
- Concealed trapway design
- Elongated bowl
- Powerful direct-fed siphon jet action
- 1-1/2" inlet spud
- Fully-glazed 2-1/8" trapway
- 10" x 12" water surface area
- Static weight load of 1,000 lbs.*
- 100% factory flush tested

❑ **3351.101** Elongated bowl only, top spud
❑ **3352.101** Elongated bowl only, top spud with slotted rim for bedpan holding
❑ **3353.101** Elongated bowl only, back spud
❑ **3354.101** Elongated bowl only, back spud with slotted rim for bedpan holding

**System MaP* Score:**
- 1,000 grams of miso @ 1.1 gpf to 1.6 gpf when used with an American Standard flush valve

* Maximum Performance (MaP) testing performed by IAPMO R&T Lab. MaP Report conducted by Veritec Consulting, Inc. and Koeller and Company.

**Component Parts:**
❑ **047007-0070A** Inlet Spud (furnished with bowl)

**Nominal Dimensions:**
660 x 356 x 381mm
(26" x 14" x 15")

Recommended working pressure–between 25 psi at valve when flushing and 80 psi static

Fixture only, less seat, bolt caps, and flushometer valve

**Compliance Certifications -**
**Meets or Exceeds the Following Specifications:**
- ASME A112.19.2/CSA B45.1 for Vitreous China Fixtures

* This product is not recommended for bariatric use.

SEE REVERSE FOR ROUGHING-IN DIMENSIONS

**To Be Specified:**
❑ Color: ❑ White
❑ Seat:
- ❑ American Standard #5901.100 Heavy duty open front less cover
- ❑ American Standard #5905.100 Extra heavy duty open front less cover

❑ Flushometer Valve:
- ❑ 1.6 gpf:
  - ❑ Sensor-Operated: American Standard Selectronic® DC Power #6065.161.002 (Top Spud) AC Power #6067.161.002 (Top Spud)
  - ❑ Manual: American Standard #6047.161.002 (Top Spud)
- ❑ 1.28 gpf:
  - ❑ Sensor-Operated: American Standard Selectronic® DC Power #6065.121.002 (Top Spud) AC Power #6067.121.002 (Top Spud)
  - ❑ Manual: American Standard #6047.121.002 (Top Spud)
- ❑ 1.6 / 1.1 gpf Dual Flush:
  - ❑ Sensor-Operated: American Standard Selectronic® DC Power #6065.761.002 (Top Spud) AC Power #6067.761.002 (Top Spud)
- ❑ 1.28 / 1.1 gpf Dual Flush:
  - ❑ Sensor-Operated: American Standard Selectronic® DC Power #6065.721.002 (Top Spud) AC Power #6067.721.002 (Top Spud)

**MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 REQUIREMENTS FOR ACCESSIBLE AND USABLE BUILDING FACILITIES - CHECK LOCAL CODES.**
- When installed so top of seat is 432 to 483mm (17" to 19") from the finished floor.

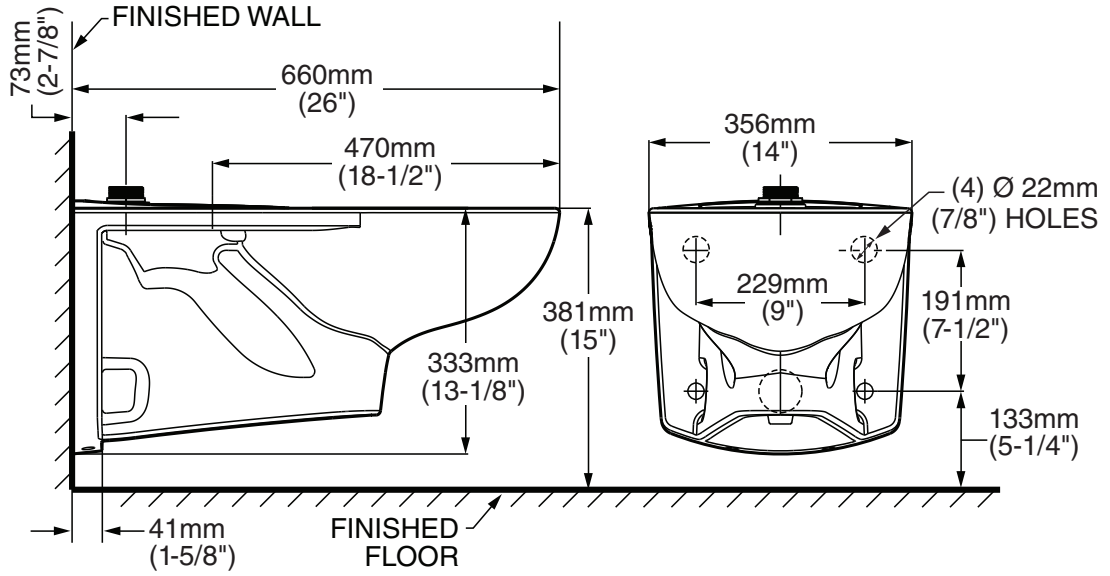
EVERCLEAN® Surface

WATER EFFICIENT PRODUCT

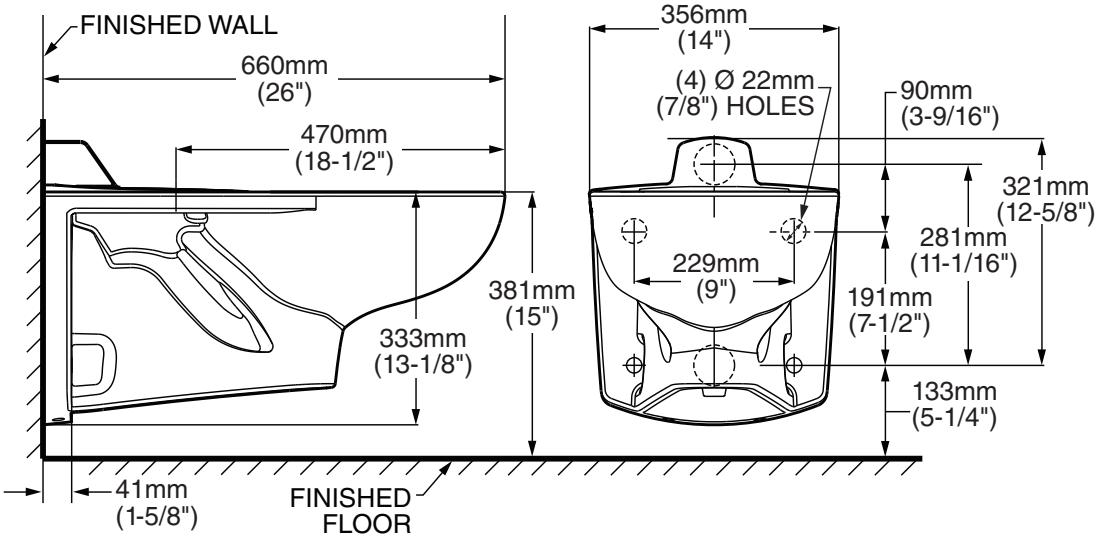
# AFWALL® MILLENNIUM™ FloWise® ELONGATED FLUSHOMETER TOILET

**VITREOUS CHINA with EVERCLEAN®**

**3351.101/3352.101**




**3353.101/3354.101**




**NOTES:**

● **Toilet designed to meet ADA accessibility standards when top of seat height set at 432 to 483mm (17" to 19") from finished floor.**

PRODUCT 3351 AND 3353 SHOWN, 3352 AND 3354 SAME EXCEPT WITH SLOTTED RIM FOR BED PAN HOLDING.
**WASTE OUTLET SEAL RING MUST BE NEOPRENE OR GRAPHITE-FELT (WAX RING NOT RECOMMENDED).**
SUGGESTED 2mm (1/16) CLEARANCE BETWEEN FACE OF WALL AND BACK OF BOWL.
TO COMPLY WITH AREA CODE GOVERNING THE HEIGHT OF VACUUM BREAKER ON THE FLUSHOMETER VALVE, THE PLUMBER MUST VERIFY DIMENSIONS SHOWN FOR SUPPLY ROUGHING.
FLUSHOMETER VALVE NOT INCLUDED WITH FIXTURE AND MUST BE ORDERED SEPARATELY.
CARRIER FITTING AS REQUIRED TO BE FURNISHED BY OTHERS.
PROVIDE SUITABLE REINFORCEMENT FOR ALL WALL SUPPORT.

**IMPORTANT:** Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages

American Standard
Style That Works Better

# BABY DEVORO™ FloWise®
# ROUND FRONT FLUSHOMETER TOILET
**VITREOUS CHINA**

## BABY DEVORO™ FloWise® 10" HIGH ROUND FRONT

❑ **2282.001**
- Floor mount flushometer valve toilet
- Vitreous china
- High Efficiency, Low Consumption. Operates in the range of 1.28 gpf to 1.6 gpf (4.9 Lpf to 6.0 Lpf)
- Meets definition of HET (High Efficiency Toilet) when used with a 1.28 gpf high efficiency flush valve
- 10-1/4" rim height
- 10" roughing-in
- Round front bowl
- Siphon jet action
- Fully glazed trapway
- 1-1/2" inlet spud
- 2 color-matched bolt caps
- 100% factory flush tested

**Component parts:**
❑ **047007-0070A** Inlet spud (furnished with bowl)
❑ **481310-100** Bolt caps with retainers (furnished with bowl)

**Nominal Dimensions:**
595 x 347 x 260mm
(23-1/2" x 13-1/8" x 10-1/4")

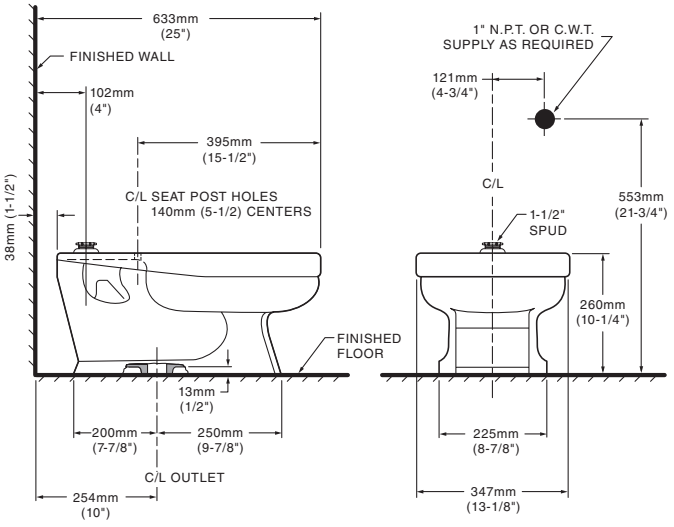
Recommended working pressure – between 25 psi at valve when flushing and 80 psi static

Fixture only, less seat, bolt caps, and flush valve

**Compliance Certifications -**
**Meets or Exceeds the Following Specifications:**
- ASME A112.19.2-2008 / CSA B45.1-08 for Vitreous China Fixtures

**System MaP* Score:**
- 800 grams of miso @ 1.28 gpf

* Maximum Performance (MaP) testing performed by IAPMO R&T Lab. MaP Report conducted by Veritec Consulting, Inc. and Koeller and Company.




**To Be Specified:**
❑ Color: ❑ White
❑ Seat: Olsonite #126-CC open front seat less cover
❑ Seat: Church #1580C open front seat less cover
❑ Alternate Seat:
  ❑ American Standard 5385.010 seat and cover
❑ Flush Valve
  1.6 gpf:
  ❑ Sensor-Operated: American Standard Selectronic® DC Power #6065.161.002 (Top Spud)
  ❑ Manual: American Standard #6047.161.002 (Top Spud)
  1.28 gpf:
  ❑ Sensor-Operated: American Standard Selectronic® DC Power #6065.121.002 (Top Spud)
  ❑ Manual: American Standard #6047.121.002 (Top Spud)

**NOTES:**
TO COMPLY WITH AREA CODE GOVERNING THE HEIGHT OF VACUUM BREAKER ON FLUSH VALVE, THE PLUMBER MUST VERIFY DIMENSIONS SHOWN FOR SUPPLY ROUGHING. FLUSH VALVE NOT INCLUDED AND MUST BE ORDERED SEPARATELY.
THIS TOILET IS DESIGNED TO ROUGH-IN AT A MINIMUM DIMENSION OF 254MM (10") FROM FINISHED WALL TO C/L OF OUTLET.

**IMPORTANT**: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

WATER EFFICIENT PRODUCT

American Standard
Style That Works Better

# SELECTRONIC™ FloWise®
# TOILET FLUSH VALVE
## BATTERY POWERED, SENSOR OPERATED, 1.28 GPF

**GENERAL DESCRIPTION:**
Exposed, Battery Powered, Sensor Operated Selectronic™ Water Closet Flush Valve for floor-mounted or wall-hung 1-1/2" top spud bowls.

Inlet includes 1" I.P.S. angle stop with back-flow protection, vandal-resistant cap, sweat solder kit, cover tube and wall flange.

Outlet includes 1-1/2" vacuum breaker with adjustable tailpiece, spud coupling and flange.

**PRODUCT FEATURES:**
- Electronic flush valve with Selectronic™ proximity system for “Hands Free” operation
- Self-Cleaning Piston operation helps prevent clogging and reduces maintenance
- Positive seal ensures leak-free performance
- Fully mechanical Manual Override Button can flush toilet during a power outage
- Range can be adjusted manually or by remote control
- Sensor & electronic controls are fully enclosed and water resistant
- Automatically flushes after 24 hours of non-use to maintain trap seal
- Safety timer helps prevent vandalism by turning off the valve if sensor is covered for more than 1 minute
- 3-second Flush Delay
- Low Battery indicator
- Battery can be changed without turning off the water
- Factory-installed 6V lithium battery included
- Can be installed left or right-handed
- ADA compliant

**MODEL NUMBER:**

- ❑ **6065.121.002** Flush Valve for 11-1/2" Supply C\L to top of bowl, 1.28 gpf
- ❑ **6065.122.002** Flush Valve for 27" Supply C\L to top of bowl, 1.28 gpf
- ❑ **6065.525.002** Retrofit for Existing Flush Valves, 1.28 gpf. Replaces industry standard manual and electronic valves. Does not include the vacuum breaker assembly, angle stop or sweat solder kit.

**OPERATING PRESSURE:**
Overall Range: 20-125 psi**
Recommended: 25 psi (flowing)-80 psi (static)

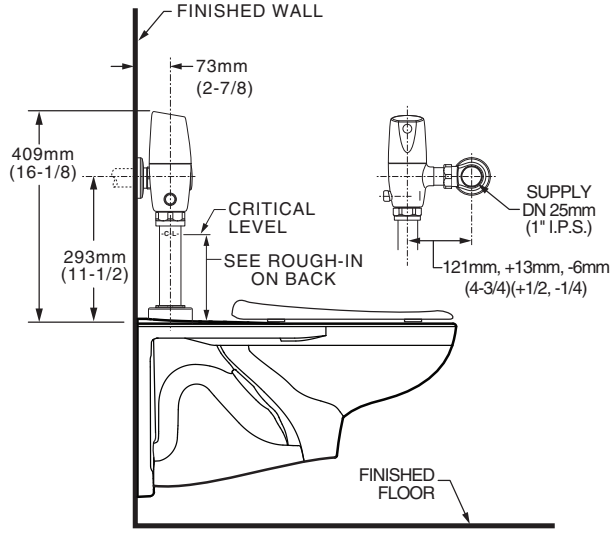
**FLOW REQUIREMENT:**
25gpm (94.6 L/min.)

** Water pressure over 80 psi is not recommended for most plumbing fixtures.

**BATTERY LIFE:**
Up to 4-year life, (approx. 200,000 cycles)

**ACCESSORIES:**
- Cast wall flanges (3/4", 1" & 1-1/2")
- Solid ring pipe supports (2-1/2" & 6" C-E)
- Split ring pipe supports (2-1/2" & 6" C-E)

**TYPICAL WATER CLOSET INSTALLATION:**
**AFWALL™ TOILET SHOWN**




**RECOMMENDED SPECIFICATION:**
Electronic proximity infrared sensor activated toilet flush valve shall feature self-cleaning piston valve. Includes a fully mechanical manual over-ride that can provide a complete flush without battery power. Includes cast brass valve body and metal cover with chrome finish, vandal resistant stop cap and lithium battery. Angle stop with back-flow protection and vacuum breaker included. 1.28 gpf / 4.8 Lpf Flush valve shall be American Standard Model # 6065.12_.002.

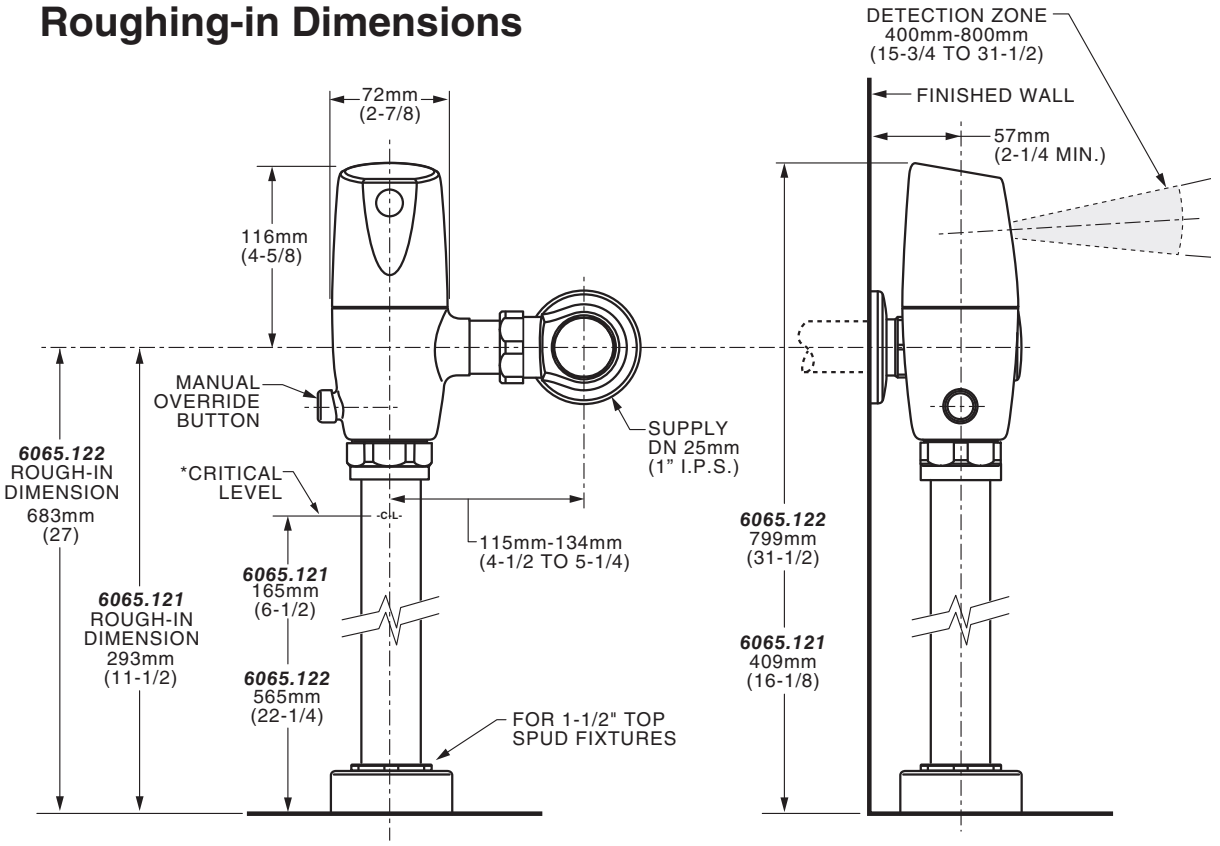
American Standard
Style That Works Better

# SELECTRONIC™ FloWise® TOILET FLUSH VALVE

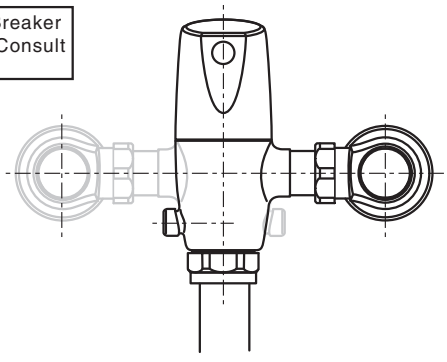
## BATTERY POWERED, SENSOR OPERATED, 1.28 GPF

**LISTINGS:**
- ASSE 1037
- ANSI/ASME A112.19.2
- ADA Compliant

## Roughing-in Dimensions




*Note: The Critical Line (-C-L-) on Vacuum Breaker must typically be 6" (152mm) above fixture. Consult Codes for details.



**Right or Left Hand Installation**

KOHLER®

# Wellworth®
Class Five® Toilet
**K-3575**

## Features
- Two-piece toilet.
- Elongated bowl offers added room and comfort.
- 1.28 gallons per flush (gpf).
- Standard left-hand trip lever included.
- Combination consists of the K-4436 tank and the K-4198 bowl.
- Coordinates with other products in the Wellworth collection.

## Technology
- Single-flush gravity uses the force of gravity and a precision-engineered tank, bowl, and trapway to create a strong siphon during flushing.
- KOHLER's canister flush valve harnesses the natural force of gravity and optimizes flushing performance.
- Class Five® flushing technology offers virtually plug-free performance and rinsing power for a clean bowl.

## Installation
- Standard 12-inch rough-in.
- Seat and supply line not included.

## Water Conservation & Rebates
- WaterSense® toilets meet strict EPA flushing guidelines, including using at least 20 percent less water than 1.6-gallon toilets.
- Eligible for consumer rebates in some municipalities.
- This product meets water savings requirements for CALGreen and Colorado SB 14-103.

## Recommended Accessories
K-4636 Cachet® Quiet-Close™ Elongated Toilet Seat
K-5588 Purefresh® Elongated Toilet Seat
K-4108 C3®-230 Elongated Cleansing Toilet Seat
K-5420 Low-Profile Bolt Caps
K-9380-L Left-Hand Trip Lever
1023457 Wax Ring/Hardware Kit
1265114 Connector Hose

## Components
Product includes:
K-4198 Elongated Bowl
K-4436 Toilet Tank
Additional included component/s: Tank cover, Trip lever, Bolt cap accessory pack, and Tank accessory pack.

## Codes/Standards
ASME A112.19.2/CSA B45.1
DOE - Energy Policy Act 1992
EPA WaterSense®

## KOHLER® One-Year Limited Warranty
See website for detailed warranty information.

## Available Color/Finishes
*Color tiles intended for reference only.*

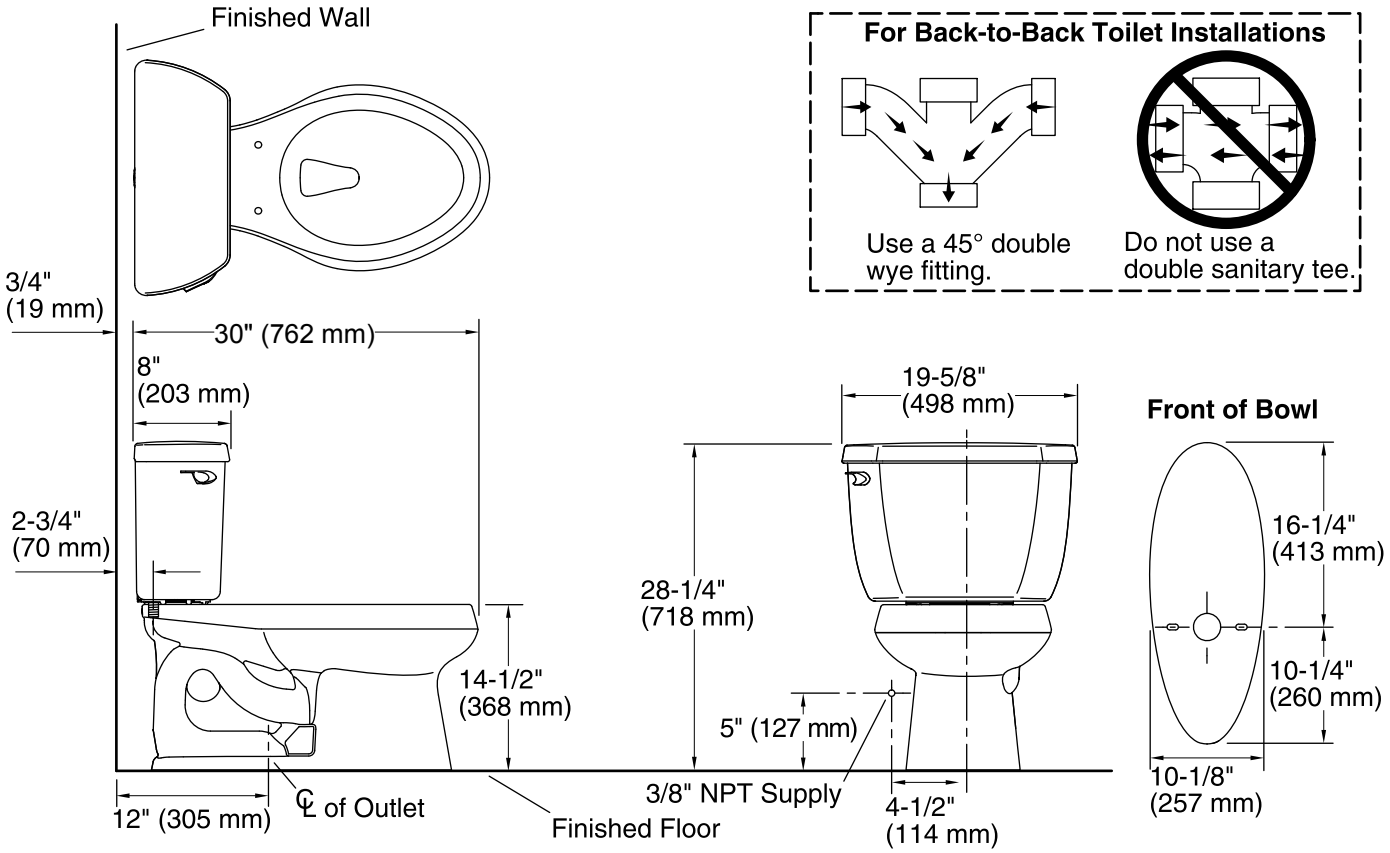
| Color | Code | Description |
|---|---|---|
| | 0 | White |
| | 96 | Biscuit |
| | 47 | Almond |
| | 7 | Black Black™ |

KOHLER®

# Wellworth®

Class Five® Toilet

**K-3575**




## Technical Information

All product dimensions are nominal.

| | |
|---|---|
| Toilet type: | Two-piece, Floor-mount |
| Waste Outlet: | Floor |
| Bowl shape: | Elongated front |
| Flush type: | Class Five® |
| Trap passageway: | 2-1/8" (54 mm) |
| Water Consumption Full: | 1.28 gpf (4.8 lpf) |
| Water surface size: | 11-1/4" x 8-1/4" (286 mm x 210 mm) |
| Rim to water surface: | 5-1/4" (133 mm) |
| Rough-in: | 12 |
| Seat-mounting holes: | 5-1/2" (140 mm) |

## Notes

Install this product according to the installation instructions.

For back-to-back toilet installations: Use only a 45° double wye fitting.

# SELECTRONIC® SENSOR-OPERATED TOILET FLUSH VALVE, 1.28 GPF
## BATTERY POWERED

Certified by IAPMO R&T

### GENERAL DESCRIPTION:
Exposed, sensor-operated Selectronic® Toilet Flush Valve for floor-mounted or wall-hung 1-1/2" top spud bowls. CR-P2 lithium battery powered.

### PRODUCT FEATURES:
- **Factory-Installed CR-P2 Lithium Battery**
- **Self-Cleaning Piston** with integral wiper spring significantly reduces clogging and maintenance
- **No Routine Maintenance:** no diaphragms to replace; no filters to clean
- **Selectronic® Proximity System** with universal sensor provides hygienic, "hands free" operation
- **State-of-the-Art Electronics** prevent ghost flushing
- **Dezincification Resistant** brass alloy
- **Fully Mechanical Manual Override Button** can flush the valve without power
- **Fail-Safe:** Valve automatically closes upon loss of power or water pressure and does not need to be reset
- **Adjustable Sanitary Flush** cleans the fixture & maintains the trap seal.
- **Chemical Resistant EPDM Seals** for extended life
- **High Back Pressure Vacuum Breaker**
- **Adjustable Tailpiece**
- **Range can be adjusted manually or with optional remote control**
- **No external volume adjustment.**
- **Can be installed left or right handed**

### MODEL NUMBER:

❑ **6065.121.002** Exposed, sensor-operated flush valve for 1-1/2" top spud flushometer bowls, 1.28 gpf.

Inlet includes 1" sweat solder kit and angle stop with back flow protection and vandal-resistant cap.

Outlet includes 1-1/2" high back pressure vacuum breaker with spud coupling and flange.

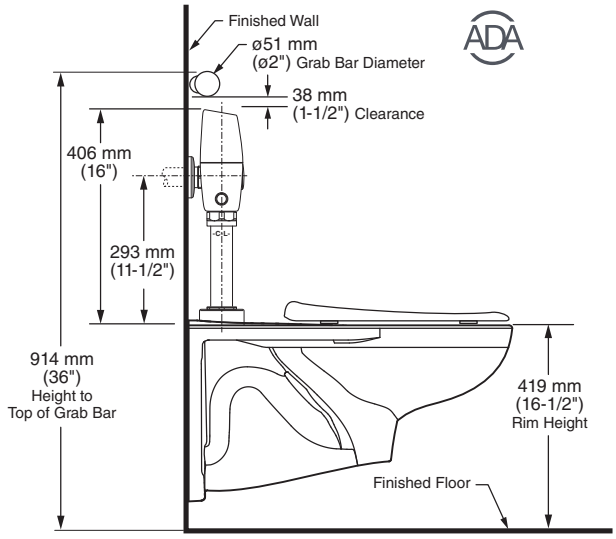
### OPERATING PRESSURE:
25 psi (flowing) - 80 psi (static)

### FLOW REQUIREMENT:
25 gpm (94.6 L/min.)

### BATTERY LIFE:
4 years @ 4,000 flushes per month

### OPTIONAL ACCESSORIES:
- Cast wall flange: 1" (6065.810)
- Split ring pipe supports: 2-1/2" C-E (6065.822) & 6" C-E (6065.862)

### ADA WATER CLOSET INSTALLATION: AFWALL® TOILET SHOWN




** Flush Valve can be installed to meet ADA 2010 Section 609 when installed as shown

### RECOMMENDED SPECIFICATION:
Electronic, sensor activated toilet flush valve shall feature self-cleaning piston valve with integral wiper spring in refill orifice to prevent clogging. Includes a factory-installed CR-P2 lithium battery and fully mechanical manual override that can flush the valve without power. Includes dezincification-resistant brass valve body and metal cover with chrome finish. Includes angle stop with back-flow protection & vandal-resistant cap. Sweat solder kit and high back pressure vacuum breaker also included. 1.28 gpf / 4.8 Lpf flush valve shall be American Standard Model # 6065.121.002.

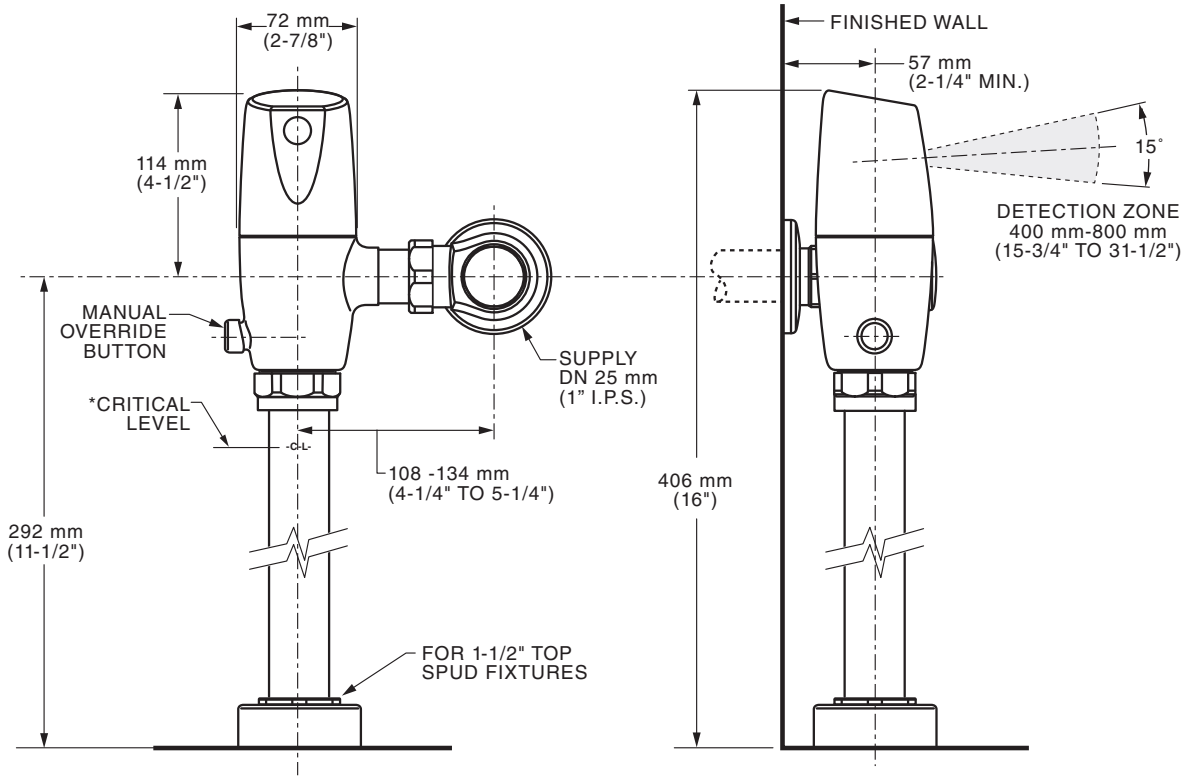
# SELECTRONIC® SENSOR-OPERATED TOILET FLUSH VALVE, 1.28 GPF

## BATTERY POWERED

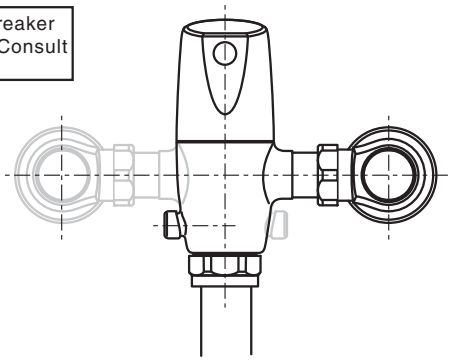
**LISTINGS:**

- ASSE 1037
- ANSI/ASME A112.19.2
- ADA Compliant

## Roughing-in Dimensions




*Note: The Critical Line (-C-L-) on Vacuum Breaker must typically be 6" (152 mm) above fixture. Consult Codes for details.



**Right or Left Hand Installation**

**MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 REQUIREMENTS FOR ACCESSIBLE AND USABLE BUILDING FACILITIES-CHECK LOCAL CODES**

PART OF LIXIL

# THERM-X-TROL® STL (CL) SERIES

## THERMAL EXPANSION ABSORBERS

## INSTALLATION & OPERATION INSTRUCTIONS

AMTROL®

## Models ST-35L(CL) through ST-600L(CL)
## Partial Aceptance Bladder Models

**NOTE:** Inspect for shipping damage and notify freight carrier or store where purchased immediately if damage is present. To avoid risk of personal injury and property damage, if the product appears to be malfunctioning or shows signs of corrosion, call a licensed professional immediately. Current copies of the Product manual can be viewed at www.amtrol.com. Use proper safety equipment when installing.

**THIS IS THE SAFETY ALERT SYMBOL. IT IS USED TO ALERT YOU TO POTENTIAL PERSONAL INJURY AND OTHER HAZARDS. OBEY ALL SAFETY MESSAGES THAT FOLLOW THIS SYMBOL TO REDUCE THE RISK OF PERSONAL INJURY AS WELL AS PROPERTY DAMAGE.**

**⚠WARNING** **READ CAREFULLY THE PRODUCT INSTALLATION & OPERATION INSTRUCTIONS. FAILURE TO FOLLOW THE INSTRUCTIONS AND WARNINGS MAY RESULT IN SERIOUS OR FATAL INJURY AND/OR PROPERTY DAMAGE, AND WILL VOID THE PRODUCT WARRANTY. THIS PRODUCT MUST BE INSTALLED BY A LICENSED PROFESSIONAL. FOLLOW ALL APPLICABLE LOCAL AND STATE CODES AND REGULATIONS. IN THE ABSENCE OF SUCH CODES, FOLLOW THE CURRENT EDITIONS OF THE NATIONAL PLUMBING CODE AND NATIONAL ELECTRIC CODE, AS APPLICABLE.**

**⚠WARNING** **EXPLOSION OR RUPTURE HAZARD. THE EXPANSION TANK MUST BE OPERATED SO THAT THE PRESSURE DOES NOT EXCEED THE MAXIMUM WORKING PRESSURE.**

**⚠WARNING** **EXPLOSION HAZARD.** Failure to follow the instructions in the accompanying product manual can cause a rupture or explosion; possibly causing serious or fatal injury, leaking or flooding and/or property damage.

**⚠WARNING** Use only with potable water system. Do not operate in a setting with freezing temperatures or where the temperature can exceed 240°F and do not exceed the maximum working pressure specified for this Product in the Manual. Mount vertically only.

**⚠WARNING** **Chlorine & Aggressive Water:** The water quality can significantly influence the life of this Product. You should test for corrosive elements, acidity, total solids and other relevant contaminants, including chlorine and treat your water appropriately to insure satisfactory performance and prevent premature failure.

**⚠WARNING** This Product, like most Products under pressure, may over time corrode. weaken and burst or explode, causing serious or fatal injury, leaking or flooding and/or property damage. To minimize risk, a licensed professional must install and periodically inspect and service the Product. A drip pan connected to an adequate drain must be installed if leaking or flooding could cause property damage. Do not locate in an area where leakage of the tank or connections could cause property damage to the area adjacent to the appliance or to lower floors of the structure.

**⚠WARNING** Do not expose Product to freezing temperatures or temperatures in excess of 240° F. Do not adjust the pre-charge or re-pressure this Product except for any adjustments required at the time of initial installation, especially if Product corroded, damaged or with diminished integrity. Adjustments to pre-charge must be done at ambient temperature only. Failure to properly size the Product or follow these instructions may result in excessive strain on the system lead to Product failure, serious or fatal personal injury, leakage and/or property damage.

**⚠WARNING** **EXPLOSION OR RUPTURE HAZARD** A relief valve must be installed to prevent pressure in excess of local code requirement or maximum working pressure designated in the Product Manual, whichever is less. At least once every 3 years or if discharge is present, a licensed contractor should inspect the temperature and pressure relief valve and replace if corrosion is evident or the valve does not function. **FAILURE TO INSPECT THIS VALVE AS DIRECTED COULD RESULT IN UNSAFE TEMPERATURE OR PRESSURE BUILD-UP WHICH CAN RESULT IN PRODUCT FAILURE, SERIOUS INJURY OR DEATH AND/OR SEVERE PROPERTY DAMAGE AND VOID THE PRODUCT WARRANTY.**

**⚠WARNING** This product can expose you to chemicals including lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

# PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

**IMPORTANT GENERAL SAFETY INFORMATION -**
**ADDITIONAL SPECIFIC SAFETY ALERTS APPEAR IN THE FOLLOWING INSTRUCTIONS.**

**⚠WARNING FAILURE TO PROPERLY SEAL WILL RESULT IN LOSS OF PRECHARGE CAUSING PRODUCT TO FAIL.**

## Installation

**⚠WARNING THIS PRODUCT MUST BE INSTALLED BY A LICENSED PROFESSIONAL.**

1. Visually inspect THERM-X-TROL for any damage. If damage exists return product for replacement.
2. Adjust pre-charge to equal incoming pressure.

> ⚠ **IMPORTANT**: If increasing pre-charge pressure above 55 psig the following steps must be followed:
>
> a. Tank must be connected to the system with isolation valve open.
>
> b. System must be pressurized to 55-60 psig or slightly higher than the pre-charge setting of the tank.
>
> c. Isolation valve needs to be shut.
>
> d. Pre-charge pressure of tank can now be increased to the recommended high pressure setting.
>
> e. Bring system up to pressure, and then open the isolation valve to the tank.
>
> **Failure to follow these steps could result in damage to the bladder and void all warranties.**

3. Replace and tighten plastic cap on air fitting.
4. Install the THERM-X-TROL on the city supply line to the water heater at a point between the water heater and backflow preventer, check valve or pressure reducing valve (see Figure 1).
5. Once the THERM-X-TROL is installed, check the city supply line for any leakage. Make repairs if necessary.
6. Before the initial firing of the water heater, open any hot water fixture and draw water until all air is removed from the system. Turn the water heater temperature control to desired ending temperature level, (see water heater instructions).
7. To relieve initial thermal expansion, slightly open a hot water faucet. Continue until water heater aquastat temperature is satisfied. Once heater is at its operating range, no further bleeding of expanded water is required.
8. The system water heater and THERM-X-TROL will now be operational. The THERM-X-TROL will control pressure increases caused by thermal expansion to a level well below the water heater relief valve setting.

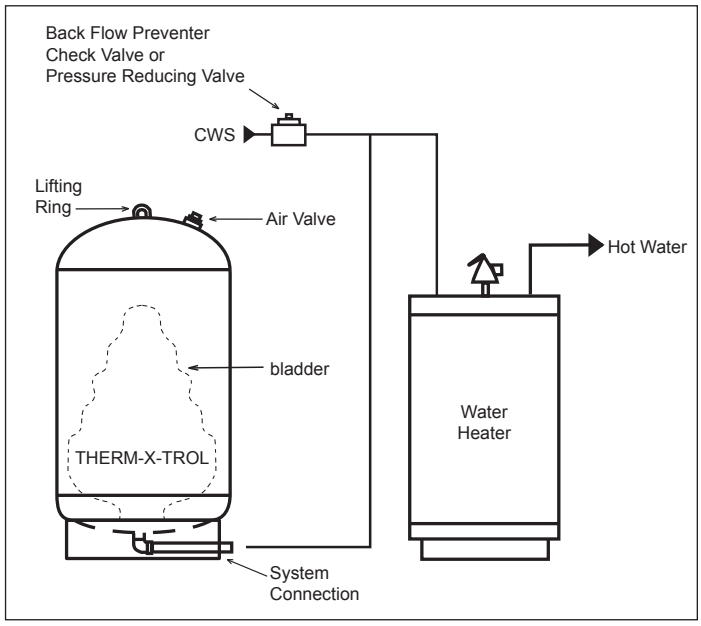
## Maintenance

1. A licensed professional should check the complete heating system, including the THERM-X-TROL, yearly and more frequently as the system ages.

## Operation

1. The THERM-X-TROL is installed in the supply line between the backflow preventer and the water heater. Its sealed-in air pre-charge prevents water from entering it until the system pressure exceeds the pre-charge pressure.
2. As the water temperature rises, expanded water enters the THERM-X-TROL's non-corrosive water reservoir. The pre-charged air chamber absorbs the pressure increase, keeping system pressures below the relief valve setting.
3. As hot water is used, the pressure in the air chamber forces water back into the system until the THERM-X-TROL is empty. At this point, the pressure in the air chamber once again equals the supply pressure.
4. Water treatment is not to exceed 200° F or fall below 35° F.

Figure 1.




## Warranty

ST-35L(CL) through ST-600L(CL) Models:
One (1) Year Limited Warranty

**Visit www.amtrol.com for complete warranty details.**

WORTHINGTON INDUSTRIES

1400 Division Road, West Warwick, RI USA 02893
T: 800.426.8765 **www.amtrol.com**

MADE IN USA



Part #: 9017-118 (06/19)

# THERM-X-TROL®

Thermal Expansion: Full Acceptance Bladder ST-440C and ST-450C Series ASME

## 150 PSIG Working Pressure

### Construction

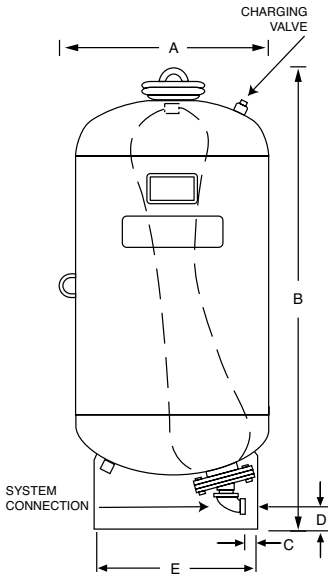
| | |
|---|---|
| Shell | Steel |
| Bladder Material | Heavy Duty Butyl NSF/ANSI 61 |
| Bladder Thickness | .100 In Minimum |
| System Connection | Bronze |
| Finish | Red Oxide Primer |
| Air Valve | Schrader Valve w/ EPDM Seat |
| Factory Precharge | 25 PSIG (1.7 bar) |

### Performance

| | |
|---|---|
| Maximum Operating Temperature | 240°F (115°C) |
| Maximum Working Pressure | 150 PSIG (10.3 bar) |
| Warranty | 1-Year |

### Application

- For use in closed, potable water systems to control pressure build-up.
- Full acceptance replaceable bladder design.
- Optional sight glass and seismic restraints available.
- Designed and constructed per ASME Code Section VIII, Division 1.




### ASME Models

| Model Number | Tank Volume | | Max. Accept. Factor | A Tank Diameter | | B Tank Height | | C System Conn. Height | | D Conn. Centerline | | E Stand Diameter | | System Conn. (NPTF) | Shipping Weight | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gal | Lit | | In | mm | In | mm | In | mm | In | mm | In | mm | In | Lbs | Kg |
| ST-447C | 53 | 200 | 1.0 | 24 | 610 | 45 | 1143 | 2 | 51 | 3¾ | 95 | 19 | 483 | 2 | 262 | 119 |
| ST-448C | 80 | 300 | 1.0 | 24 | 610 | 59 | 1498 | 2 | 51 | 3¾ | 95 | 19 | 483 | 2 | 340 | 154 |
| ST-449C | 106 | 400 | 1.0 | 24 | 610 | 73 | 1854 | 2 | 51 | 3¾ | 95 | 19 | 483 | 2 | 360 | 163 |
| ST-450C | 132 | 500 | 1.0 | 24 | 610 | 87 | 2210 | 2 | 51 | 3¾ | 95 | 19 | 483 | 2 | 400 | 181 |
| ST-451C | 158 | 600 | 1.0 | 30 | 762 | 73 | 1854 | 3½ | 89 | 5½ | 140 | 24 | 610 | 2 | 587 | 266 |
| ST-452C | 211 | 800 | 1.0 | 30 | 762 | 91 | 2311 | 3½ | 89 | 5½ | 140 | 24 | 610 | 2 | 625 | 283 |
| ST-453C | 264 | 1000 | 1.0 | 36 | 914 | 86 | 2184 | 4½ | 114 | 7 | 178 | 30 | 762 | 3 | 760 | 345 |
| ST-454C | 317 | 1200 | 1.0 | 36 | 914 | 98 | 2438 | 4½ | 114 | 7 | 178 | 30 | 762 | 3 | 850 | 386 |
| ST-455C | 370 | 1400 | 1.0 | 36 | 914 | 110 | 2794 | 4½ | 114 | 7 | 178 | 30 | 762 | 3 | 935 | 424 |
| ST-456C | 422 | 1600 | 1.0 | 48 | 1219 | 82 | 2083 | 7½ | 191 | 7⅛ | 178 | 42 | 1067 | 3 | 1423 | 645 |
| ST-457C | 528 | 2000 | 1.0 | 48 | 1219 | 97 | 2464 | 7½ | 191 | 7⅛ | 178 | 42 | 1067 | 3 | 1505 | 683 |

All dimensions and weights are approximate.

Job Name _____ Notes _____

Engineer _____ _____

Contractor _____ _____

P.O. No. _____ _____

Sales Rep. _____ _____

Model No. _____ _____

NSF Certified to NSF/ANSI/CAN 61 BLADDER ONLY

ISO 9001:2015 CERTIFIED

LOW-LEAD IAPMO R&T

# Commercial Gas Water Heaters

## CYCLONE® Mxi MODULATING

### MODULATING BURNER ADVANCES THE CYCLONE TO HIGHER LEVELS OF EFFICIENCY

The full line of A. O. Smith Cyclone Mxi condensing water heaters has been designed to provide years of dependable service and feature industry leading technology. Models are available from 120,000 to 500,000 Btu/h and all deliver thermal efficiencies of 95% and higher. The unique helical coil heat exchanger limits weld joints for optimal service life while maximizing heat transfer.

Cyclone is the industry leader in high efficiency commercial water heating. The current Mxi modulating models adjust firing rate to the specific demand further increasing efficiency and money savings.

#### INTELLIGENT CONTROL SYSTEM WITH TOUCH SCREEN DISPLAY AND ICOMM CONNECTIVETY ONBOARD*

- Exclusive A. O. Smith designed color touch display control system
- Provides detailed water heater status information
- Precise temperature control adjustable from 90 to 180 degrees
- Built-in diagnostics
- Run history information
- *Cyclone Mxi models manufactured March 1, 2018 to present come standard with iCOMM Wi-Fi connectivety onboard. Remotely monitor and adjust the water heater via the A. O. Smith app. No charge connectivety using Wi-Fi or Ethernet connection.
- Intelligent Demand Response (IDR) feature senses large water draws and automatically adjusts the differential setpoint. This feature increases the hot water available when it is needed the most.

#### SUBMERGED COMBUSTION CHAMBER, WITH HELICAL HEAT EXCHANGER COIL

- Positioned in center of tank, surrounded by water to virtually eliminate radiant heat loss from chamber
- Direct spark ignition
- Spiral heat exchanger keeps hot burner gases swirling, uses centrifugal force to maximize efficiency of heat transfer to water in tank
- Spiral heat exchanger reduces lime scale from forming on water-side surfaces, which maintains energy efficiency over time

#### POWERED ANODES STANDARD ON ALL MODELS

- Provides long-lasting tank protection in varying water conditions
- Powered anodes are non-sacrificial
- Automatically adjusts output needed to properly protect the tank

#### PERMAGLAS® ULTRA COAT™ GLASS LINING

- Glass coating is applied using a liquid slush coating technique to ensure uniform coating
- Heat exchanger coil is glassed both externally and internally for optimum protection

#### MECHANICAL VENTING VERSATILITY

- Conventional power venting or direct venting
- Vents vertically or through a sidewall
- Front located exhaust and condensate connections allow for easy install and access
- Vents with low cost PVC Schedule 40 intake and exhaust pipe. Approved for optional CPVC Schedule 40, Polypropylene and AL29-4C stainless steel vent materials
- Direct-vent intake and exhaust pipe can terminate separately outside building or through single opening, using concentric vent assembly
- Canadian installations require ULC S636 PVC/ CPVC, ULC S636 Polypropylene and AL29-4C stainless steel pipe for intake and exhaust

#### HIGH EFFICIENCY MODULATING PRE-MIX POWERED BURNER

- Down-fired pre-mix burner provides optimum efficiency and quiet operation
- Top-mounted burner position prevents condensation from affecting burner operation

#### 3-YEAR LIMITED TANK / 1-YEAR LIMITED PARTS WARRANTY

- For complete warranty information, consult written warranty or go to hotwater.com

**BTH-120(A) THROUGH BTH-500(A)**
**MODEL SHOWN:**
**BTH-199(A) SERIES 300/301**

Low Lead Content · ENERGY STAR · CERTIFIED WATER QUALITY · HLW · GAS-FIRED LISTED · iCOMM · AHRI CERTIFIED www.ahridirectory.org · ASME (Optional)



**www.hotwater.com | 800-527-1953 Toll-Free USA | A. O. Smith Corporation | 500 Tennessee Waltz Parkway | Ashland City, TN 37015**

# Commercial Gas Water Heaters

## OTHER FEATURES:

### SPACE-SAVING DESIGN FOR INSTALLATION FLEXIBILITY

- Easy-to-remove top cover for convenient access to serviceable parts
- 0″ installation clearances on sides and rear, 1-1/2″ installation clearance on top
- Handhole cleanout allows easy access to tank interior for cleaning
- 0″ clearance to combustibles, approved for installation on combustible floors

### CODES AND STANDARDS

- CSA certified and ASME rated T&P relief valve
- Maximum hydrostatic working pressure: 160 psi
- All models are design certified by Underwriters Laboratories (UL), Inc., to ANSI Z21.10.3 - CSA 4.3 Standards
- Meets the thermal efficiency and standby loss requirements of the U.S. Department of Energy and current edition ASHRAE/IES 90.1
- Design Certified by Underwriters Laboratories to NSF standard 5 for 180°F (62°C) water
- Complies with SCAQMD Rule 1146.2 and other Air Quality Management Districts with similar requirements for ultra low-NOx emissions
- ASME tank construction optional on 120-500 model sizes

### VENT REQUIREMENTS FOR BTH 120(A) - 250(A)

| Number of 90° Elbows Installed | 3 Inch Pipe | 4 Inch Pipe |
|---|---|---|
| | Maximum Feet (Meters) | Maximum Feet (Meters) |
| **One (1)** | 45 feet (13.7 meters) | 115 feet (35 meters) |
| **Two (2)** | 40 feet (12.2 meters) | 110 feet (33.5 meters) |
| **Three (3)** | 35 feet (10.7 meters) | 105 feet (32 meters) |
| **Four (4)** | 30 feet (9.1 meters) | 100 feet (30.5 meters) |
| **Five (5)** | N/A | 95 feet (29 meters) |
| **Six (6)** | N/A | 90 feet (27.4 meters) |

### VENT REQUIREMENTS FOR BTH 300(A) - 500(A)

| Number of 90° Elbows Installed | 4 Inch Pipe | 6 Inch Pipe |
|---|---|---|
| | Maximum Feet (Meters) | Maximum Feet (Meters) |
| **One (1)** | 65 feet (19.8 meters) | 115 feet (35 meters) |
| **Two (2)** | 60 feet (18.2 meters) | 110 feet (33.5 meters) |
| **Three (3)** | 55 feet (16.8 meters) | 105 feet (32 meters) |
| **Four (4)** | 50 feet (15.2 meters) | 100 feet (30.5 meters) |
| **Five (5)** | 45 feet (13.7 meters) | 95 feet (29 meters) |
| **Six (6)** | 40 feet (12.2 meters) | 90 feet (27.4 meters) |

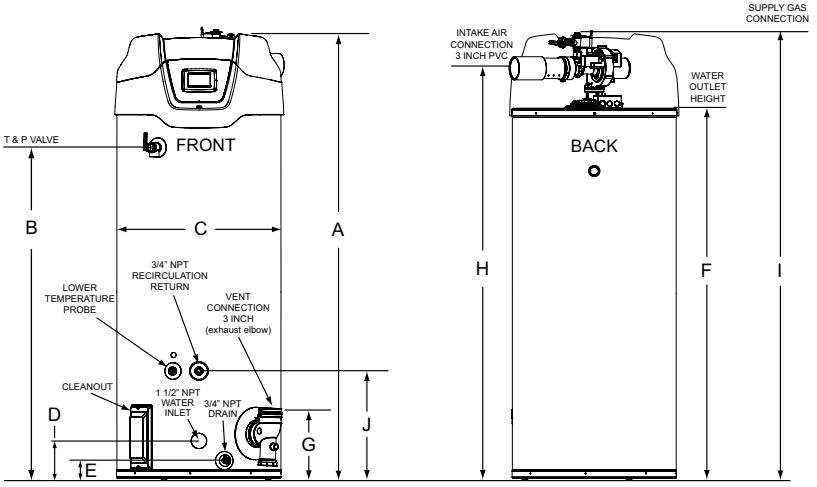
### GAS PRESSURE REQUIREMENTS

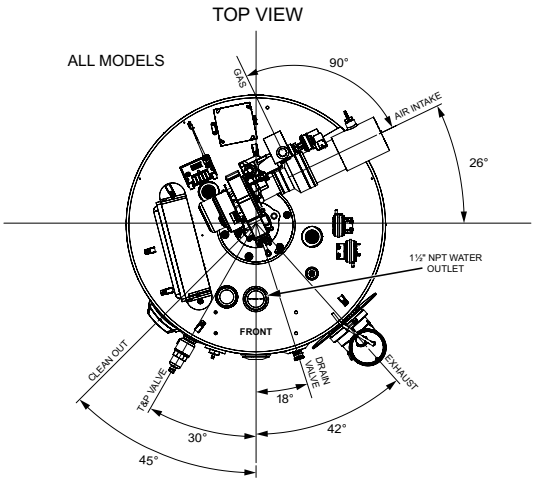
| Model Number | Manifold Pressure | | Minimum Supply Pressure | | Maximum Supply Pressure | |
|---|---|---|---|---|---|---|
| | Natural Gas | Propane Gas | Natural Gas | Propane Gas | Natural Gas | Propane Gas |
| **BTH-120(A)** | 0"W.C. (0 kPa) | 0"W.C. (0 kPa) | 3.5"W.C. (1.10 kPa) | 8.5"W.C. (2.12 kPa) | 14"W.C. (3.49 kPa) | 14"W.C. (3.49 kPa) |
| **BTH-150(A)** | 0"W.C. (0 kPa) | 0"W.C. (0 kPa) | 3.5"W.C. (1.10 kPa) | 8.5"W.C. (2.12 kPa) | 14"W.C. (3.49 kPa) | 14"W.C. (3.49 kPa) |
| **BTH-199(A)** | 0"W.C. (0 kPa) | 0"W.C. (0 kPa) | 3.5"W.C. (1.10 kPa) | 8.5"W.C. (2.12 kPa) | 14"W.C. (3.49 kPa) | 14"W.C. (3.49 kPa) |
| **BTH-250(A)** | 0"W.C. (0 kPa) | 0"W.C. (0 kPa) | 3.5"W.C. (1.10 kPa) | 8.5"W.C. (2.12 kPa) | 14"W.C. (3.49 kPa) | 14"W.C. (3.49 kPa) |
| **BTH-300(A)** | 0"W.C. (0 kPa) | 0"W.C. (0 kPa) | 4.8"W.C. (1.19 kPa) | 8.5"W.C. (2.12 kPa) | 14"W.C. (3.49 kPa) | 14"W.C. (3.49 kPa) |
| **BTH-400(A)** | 0"W.C. (0 kPa) | 0"W.C. (0 kPa) | 4.8"W.C. (1.19 kPa) | 8.5"W.C. (2.12 kPa) | 14"W.C. (3.49 kPa) | 14"W.C. (3.49 kPa) |
| **BTH-500(A)** | 0"W.C. (0 kPa) | 0"W.C. (0 kPa) | 4.8"W.C. (1.19 kPa) | 8.5"W.C. (2.12 kPa) | 14"W.C. (3.49 kPa) | 14"W.C. (3.49 kPa) |

Depending on the installed equivalent length, and/or the number of appliances connected, the supply gas line size may need to be increased beyond the minimum required size.

# Commercial Gas Water Heaters

**BTH 120-250**



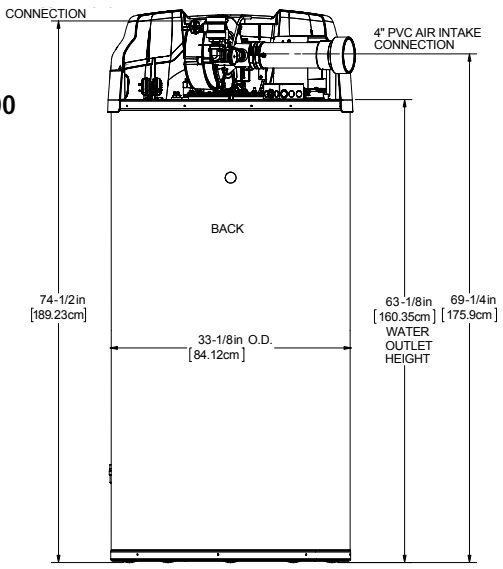

* Center line of water outlet on top of the water heaters is approximately 7 inches from the front edge of the water heater

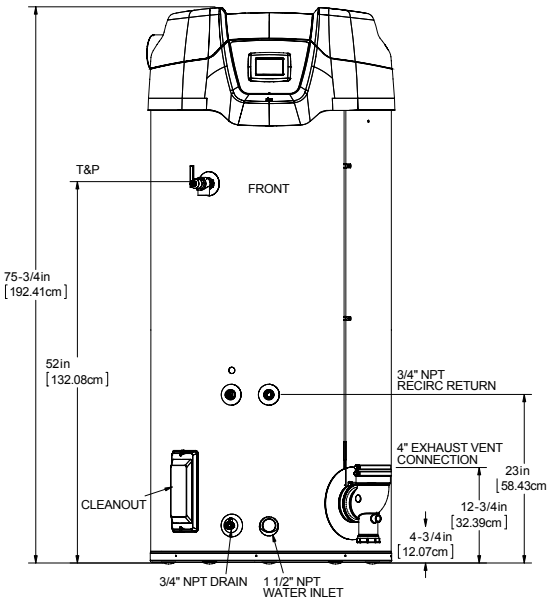
| Model Number | Approx. Capacity | | Dimensions | | | | | | | | | | lb/kg | Approx. Shipping Weight Std | Approx. Shipping Weight ASME |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | D | E | F | G | H | I | J | | | |
| **BTH-120(A)** | Gallons | 60 | 55 1/2 | 35 | 27 3/4 | 6 5/16 | 3 | 42 1/4 | 11 1/4 | 48 1/2 | 53 1/2 | 18 1/4 | lb | 460 | 490 |
| | Liters | 227 | 141 | 88.9 | 70.5 | 16 | 7.62 | 107.32 | 28.6 | 123.2 | 135.9 | 46.36 | kg | 208 | 220 |
| **BTH-150(A)** | Gallons | 100 | 76 1/2 | 56 3/8 | 27 3/4 | 6 5/16 | 3 | 64 | 11 1/4 | 70 | 75 1/2 | 18 1/4 | lb | 523 | 553 |
| | Liters | 379 | 194.9 | 143.2 | 70.5 | 16 | 7.62 | 162.6 | 28.6 | 177.8 | 191.8 | 46.36 | kg | 237 | 251 |
| **BTH-199(A)** | Gallons | 100 | 76 1/2 | 56 3/8 | 27 3/4 | 6 5/16 | 3 | 64 | 11 1/4 | 70 | 75 1/2 | 18 1/4 | lb | 523 | 553 |
| | Liters | 379 | 194.9 | 143.2 | 70.5 | 16 | 7.62 | 162.6 | 28.6 | 177.8 | 191.8 | 46.36 | kg | 237 | 251 |
| **BTH-250(A)** | Gallons | 100 | 76 1/2 | 56 3/8 | 27 3/4 | 6 5/16 | 3 | 64 | 11 1/4 | 70 | 75 1/2 | 18 1/4 | lb | 523 | 553 |
| | Liters | 379 | 194.9 | 143.2 | 70.5 | 16 | 7.62 | 162.6 | 28.6 | 177.8 | 191.8 | 46.36 | kg | 237 | 251 |

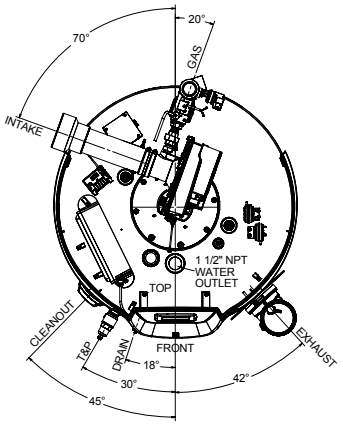
Electrical characteristics-120V-60Hz A.C., 5.0 A
"A" in model represents ASME construction
Propane gas models available
Dimensions and specifications subject to change without notice in accordance with our policy of continuous product improvement.

# Commercial Gas Water Heaters

**BTH 300-500**




| Model Number | Approx. Capacity | | Dimensions | | | | | | | | | | lb/kg | Approx. Shipping Weight Std | Approx. Shipping Weight ASME |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | D | E | F | G | H | I | J | | | |
| BTH-300(A) | Gallons | 119 | 75 3/4 | 52 | 33 1/8 | 4 3/4 | 4 3/4 | 63 1/8 | 12 3/4 | 69 1/4 | 74 1/2 | 23 | lb | 855 | 855 |
| | Liters | 450.96 | 192.41 | 132.08 | 84.12 | 12.07 | 12.07 | 160.35 | 32.39 | 175.9 | 189.23 | 58.43 | kg | 387 | 387 |
| BTH-400(A) | Gallons | 119 | 75 3/4 | 52 | 33 1/8 | 4 3/4 | 4 3/4 | 63 1/8 | 12 3/4 | 69 1/4 | 74 1/2 | 23 | lb | 855 | 855 |
| | Liters | 450.96 | 192.41 | 132.08 | 84.12 | 12.07 | 12.07 | 160.35 | 32.39 | 175.9 | 189.23 | 58.43 | kg | 387 | 387 |
| BTH-500(A) | Gallons | 119 | 75 3/4 | 52 | 33 1/8 | 4 3/4 | 4 3/4 | 63 1/8 | 12 3/4 | 69 1/4 | 74 1/2 | 23 | lb | 855 | 855 |
| | Liters | 450.96 | 192.41 | 132.08 | 84.12 | 12.07 | 12.07 | 160.35 | 32.39 | 175.9 | 189.23 | 58.43 | kg | 387 | 387 |

Electrical characteristics-120V-60Hz A.C., 5.0 A
"A" in model represents ASME construction
Propane gas models available
Dimensions and specifications subject to change without notice in accordance with our policy of continuous product improvement.

# Commercial Gas Water Heaters

## RECOVERY CAPACITY

| Model Number | Type of Gas | Input | | Thermal Efficiency |
|---|---|---|---|---|
| | | BTU/HR | kW | |
| **BTH-120(A)** | Natural/Propane | 120,000 | 35 | 95% |
| **BTH-150(A)** | Natural/Propane | 150,000 | 44 | 98% |
| **BTH-199(A)** | Natural/Propane | 199,900 | 58 | 97% |
| **BTH-250(A)** | Natural/Propane | 250,000 | 73 | 96% |
| **BTH-300(A)** | Natural/Propane | 300,000 | 88 | 96% |
| **BTH-400(A)** | Natural/Propane | 399,900 | 117 | 95% |
| **BTH-500(A)** | Natural/Propane | 499,900 | 146 | 95% |

| Model Number | U.S. GALLONS/HR AND LITRES/HR AT TEMPERATURE RISE INDICTATED | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Approx. Capacity | °F | 30°F | 40°F | 50°F | 60°F | 70°F | 80°F | 90°F | 100°F | 110°F | 120°F | 130°F | 140°F |
| | | °C | 17°C | 22°C | 28°C | 33°C | 39°C | 44°C | 50°C | 56°C | 61°C | 67°C | 72°C | 78°C |
| **BTH-120(A)** | 60 U.S. Gals. | GPH | 461 | 345 | 276 | 230 | 197 | 173 | 154 | 138 | 126 | 115 | 106 | 99 |
| | 227 Litres | LPH | 1743 | 1308 | 1046 | 872 | 747 | 654 | 581 | 523 | 475 | 436 | 402 | 374 |
| **BTH-150(A)** | 100 U.S. Gals. | GPH | 594 | 445 | 356 | 297 | 255 | 223 | 198 | 178 | 162 | 148 | 137 | 127 |
| | 379 Litres | LPH | 2248 | 1686 | 1349 | 1124 | 963 | 843 | 749 | 674 | 613 | 562 | 519 | 482 |
| **BTH-199(A)** | 100 U.S. Gals. | GPH | 783 | 588 | 470 | 392 | 336 | 294 | 261 | 235 | 214 | 196 | 181 | 168 |
| | 379 Litres | LPH | 2965 | 2224 | 1779 | 1483 | 1271 | 1112 | 988 | 890 | 809 | 741 | 684 | 635 |
| **BTH-250(A)** | 100 U.S. Gals. | GPH | 970 | 727 | 582 | 485 | 416 | 364 | 323 | 291 | 264 | 242 | 224 | 208 |
| | 379 Litres | LPH | 3670 | 2753 | 2202 | 1835 | 1573 | 1376 | 1223 | 1101 | 1001 | 918 | 847 | 786 |
| **BTH-300(A)** | 119 U.S. Gals. | GPH | 1164 | 873 | 698 | 582 | 499 | 436 | 388 | 349 | 317 | 291 | 269 | 249 |
| | 450.96 Litres | LPH | 4405 | 3304 | 2643 | 2202 | 1888 | 1652 | 1468 | 1321 | 1201 | 1101 | 1017 | 944 |
| **BTH-400(A)** | 119 U.S. Gals. | GPH | 1535 | 1151 | 921 | 767 | 658 | 576 | 512 | 460 | 419 | 384 | 354 | 329 |
| | 450.96 Litres | LPH | 5810 | 4358 | 3486 | 2905 | 2490 | 2179 | 1937 | 1743 | 1585 | 1453 | 1341 | 1245 |
| **BTH-500(A)** | 119 U.S. Gals. | GPH | 1919 | 1439 | 1151 | 959 | 822 | 720 | 640 | 576 | 523 | 480 | 443 | 411 |
| | 450.96 Litres | LPH | 7263 | 5448 | 4358 | 3632 | 3113 | 2724 | 2421 | 2179 | 1981 | 1816 | 1676 | 1556 |

Recovery capacities are based on AHRI rated thermal efficiencies.
For ASME Construction add an "A" to the end of the model number ex: BTH-120A.

## STORAGE CAPACITY

| Model Number | U.S. Gallons | Liters |
|---|---|---|
| **BTH 120** | 60 | 227 |
| **BTH 150** | 100 | 379 |
| **BTH 199** | 100 | 379 |
| **BTH 250** | 100 | 379 |
| **BTH 300** | 119 | 450.96 |
| **BTH 400** | 119 | 450.96 |
| **BTH 500** | 119 | 450.96 |

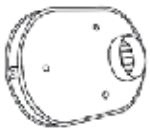
## GAS LINE CONNECTION SIZE

| Model | Series | Natural Gas | Propane Gas |
|---|---|---|---|
| **BTH 120** | 300/301 | 3/4" NPT | 3/4" NPT |
| **BTH 150** | 300/301 | 3/4" NPT | 3/4" NPT |
| **BTH 199** | 300/301 | 3/4" NPT | 3/4" NPT |
| **BTH 250** | 300/301 | 3/4" NPT | 3/4" NPT |
| **BTH 300** | 300/301 | 1-1/2" NPT | 1-1/2" NPT |
| **BTH 400** | 300/301 | 1-1/2" NPT | 1-1/2" NPT |
| **BTH 500** | 300/301 | 1-1/2" NPT | 1-1/2" NPT |

## OPTIONAL KITS

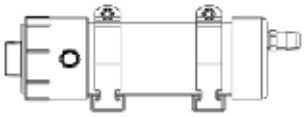
### OPTIONAL CONCENTRIC VENT KITS

- BTH-120 - 250 vent kit p/n 100111100
- BTH-300 - 500 vent kit p/n 100113124



### OPTIONAL LOW PROFILE TERMINATION VENT KITS

- 3˝ Flush Mount Vent Kit p/n 100187887
- 4˝ Flush Mount Vent Kit p/n 100187888
- 6˝ Flush Mount Vent Kit p/n 100187889



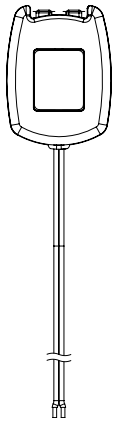
### OPTIONAL CONDENSATE NEUTRALIZATION KITS

- BTH-120-300 kit p/n 100289339
- BTH-400-500 kit p/n 100289340

### COMMON VENTING KITS FOR UP TO 3 WATER HEATERS (ONE KIT PER WATER HEATER REQUIRED)

| Kit | Description |
|---|---|
| **100227396** | PVC Common Vent Kit, 120 – 250 Models |
| **100223775** | PVC Common Vent Kit, 300 – 500 Models |
| **100227395** | Polypropylene Common Vent Kit, 120 -250 Models |
| **100223774** | Polypropylene Common Vent Kit, 300 - 500 Models |

Installations must comply with all national, state and local codes.
See kit instructions and corresponding water heater manual for detailed installation instructions and additional information.
50 Feet maximum equivalent length of straight pipe common vent and elbows
NOTE: Order 1 kit for each water heater.
See the Common Vent Kit manual or spec sheet for detailed information.



### OPTIONAL LEAK DETECTION KIT

- BTH-120 - 500 kit p/n 100302557

**SPECIFICATION**

(Natural or Propane) gas water heater(s) shall be A. O. Smith Cyclone Mxi model # _____ or equal, minimum 95% thermal efficiency, a storage capacity of _____ gallons, an input rating of _____ BTUs per hour, a recovery rating of _____ gallons per hour (gph) at 100°F rise and a maximum hydrostatic working pressure of 160 psi. Water heater(s) shall: 1. Modulating gas burner that automatically adjusts the input based on demand. 2. Powered anodes that are non sacrificial and maintenance free. 3. Have seamless glass-lined steel tank construction, with glass lining applied to all water-side surfaces after the tank has been assembled and welded; 4. Meets the thermal efficiency and/or standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IES 90.1; 5. Have foam insulation and a CSA Certified and ASME rated T&P relief valve; 6. Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up; 7. Be approved for 0˝ clearance to combustibles.

The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout. No charge connectivety shall be provided allowing for remote viewing and fault notificaion via app. 1. All models are design certified by Underwriters Laboratories (UL), Inc., according to ANSI Z21.10.3 - CSA 4.3 standards governing storage type water heaters; 2. Meet the thermal efficiency and standby loss requirements of the U. S. Department of Energy and current edition ASHRAE/IES 90.1. Complies with SCAQMD Rule 1146.2 and other air quality management districts with similar requirements for low NOx emissions.

120K-250K BTU Input: For Standard Power Venting: Water heater(s) shall be suitable for power venting using a (3˝ or 4˝) _____ diameter PVC pipe for a total distance of (50 ft or 120 ft.) _____ equivalent feet of vent piping. For Power Direct Venting: Water heater(s) shall be suitable for power direct venting using a (3˝ or 4˝) _____ diameter PVC pipe for a total distance of (50 ft or 120 ft.) _____ equivalent feet of vent piping and (50 ft. or 120 ft.)_____ equivalent feet of intake air piping.

300K - 500K BTU Input: For Standard Power Venting: Water heater(s) shall be suitable for standard power venting using a (4˝ or 6˝)_____ diameter PVC pipe for a total distance of (70 ft. or 120 ft.)_____ equivalent feet of vent piping. For Power Direct Venting: Water heater(s) shall be suitable for power direct venting using a (4˝ or 6˝) _____ diameter PVC pipe for a total distance of (70 ft or 120 ft.) _____ equivalent feet of vent piping and (70 ft. or 120 ft.)_____ equivalent feet of intake air piping.

Operation of the water heater(s) in a closed system where thermal expansion has not been compensated for (with a properly sized thermal expansion tank) will void the warranty.

**For Technical Information, call 800-527-1953. A. O. Smith Corporation reserves the right to make product changes or improvements without prior notice.**

# Cut Sheets

# Water Heaters & Calculations

# THERM-X-TROL® STL (CL) SERIES

## THERMAL EXPANSION ABSORBERS

## INSTALLATION & OPERATION INSTRUCTIONS

AMTROL®

## Models ST-35L(CL) through ST-600L(CL)
## Partial Aceptance Bladder Models

**NOTE:** Inspect for shipping damage and notify freight carrier or store where purchased immediately if damage is present. To avoid risk of personal injury and property damage, if the product appears to be malfunctioning or shows signs of corrosion, call a licensed professional immediately. Current copies of the Product manual can be viewed at www.amtrol.com. Use proper safety equipment when installing.

**THIS IS THE SAFETY ALERT SYMBOL. IT IS USED TO ALERT YOU TO POTENTIAL PERSONAL INJURY AND OTHER HAZARDS. OBEY ALL SAFETY MESSAGES THAT FOLLOW THIS SYMBOL TO REDUCE THE RISK OF PERSONAL INJURY AS WELL AS PROPERTY DAMAGE.**

**⚠WARNING** **READ CAREFULLY THE PRODUCT INSTALLATION & OPERATION INSTRUCTIONS. FAILURE TO FOLLOW THE INSTRUCTIONS AND WARNINGS MAY RESULT IN SERIOUS OR FATAL INJURY AND/OR PROPERTY DAMAGE, AND WILL VOID THE PRODUCT WARRANTY. THIS PRODUCT MUST BE INSTALLED BY A LICENSED PROFESSIONAL. FOLLOW ALL APPLICABLE LOCAL AND STATE CODES AND REGULATIONS. IN THE ABSENCE OF SUCH CODES, FOLLOW THE CURRENT EDITIONS OF THE NATIONAL PLUMBING CODE AND NATIONAL ELECTRIC CODE, AS APPLICABLE.**

**⚠WARNING** **EXPLOSION OR RUPTURE HAZARD. THE EXPANSION TANK MUST BE OPERATED SO THAT THE PRESSURE DOES NOT EXCEED THE MAXIMUM WORKING PRESSURE.**

**⚠WARNING** **EXPLOSION HAZARD.** Failure to follow the instructions in the accompanying product manual can cause a rupture or explosion; possibly causing serious or fatal injury, leaking or flooding and/or property damage.

**⚠WARNING** Use only with potable water system. Do not operate in a setting with freezing temperatures or where the temperature can exceed 240°F and do not exceed the maximum working pressure specified for this Product in the Manual. Mount vertically only.

**⚠WARNING** **Chlorine & Aggressive Water:** The water quality can significantly influence the life of this Product. You should test for corrosive elements, acidity, total solids and other relevant contaminants, including chlorine and treat your water appropriately to insure satisfactory performance and prevent premature failure.

**⚠WARNING** This Product, like most Products under pressure, may over time corrode. weaken and burst or explode, causing serious or fatal injury, leaking or flooding and/or property damage. To minimize risk, a licensed professional must install and periodically inspect and service the Product. A drip pan connected to an adequate drain must be installed if leaking or flooding could cause property damage. Do not locate in an area where leakage of the tank or connections could cause property damage to the area adjacent to the appliance or to lower floors of the structure.

**⚠WARNING** Do not expose Product to freezing temperatures or temperatures in excess of 240° F. Do not adjust the pre-charge or re-pressure this Product except for any adjustments required at the time of initial installation, especially if Product corroded, damaged or with diminished integrity. Adjustments to pre-charge must be done at ambient temperature only. Failure to properly size the Product or follow these instructions may result in excessive strain on the system lead to Product failure, serious or fatal personal injury, leakage and/or property damage.

**⚠WARNING** **EXPLOSION OR RUPTURE HAZARD** A relief valve must be installed to prevent pressure in excess of local code requirement or maximum working pressure designated in the Product Manual, whichever is less. At least once every 3 years or if discharge is present, a licensed contractor should inspect the temperature and pressure relief valve and replace if corrosion is evident or the valve does not function. **FAILURE TO INSPECT THIS VALVE AS DIRECTED COULD RESULT IN UNSAFE TEMPERATURE OR PRESSURE BUILD-UP WHICH CAN RESULT IN PRODUCT FAILURE, SERIOUS INJURY OR DEATH AND/OR SEVERE PROPERTY DAMAGE AND VOID THE PRODUCT WARRANTY.**

**⚠WARNING** This product can expose you to chemicals including lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

# PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

**IMPORTANT GENERAL SAFETY INFORMATION -**
**ADDITIONAL SPECIFIC SAFETY ALERTS APPEAR IN THE FOLLOWING INSTRUCTIONS.**

**⚠WARNING FAILURE TO PROPERLY SEAL WILL RESULT IN LOSS OF PRECHARGE CAUSING PRODUCT TO FAIL.**

## Installation

**⚠WARNING THIS PRODUCT MUST BE INSTALLED BY A LICENSED PROFESSIONAL.**

1. Visually inspect THERM-X-TROL for any damage. If damage exists return product for replacement.
2. Adjust pre-charge to equal incoming pressure.

> ⚠ **IMPORTANT**: If increasing pre-charge pressure above 55 psig the following steps must be followed:
>
> a. Tank must be connected to the system with isolation valve open.
>
> b. System must be pressurized to 55-60 psig or slightly higher than the pre-charge setting of the tank.
>
> c. Isolation valve needs to be shut.
>
> d. Pre-charge pressure of tank can now be increased to the recommended high pressure setting.
>
> e. Bring system up to pressure, and then open the isolation valve to the tank.
>
> **Failure to follow these steps could result in damage to the bladder and void all warranties.**

3. Replace and tighten plastic cap on air fitting.
4. Install the THERM-X-TROL on the city supply line to the water heater at a point between the water heater and backflow preventer, check valve or pressure reducing valve (see Figure 1).
5. Once the THERM-X-TROL is installed, check the city supply line for any leakage. Make repairs if necessary.
6. Before the initial firing of the water heater, open any hot water fixture and draw water until all air is removed from the system. Turn the water heater temperature control to desired ending temperature level, (see water heater instructions).
7. To relieve initial thermal expansion, slightly open a hot water faucet. Continue until water heater aquastat temperature is satisfied. Once heater is at its operating range, no further bleeding of expanded water is required.
8. The system water heater and THERM-X-TROL will now be operational. The THERM-X-TROL will control pressure increases caused by thermal expansion to a level well below the water heater relief valve setting.

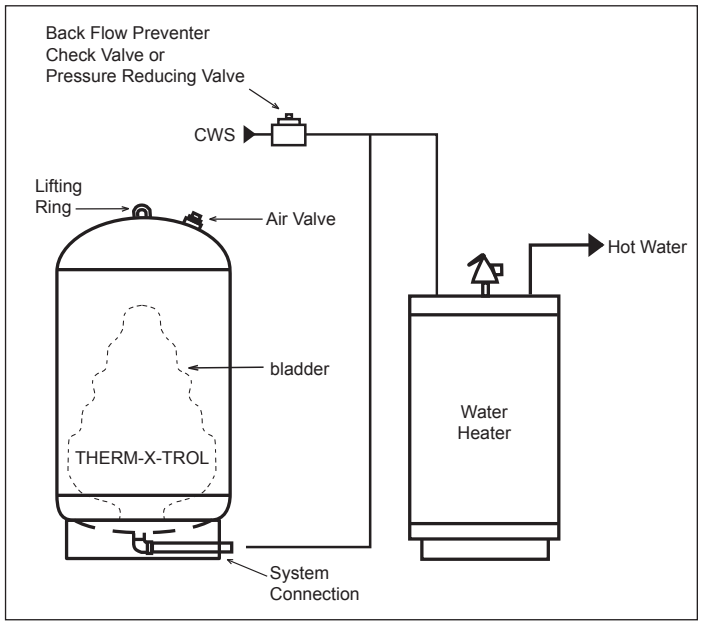
## Maintenance

1. A licensed professional should check the complete heating system, including the THERM-X-TROL, yearly and more frequently as the system ages.

## Operation

1. The THERM-X-TROL is installed in the supply line between the backflow preventer and the water heater. Its sealed-in air pre-charge prevents water from entering it until the system pressure exceeds the pre-charge pressure.
2. As the water temperature rises, expanded water enters the THERM-X-TROL's non-corrosive water reservoir. The pre-charged air chamber absorbs the pressure increase, keeping system pressures below the relief valve setting.
3. As hot water is used, the pressure in the air chamber forces water back into the system until the THERM-X-TROL is empty. At this point, the pressure in the air chamber once again equals the supply pressure.
4. Water treatment is not to exceed 200° F or fall below 35° F.

Figure 1.




## Warranty

ST-35L(CL) through ST-600L(CL) Models:
One (1) Year Limited Warranty

**Visit www.amtrol.com for complete warranty details.**

WORTHINGTON INDUSTRIES

1400 Division Road, West Warwick, RI USA 02893
T: 800.426.8765 **www.amtrol.com**

MADE IN USA



Part #: 9017-118 (06/19)

# THERM-X-TROL®

Thermal Expansion: Full Acceptance Bladder ST-440C and ST-450C Series ASME

## 150 PSIG Working Pressure

### Construction

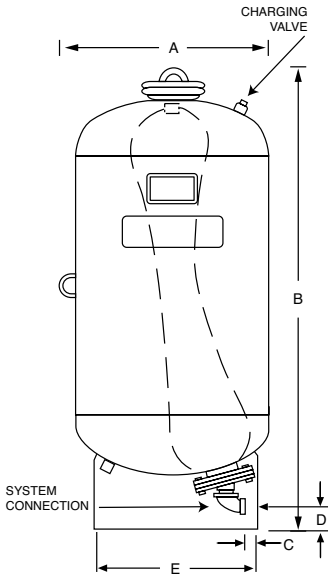
| | |
|---|---|
| Shell | Steel |
| Bladder Material | Heavy Duty Butyl NSF/ANSI 61 |
| Bladder Thickness | .100 In Minimum |
| System Connection | Bronze |
| Finish | Red Oxide Primer |
| Air Valve | Schrader Valve w/ EPDM Seat |
| Factory Precharge | 25 PSIG (1.7 bar) |

### Performance

| | |
|---|---|
| Maximum Operating Temperature | 240°F (115°C) |
| Maximum Working Pressure | 150 PSIG (10.3 bar) |
| Warranty | 1-Year |

### Application

- For use in closed, potable water systems to control pressure build-up.
- Full acceptance replaceable bladder design.
- Optional sight glass and seismic restraints available.
- Designed and constructed per ASME Code Section VIII, Division 1.




### ASME Models

| Model Number | Tank Volume | | Max. Accept. Factor | A Tank Diameter | | B Tank Height | | C System Conn. Height | | D Conn. Centerline | | E Stand Diameter | | System Conn. (NPTF) | Shipping Weight | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gal | Lit | | In | mm | In | mm | In | mm | In | mm | In | mm | In | Lbs | Kg |
| ST-447C | 53 | 200 | 1.0 | 24 | 610 | 45 | 1143 | 2 | 51 | 3¾ | 95 | 19 | 483 | 2 | 262 | 119 |
| ST-448C | 80 | 300 | 1.0 | 24 | 610 | 59 | 1498 | 2 | 51 | 3¾ | 95 | 19 | 483 | 2 | 340 | 154 |
| ST-449C | 106 | 400 | 1.0 | 24 | 610 | 73 | 1854 | 2 | 51 | 3¾ | 95 | 19 | 483 | 2 | 360 | 163 |
| ST-450C | 132 | 500 | 1.0 | 24 | 610 | 87 | 2210 | 2 | 51 | 3¾ | 95 | 19 | 483 | 2 | 400 | 181 |
| ST-451C | 158 | 600 | 1.0 | 30 | 762 | 73 | 1854 | 3½ | 89 | 5½ | 140 | 24 | 610 | 2 | 587 | 266 |
| ST-452C | 211 | 800 | 1.0 | 30 | 762 | 91 | 2311 | 3½ | 89 | 5½ | 140 | 24 | 610 | 2 | 625 | 283 |
| ST-453C | 264 | 1000 | 1.0 | 36 | 914 | 86 | 2184 | 4½ | 114 | 7 | 178 | 30 | 762 | 3 | 760 | 345 |
| ST-454C | 317 | 1200 | 1.0 | 36 | 914 | 98 | 2438 | 4½ | 114 | 7 | 178 | 30 | 762 | 3 | 850 | 386 |
| ST-455C | 370 | 1400 | 1.0 | 36 | 914 | 110 | 2794 | 4½ | 114 | 7 | 178 | 30 | 762 | 3 | 935 | 424 |
| ST-456C | 422 | 1600 | 1.0 | 48 | 1219 | 82 | 2083 | 7½ | 191 | 7⅛ | 178 | 42 | 1067 | 3 | 1423 | 645 |
| ST-457C | 528 | 2000 | 1.0 | 48 | 1219 | 97 | 2464 | 7½ | 191 | 7⅛ | 178 | 42 | 1067 | 3 | 1505 | 683 |

All dimensions and weights are approximate.

Job Name _____ Notes _____

Engineer _____ _____

Contractor _____ _____

P.O. No. _____ _____

Sales Rep. _____ _____

Model No. _____ _____

NSF Certified to NSF/ANSI/CAN 61 BLADDER ONLY

ISO 9001:2015 CERTIFIED

LOW-LEAD IAPMO R&T

# Company


| | |
|---|---|
| **Company** | Leonard Valve Company |
| **Address** | 1360 Elmwood Avenue, Cranston, RI 02910 |
| **Phone** | (800) 222-1208 |
| **Fax** | (401) 941-5310 |
| **Email** | info@leonardvalve.com |
| **Site** | www.leonardvalve.com |


# Recommended Model

### PNV-125-LF - Proton Electronic Mixing Valve

In support of various states Low Lead laws, Leonard is pleased to offer the new Nucleus line of electronic mixing valves. These valves have all been certified as meeting the lead free requirements. Note: Lead Free is defined as “not more than a weighted average of 0.25 percent when used with respect to the wetted surfaces of pipes and pipe fittings, plumbing fittings, and fixtures”. In addition, these valves are all listed to the stringent performance requirements of the ASSE 1017 Standard. Leonard’s Proton models give plumbing engineers outlet temperature control within +/- 2F from set point, regardless of demand. Features include user programmable set point, integral daily sweep.

https://www.leonardvalve.com/products/lines/228/product/4728

# Alternative Models

### Megatron PNV-125-LF - Proton Electronic Mixing Valve

https://www.leonardvalve.com/products/lines/228/product/4872

# Information

| | |
|---|---|
| **Technology** | Digital |
| **Facility** | School |
| **Job Name** | null |
| **Units** | Standard |

# Fixtures

| | |
|---|---|
| **Commercial Washing Machine** | 2 |
| **Lavatory: Private - LEED (0.5 GPM)** | 16 |
| **Lavatory: Public - LEED (0.5 GPM)** | 18 |
| **Sink: Classroom** | 29 |
| **Sink: Slop** | 2 |

# Parameters

| | |
|---|---|
| **Max Flow** | 20.12 |
| **Pressure Drop** | 5 |
| **Minimal Flow** | 20 |
| **Additional Flow** | 0 |

A. O. Smith
Phone: 1.866.362.9898
www.hotwater.com

# Pro-Size Selection Report

November 16, 2021

## Project Information

| | | | |
|---|---|---|---|
| Project #: | | Prepared for: | GES |
| Project Name: | NIST-Multi-family | | |
| Location: | Nationwide | Prepared by: | Yedi |
| Engineer: | GES | | |
| Contractor: | | | |

## Selected Product

**BTH-199 Mxi**

### Cyclone® Mxi Modulating

| | | | |
|---|---|---|---|
| # Heaters: | 2 | Heater Recovery: | 470 USGPH @ 100 °F Rise |
| Model Number: | BTH-199 Mxi | 1st Hour Delivery: | 610 USGPH |
| Heater Storage (ea): | 100 USG | 3 Hour Average: | 517 USGPH |
| Input (ea): | 199,000 Btu/hr | Est. Storage Recovery: | 26 min |
| New External Tanks: | 0 | % Of Demand: | 116% |
| Tank Capacity (ea): | 0 USG | | |
| Total Usable Storage: | 140 USG | | |

This model is iCOMM COMPATIBLE.
iCOMM
For info call: 1-888-WATER02

| Model Number | Hi Cube Trailer Load Factor | Gallon Capacity | Recovery Capacity GPH 100 Degree Rise | Input BTU/HR | Height | Diameter | Approx. Shipping Weight (lbs.) |
|---|---|---|---|---|---|---|---|
| BTH-199 Mxi | 2.78 | 100 | 470 | 199,000 | 76 | 27.75 | 523 |

- Standard and Low profile concentric vent available
- Vents with PVC, CPVC polypropylene and AL-29-4C Stainless steel
- Venting distances of up to 120' on all models
- Meets or exceed the thermal efficiency and /or standby loss requirements of the U.S. Department of Energy and current edition of ASHRAE/IESNA 90.1
- Meets NSF requirement's (no leg kit needed)
- Up to 98% Thermal Efficiency
- Down-Fired Low-NOx Powered-Burner Design
- Fully Submerged, Spiral-Shaped Condensing Heat Exchanger
- Complies with SCAQMD Rule 1146.2
- Sidewall and Vertical power vent and direct Vent Options
- Space-Saving Design, with Zero Clearance to Combustibles

## Application Loads

### Summary

| | | | |
|---|---|---|---|
| Peak Demand: | 526 USGPH | Temperature Rise: | 100 °F |

### Application Settings

| | | | |
|---|---|---|---|
| Type: | Apartment Building | | |
| Building Use: | High Peak Demand | Cold Water Temp: | 40 °F |
| Peak Demand Period: | 1.00 Hours | Stored Water Temp: | 140 °F |
| Equipment: | Water Heaters Only (no external storage) | Approx. Storage: | 25% |
| | | # Storage Tanks: | Not Specified |
| Fuel Type: | Natural Gas | Existing Storage: | None |
| Location: | Indoor | | |

| | |
|---|---|
| LoNOx: | Not Required |
| UltrasLowNOx: | Not Required |
| ASME: | Not Required |
| # Heaters: | 2 |
| Altitude: | Less than 2000 ft |

## Load Data

| | |
|---|---|
| Shower Head Flowrate: | 2.0 USGPM |
| Units w/ 1 Bath: | 32 @ 1.5 persons/unit |
| Units w/ 1-1/2 Bath: | 0 @ 2 persons/unit |
| Units w/ 2 Bath: | 0 @ 2.5 persons/unit |
| Units w/ 2-1/2 Bath: | 0 @ 3 persons/unit |
| Laundry Model 1: | 4 @ 24 lbs |
| Laundry Model 2: | 0 @ 0 lbs |
| Additional Load: | 0 USGPH |
| Design Oversize: | 0% |

A. O. Smith
Phone: 1.866.362.9898
www.hotwater.com

# Pro-Size Selection Report

November 16, 2021

## Project Information

| | | | |
|---|---|---|---|
| Project #: | | Prepared for: | GES |
| Project Name: | NIST-School | | |
| Location: | Nationwide | Prepared by: | Yedi |
| Engineer: | GES | | |
| Contractor: | | | |

## Selected Product

**BTH-199 Mxi**

### Cyclone® Mxi Modulating

| | | | |
|---|---|---|---|
| # Heaters: | 2 | Heater Recovery: | 470 USGPH @ 100 °F Rise |
| Model Number: | BTH-199 Mxi | 1st Hour Delivery: | 610 USGPH |
| Heater Storage (ea): | 100 USG | 3 Hour Average: | 517 USGPH |
| Input (ea): | 199,000 Btu/hr | Est. Storage Recovery: | 26 min |
| New External Tanks: | 0 | % Of Demand: | 145% |
| Tank Capacity (ea): | 0 USG | | |
| Total Usable Storage: | 140 USG | | |

This model is iCOMM COMPATIBLE. iCOMM For info call: 1-888-WATER02

| Model Number | Hi Cube Trailer Load Factor | Gallon Capacity | Recovery Capacity GPH 100 Degree Rise | Input BTU/HR | Height | Diameter | Approx. Shipping Weight (lbs.) |
|---|---|---|---|---|---|---|---|
| BTH-199 Mxi | 2.78 | 100 | 470 | 199,000 | 76 | 27.75 | 523 |

- Standard and Low profile concentric vent available
- Vents with PVC, CPVC polypropylene and AL-29-4C Stainless steel
- Venting distances of up to 120' on all models
- Meets or exceed the thermal efficiency and /or standby loss requirements of the U.S. Department of Energy and current edition of ASHRAE/IESNA 90.1
- Meets NSF requirement's (no leg kit needed)
- Up to 98% Thermal Efficiency
- Down-Fired Low-NOx Powered-Burner Design
- Fully Submerged, Spiral-Shaped Condensing Heat Exchanger
- Complies with SCAQMD Rule 1146.2
- Sidewall and Vertical power vent and direct Vent Options
- Space-Saving Design, with Zero Clearance to Combustibles

## Application Loads

### Summary

| | | | |
|---|---|---|---|
| Peak Demand: | 420 USGPH | Temperature Rise: | 100 °F |

Sizing Notes

Hot water loads for pools, hot tubs, or other uses should be considered separately. Restaurant or food service loads should be considered separately if independent water heating equipment is to be used.

### Application Settings

| | | | |
|---|---|---|---|
| Type: | Schools | | |
| Building Use: | Elementary School | Cold Water Temp: | 40 °F |

| | | | |
|---|---|---|---|
| Peak Demand Period: | 1.00 Hours | Stored Water Temp: | 140 °F |
| Equipment: | Water Heaters Only (no external storage) | Approx. Storage: | 25% |
| | | # Storage Tanks: | Not Specified |
| Fuel Type: | Natural Gas | Existing Storage: | None |
| Location: | Indoor | | |
| LoNOx: | Not Required | | |
| UltrasLowNOx: | Not Required | | |
| ASME: | Not Required | | |
| # Heaters: | 2 | | |
| Altitude: | Less than 2000 ft | | |

## Load Data

| | |
|---|---|
| Number of Shower Heads: | 0 |
| Shower Head Flowrate: | 2.5 USGPM |
| Shower Demand Period: | 10 min |
| Shower Recovery Time: | 50 min |
| Students: | 700 |
| Bradley Washfountain (Full): | 0 |
| Bradley Washfountain (Half): | 0 |
| Private Lavatory: | 14 |
| Public Lavatory: | 18 |
| Dishwasher: | 0 @ 100 USGPH |
| Foot Basin: | 0 |
| Kitchen Sink: | 29 |
| Pantry Sink: | 0 |
| Service Sink: | 0 |
| Additional Load: | 0 USGPH |
| Design Oversize: | 0% |

# Commercial Gas Water Heaters

## CYCLONE® Mxi MODULATING

### MODULATING BURNER ADVANCES THE CYCLONE TO HIGHER LEVELS OF EFFICIENCY

The full line of A. O. Smith Cyclone Mxi condensing water heaters has been designed to provide years of dependable service and feature industry leading technology. Models are available from 120,000 to 500,000 Btu/h and all deliver thermal efficiencies of 95% and higher. The unique helical coil heat exchanger limits weld joints for optimal service life while maximizing heat transfer.

Cyclone is the industry leader in high efficiency commercial water heating. The current Mxi modulating models adjust firing rate to the specific demand further increasing efficiency and money savings.

#### INTELLIGENT CONTROL SYSTEM WITH TOUCH SCREEN DISPLAY AND ICOMM CONNECTIVETY ONBOARD*

- Exclusive A. O. Smith designed color touch display control system
- Provides detailed water heater status information
- Precise temperature control adjustable from 90 to 180 degrees
- Built-in diagnostics
- Run history information
- *Cyclone Mxi models manufactured March 1, 2018 to present come standard with iCOMM Wi-Fi connectivety onboard. Remotely monitor and adjust the water heater via the A. O. Smith app. No charge connectivety using Wi-Fi or Ethernet connection.
- Intelligent Demand Response (IDR) feature senses large water draws and automatically adjusts the differential setpoint. This feature increases the hot water available when it is needed the most.

#### SUBMERGED COMBUSTION CHAMBER, WITH HELICAL HEAT EXCHANGER COIL

- Positioned in center of tank, surrounded by water to virtually eliminate radiant heat loss from chamber
- Direct spark ignition
- Spiral heat exchanger keeps hot burner gases swirling, uses centrifugal force to maximize efficiency of heat transfer to water in tank
- Spiral heat exchanger reduces lime scale from forming on water-side surfaces, which maintains energy efficiency over time

#### POWERED ANODES STANDARD ON ALL MODELS

- Provides long-lasting tank protection in varying water conditions
- Powered anodes are non-sacrificial
- Automatically adjusts output needed to properly protect the tank

#### PERMAGLAS® ULTRA COAT™ GLASS LINING

- Glass coating is applied using a liquid slush coating technique to ensure uniform coating
- Heat exchanger coil is glassed both externally and internally for optimum protection

#### MECHANICAL VENTING VERSATILITY

- Conventional power venting or direct venting
- Vents vertically or through a sidewall
- Front located exhaust and condensate connections allow for easy install and access
- Vents with low cost PVC Schedule 40 intake and exhaust pipe. Approved for optional CPVC Schedule 40, Polypropylene and AL29-4C stainless steel vent materials
- Direct-vent intake and exhaust pipe can terminate separately outside building or through single opening, using concentric vent assembly
- Canadian installations require ULC S636 PVC/ CPVC, ULC S636 Polypropylene and AL29-4C stainless steel pipe for intake and exhaust

#### HIGH EFFICIENCY MODULATING PRE-MIX POWERED BURNER

- Down-fired pre-mix burner provides optimum efficiency and quiet operation
- Top-mounted burner position prevents condensation from affecting burner operation

#### 3-YEAR LIMITED TANK / 1-YEAR LIMITED PARTS WARRANTY

- For complete warranty information, consult written warranty or go to hotwater.com

**BTH-120(A) THROUGH BTH-500(A)**
**MODEL SHOWN:**
**BTH-199(A) SERIES 300/301**

Low Lead Content · ENERGY STAR · CERTIFIED WATER QUALITY · HLW · GAS-FIRED LISTED · iCOMM · AHRI CERTIFIED www.ahridirectory.org · ASME (Optional)



**www.hotwater.com | 800-527-1953 Toll-Free USA | A. O. Smith Corporation | 500 Tennessee Waltz Parkway | Ashland City, TN 37015**

# Commercial Gas Water Heaters

## OTHER FEATURES:

### SPACE-SAVING DESIGN FOR INSTALLATION FLEXIBILITY

- Easy-to-remove top cover for convenient access to serviceable parts
- 0″ installation clearances on sides and rear, 1-1/2″ installation clearance on top
- Handhole cleanout allows easy access to tank interior for cleaning
- 0″ clearance to combustibles, approved for installation on combustible floors

### CODES AND STANDARDS

- CSA certified and ASME rated T&P relief valve
- Maximum hydrostatic working pressure: 160 psi
- All models are design certified by Underwriters Laboratories (UL), Inc., to ANSI Z21.10.3 - CSA 4.3 Standards
- Meets the thermal efficiency and standby loss requirements of the U.S. Department of Energy and current edition ASHRAE/IES 90.1
- Design Certified by Underwriters Laboratories to NSF standard 5 for 180°F (62°C) water
- Complies with SCAQMD Rule 1146.2 and other Air Quality Management Districts with similar requirements for ultra low-NOx emissions
- ASME tank construction optional on 120-500 model sizes

### VENT REQUIREMENTS FOR BTH 120(A) - 250(A)

| Number of 90° Elbows Installed | 3 Inch Pipe | 4 Inch Pipe |
|---|---|---|
| | Maximum Feet (Meters) | Maximum Feet (Meters) |
| **One (1)** | 45 feet (13.7 meters) | 115 feet (35 meters) |
| **Two (2)** | 40 feet (12.2 meters) | 110 feet (33.5 meters) |
| **Three (3)** | 35 feet (10.7 meters) | 105 feet (32 meters) |
| **Four (4)** | 30 feet (9.1 meters) | 100 feet (30.5 meters) |
| **Five (5)** | N/A | 95 feet (29 meters) |
| **Six (6)** | N/A | 90 feet (27.4 meters) |

### VENT REQUIREMENTS FOR BTH 300(A) - 500(A)

| Number of 90° Elbows Installed | 4 Inch Pipe | 6 Inch Pipe |
|---|---|---|
| | Maximum Feet (Meters) | Maximum Feet (Meters) |
| **One (1)** | 65 feet (19.8 meters) | 115 feet (35 meters) |
| **Two (2)** | 60 feet (18.2 meters) | 110 feet (33.5 meters) |
| **Three (3)** | 55 feet (16.8 meters) | 105 feet (32 meters) |
| **Four (4)** | 50 feet (15.2 meters) | 100 feet (30.5 meters) |
| **Five (5)** | 45 feet (13.7 meters) | 95 feet (29 meters) |
| **Six (6)** | 40 feet (12.2 meters) | 90 feet (27.4 meters) |

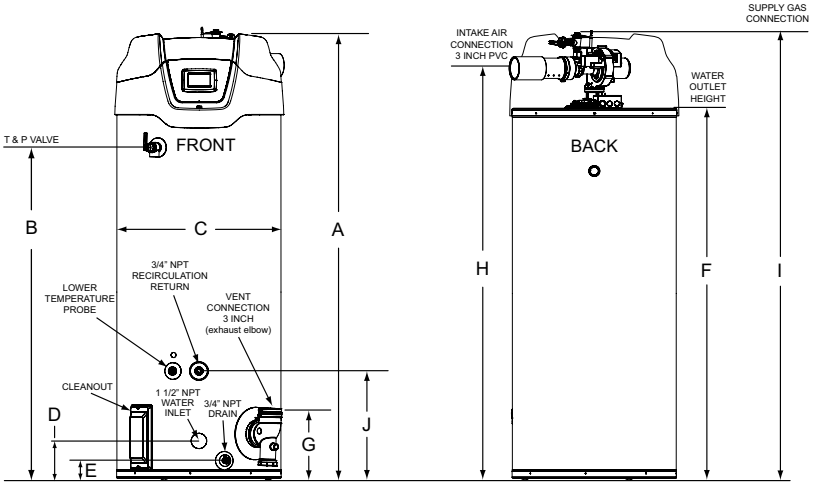
### GAS PRESSURE REQUIREMENTS

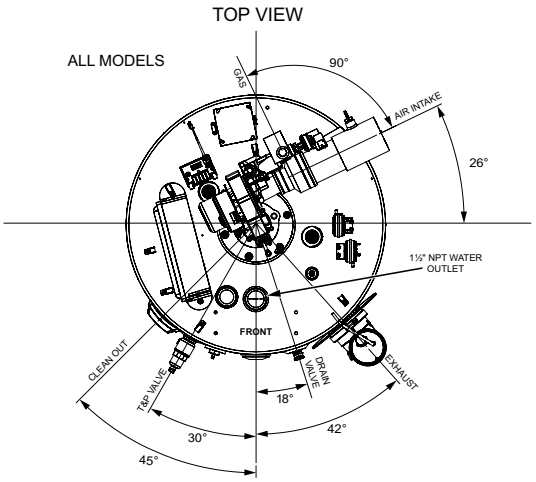
| Model Number | Manifold Pressure | | Minimum Supply Pressure | | Maximum Supply Pressure | |
|---|---|---|---|---|---|---|
| | Natural Gas | Propane Gas | Natural Gas | Propane Gas | Natural Gas | Propane Gas |
| **BTH-120(A)** | 0"W.C. (0 kPa) | 0"W.C. (0 kPa) | 3.5"W.C. (1.10 kPa) | 8.5"W.C. (2.12 kPa) | 14"W.C. (3.49 kPa) | 14"W.C. (3.49 kPa) |
| **BTH-150(A)** | 0"W.C. (0 kPa) | 0"W.C. (0 kPa) | 3.5"W.C. (1.10 kPa) | 8.5"W.C. (2.12 kPa) | 14"W.C. (3.49 kPa) | 14"W.C. (3.49 kPa) |
| **BTH-199(A)** | 0"W.C. (0 kPa) | 0"W.C. (0 kPa) | 3.5"W.C. (1.10 kPa) | 8.5"W.C. (2.12 kPa) | 14"W.C. (3.49 kPa) | 14"W.C. (3.49 kPa) |
| **BTH-250(A)** | 0"W.C. (0 kPa) | 0"W.C. (0 kPa) | 3.5"W.C. (1.10 kPa) | 8.5"W.C. (2.12 kPa) | 14"W.C. (3.49 kPa) | 14"W.C. (3.49 kPa) |
| **BTH-300(A)** | 0"W.C. (0 kPa) | 0"W.C. (0 kPa) | 4.8"W.C. (1.19 kPa) | 8.5"W.C. (2.12 kPa) | 14"W.C. (3.49 kPa) | 14"W.C. (3.49 kPa) |
| **BTH-400(A)** | 0"W.C. (0 kPa) | 0"W.C. (0 kPa) | 4.8"W.C. (1.19 kPa) | 8.5"W.C. (2.12 kPa) | 14"W.C. (3.49 kPa) | 14"W.C. (3.49 kPa) |
| **BTH-500(A)** | 0"W.C. (0 kPa) | 0"W.C. (0 kPa) | 4.8"W.C. (1.19 kPa) | 8.5"W.C. (2.12 kPa) | 14"W.C. (3.49 kPa) | 14"W.C. (3.49 kPa) |

Depending on the installed equivalent length, and/or the number of appliances connected, the supply gas line size may need to be increased beyond the minimum required size.

# Commercial Gas Water Heaters

**BTH 120-250**



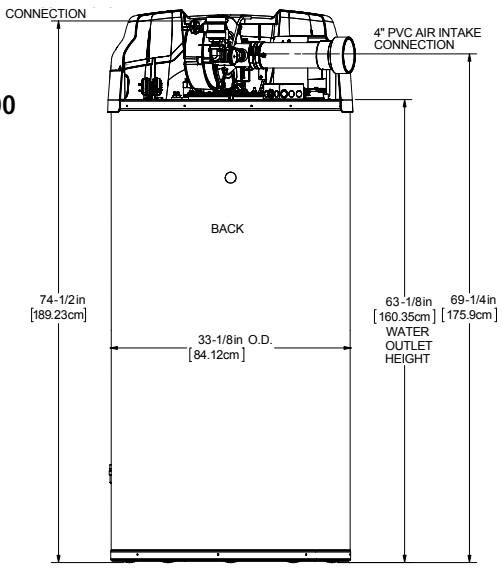

* Center line of water outlet on top of the water heaters is approximately 7 inches from the front edge of the water heater

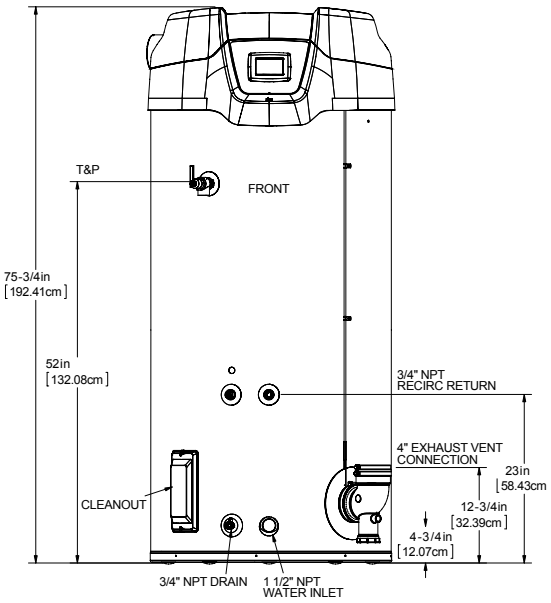
| Model Number | Approx. Capacity | | Dimensions | | | | | | | | | | lb/kg | Approx. Shipping Weight Std | Approx. Shipping Weight ASME |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | D | E | F | G | H | I | J | | | |
| **BTH-120(A)** | Gallons | 60 | 55 1/2 | 35 | 27 3/4 | 6 5/16 | 3 | 42 1/4 | 11 1/4 | 48 1/2 | 53 1/2 | 18 1/4 | lb | 460 | 490 |
| | Liters | 227 | 141 | 88.9 | 70.5 | 16 | 7.62 | 107.32 | 28.6 | 123.2 | 135.9 | 46.36 | kg | 208 | 220 |
| **BTH-150(A)** | Gallons | 100 | 76 1/2 | 56 3/8 | 27 3/4 | 6 5/16 | 3 | 64 | 11 1/4 | 70 | 75 1/2 | 18 1/4 | lb | 523 | 553 |
| | Liters | 379 | 194.9 | 143.2 | 70.5 | 16 | 7.62 | 162.6 | 28.6 | 177.8 | 191.8 | 46.36 | kg | 237 | 251 |
| **BTH-199(A)** | Gallons | 100 | 76 1/2 | 56 3/8 | 27 3/4 | 6 5/16 | 3 | 64 | 11 1/4 | 70 | 75 1/2 | 18 1/4 | lb | 523 | 553 |
| | Liters | 379 | 194.9 | 143.2 | 70.5 | 16 | 7.62 | 162.6 | 28.6 | 177.8 | 191.8 | 46.36 | kg | 237 | 251 |
| **BTH-250(A)** | Gallons | 100 | 76 1/2 | 56 3/8 | 27 3/4 | 6 5/16 | 3 | 64 | 11 1/4 | 70 | 75 1/2 | 18 1/4 | lb | 523 | 553 |
| | Liters | 379 | 194.9 | 143.2 | 70.5 | 16 | 7.62 | 162.6 | 28.6 | 177.8 | 191.8 | 46.36 | kg | 237 | 251 |

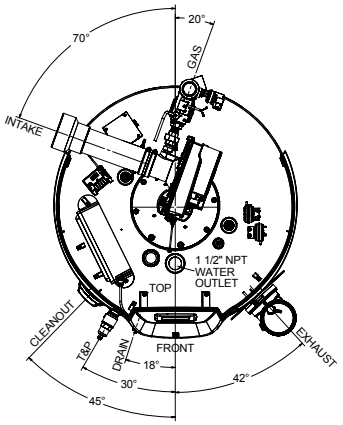
Electrical characteristics-120V-60Hz A.C., 5.0 A
"A" in model represents ASME construction
Propane gas models available
Dimensions and specifications subject to change without notice in accordance with our policy of continuous product improvement.

# Commercial Gas Water Heaters

**BTH 300-500**




| Model Number | Approx. Capacity | | Dimensions | | | | | | | | | | lb/kg | Approx. Shipping Weight Std | Approx. Shipping Weight ASME |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | D | E | F | G | H | I | J | | | |
| BTH-300(A) | Gallons | 119 | 75 3/4 | 52 | 33 1/8 | 4 3/4 | 4 3/4 | 63 1/8 | 12 3/4 | 69 1/4 | 74 1/2 | 23 | lb | 855 | 855 |
| | Liters | 450.96 | 192.41 | 132.08 | 84.12 | 12.07 | 12.07 | 160.35 | 32.39 | 175.9 | 189.23 | 58.43 | kg | 387 | 387 |
| BTH-400(A) | Gallons | 119 | 75 3/4 | 52 | 33 1/8 | 4 3/4 | 4 3/4 | 63 1/8 | 12 3/4 | 69 1/4 | 74 1/2 | 23 | lb | 855 | 855 |
| | Liters | 450.96 | 192.41 | 132.08 | 84.12 | 12.07 | 12.07 | 160.35 | 32.39 | 175.9 | 189.23 | 58.43 | kg | 387 | 387 |
| BTH-500(A) | Gallons | 119 | 75 3/4 | 52 | 33 1/8 | 4 3/4 | 4 3/4 | 63 1/8 | 12 3/4 | 69 1/4 | 74 1/2 | 23 | lb | 855 | 855 |
| | Liters | 450.96 | 192.41 | 132.08 | 84.12 | 12.07 | 12.07 | 160.35 | 32.39 | 175.9 | 189.23 | 58.43 | kg | 387 | 387 |

Electrical characteristics-120V-60Hz A.C., 5.0 A
"A" in model represents ASME construction
Propane gas models available
Dimensions and specifications subject to change without notice in accordance with our policy of continuous product improvement.

# Commercial Gas Water Heaters

## RECOVERY CAPACITY

| Model Number | Type of Gas | Input | | Thermal Efficiency |
|---|---|---|---|---|
| | | BTU/HR | kW | |
| **BTH-120(A)** | Natural/Propane | 120,000 | 35 | 95% |
| **BTH-150(A)** | Natural/Propane | 150,000 | 44 | 98% |
| **BTH-199(A)** | Natural/Propane | 199,900 | 58 | 97% |
| **BTH-250(A)** | Natural/Propane | 250,000 | 73 | 96% |
| **BTH-300(A)** | Natural/Propane | 300,000 | 88 | 96% |
| **BTH-400(A)** | Natural/Propane | 399,900 | 117 | 95% |
| **BTH-500(A)** | Natural/Propane | 499,900 | 146 | 95% |

| Model Number | U.S. GALLONS/HR AND LITRES/HR AT TEMPERATURE RISE INDICTATED | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Approx. Capacity | °F | 30°F | 40°F | 50°F | 60°F | 70°F | 80°F | 90°F | 100°F | 110°F | 120°F | 130°F | 140°F |
| | | °C | 17°C | 22°C | 28°C | 33°C | 39°C | 44°C | 50°C | 56°C | 61°C | 67°C | 72°C | 78°C |
| **BTH-120(A)** | 60 U.S. Gals. | GPH | 461 | 345 | 276 | 230 | 197 | 173 | 154 | 138 | 126 | 115 | 106 | 99 |
| | 227 Litres | LPH | 1743 | 1308 | 1046 | 872 | 747 | 654 | 581 | 523 | 475 | 436 | 402 | 374 |
| **BTH-150(A)** | 100 U.S. Gals. | GPH | 594 | 445 | 356 | 297 | 255 | 223 | 198 | 178 | 162 | 148 | 137 | 127 |
| | 379 Litres | LPH | 2248 | 1686 | 1349 | 1124 | 963 | 843 | 749 | 674 | 613 | 562 | 519 | 482 |
| **BTH-199(A)** | 100 U.S. Gals. | GPH | 783 | 588 | 470 | 392 | 336 | 294 | 261 | 235 | 214 | 196 | 181 | 168 |
| | 379 Litres | LPH | 2965 | 2224 | 1779 | 1483 | 1271 | 1112 | 988 | 890 | 809 | 741 | 684 | 635 |
| **BTH-250(A)** | 100 U.S. Gals. | GPH | 970 | 727 | 582 | 485 | 416 | 364 | 323 | 291 | 264 | 242 | 224 | 208 |
| | 379 Litres | LPH | 3670 | 2753 | 2202 | 1835 | 1573 | 1376 | 1223 | 1101 | 1001 | 918 | 847 | 786 |
| **BTH-300(A)** | 119 U.S. Gals. | GPH | 1164 | 873 | 698 | 582 | 499 | 436 | 388 | 349 | 317 | 291 | 269 | 249 |
| | 450.96 Litres | LPH | 4405 | 3304 | 2643 | 2202 | 1888 | 1652 | 1468 | 1321 | 1201 | 1101 | 1017 | 944 |
| **BTH-400(A)** | 119 U.S. Gals. | GPH | 1535 | 1151 | 921 | 767 | 658 | 576 | 512 | 460 | 419 | 384 | 354 | 329 |
| | 450.96 Litres | LPH | 5810 | 4358 | 3486 | 2905 | 2490 | 2179 | 1937 | 1743 | 1585 | 1453 | 1341 | 1245 |
| **BTH-500(A)** | 119 U.S. Gals. | GPH | 1919 | 1439 | 1151 | 959 | 822 | 720 | 640 | 576 | 523 | 480 | 443 | 411 |
| | 450.96 Litres | LPH | 7263 | 5448 | 4358 | 3632 | 3113 | 2724 | 2421 | 2179 | 1981 | 1816 | 1676 | 1556 |

Recovery capacities are based on AHRI rated thermal efficiencies.
For ASME Construction add an "A" to the end of the model number ex: BTH-120A.

## STORAGE CAPACITY

| Model Number | U.S. Gallons | Liters |
|---|---|---|
| **BTH 120** | 60 | 227 |
| **BTH 150** | 100 | 379 |
| **BTH 199** | 100 | 379 |
| **BTH 250** | 100 | 379 |
| **BTH 300** | 119 | 450.96 |
| **BTH 400** | 119 | 450.96 |
| **BTH 500** | 119 | 450.96 |

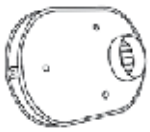
## GAS LINE CONNECTION SIZE

| Model | Series | Natural Gas | Propane Gas |
|---|---|---|---|
| **BTH 120** | 300/301 | 3/4" NPT | 3/4" NPT |
| **BTH 150** | 300/301 | 3/4" NPT | 3/4" NPT |
| **BTH 199** | 300/301 | 3/4" NPT | 3/4" NPT |
| **BTH 250** | 300/301 | 3/4" NPT | 3/4" NPT |
| **BTH 300** | 300/301 | 1-1/2" NPT | 1-1/2" NPT |
| **BTH 400** | 300/301 | 1-1/2" NPT | 1-1/2" NPT |
| **BTH 500** | 300/301 | 1-1/2" NPT | 1-1/2" NPT |

## OPTIONAL KITS

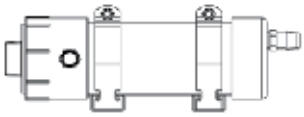
### OPTIONAL CONCENTRIC VENT KITS

- BTH-120 - 250 vent kit p/n 100111100
- BTH-300 - 500 vent kit p/n 100113124



### OPTIONAL LOW PROFILE TERMINATION VENT KITS

- 3˝ Flush Mount Vent Kit p/n 100187887
- 4˝ Flush Mount Vent Kit p/n 100187888
- 6˝ Flush Mount Vent Kit p/n 100187889



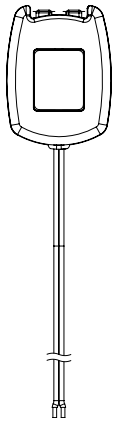
### OPTIONAL CONDENSATE NEUTRALIZATION KITS

- BTH-120-300 kit p/n 100289339
- BTH-400-500 kit p/n 100289340

### COMMON VENTING KITS FOR UP TO 3 WATER HEATERS (ONE KIT PER WATER HEATER REQUIRED)

| Kit | Description |
|---|---|
| **100227396** | PVC Common Vent Kit, 120 – 250 Models |
| **100223775** | PVC Common Vent Kit, 300 – 500 Models |
| **100227395** | Polypropylene Common Vent Kit, 120 -250 Models |
| **100223774** | Polypropylene Common Vent Kit, 300 - 500 Models |

Installations must comply with all national, state and local codes.
See kit instructions and corresponding water heater manual for detailed installation instructions and additional information.
50 Feet maximum equivalent length of straight pipe common vent and elbows
NOTE: Order 1 kit for each water heater.
See the Common Vent Kit manual or spec sheet for detailed information.



### OPTIONAL LEAK DETECTION KIT

- BTH-120 - 500 kit p/n 100302557

**SPECIFICATION**

(Natural or Propane) gas water heater(s) shall be A. O. Smith Cyclone Mxi model # _____ or equal, minimum 95% thermal efficiency, a storage capacity of _____ gallons, an input rating of _____ BTUs per hour, a recovery rating of _____ gallons per hour (gph) at 100°F rise and a maximum hydrostatic working pressure of 160 psi. Water heater(s) shall: 1. Modulating gas burner that automatically adjusts the input based on demand. 2. Powered anodes that are non sacrificial and maintenance free. 3. Have seamless glass-lined steel tank construction, with glass lining applied to all water-side surfaces after the tank has been assembled and welded; 4. Meets the thermal efficiency and/or standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IES 90.1; 5. Have foam insulation and a CSA Certified and ASME rated T&P relief valve; 6. Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up; 7. Be approved for 0˝ clearance to combustibles.

The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout. No charge connectivety shall be provided allowing for remote viewing and fault notificaion via app. 1. All models are design certified by Underwriters Laboratories (UL), Inc., according to ANSI Z21.10.3 - CSA 4.3 standards governing storage type water heaters; 2. Meet the thermal efficiency and standby loss requirements of the U. S. Department of Energy and current edition ASHRAE/IES 90.1. Complies with SCAQMD Rule 1146.2 and other air quality management districts with similar requirements for low NOx emissions.

120K-250K BTU Input: For Standard Power Venting: Water heater(s) shall be suitable for power venting using a (3˝ or 4˝) _____ diameter PVC pipe for a total distance of (50 ft or 120 ft.) _____ equivalent feet of vent piping. For Power Direct Venting: Water heater(s) shall be suitable for power direct venting using a (3˝ or 4˝) _____ diameter PVC pipe for a total distance of (50 ft or 120 ft.) _____ equivalent feet of vent piping and (50 ft. or 120 ft.)_____ equivalent feet of intake air piping.

300K - 500K BTU Input: For Standard Power Venting: Water heater(s) shall be suitable for standard power venting using a (4˝ or 6˝)_____ diameter PVC pipe for a total distance of (70 ft. or 120 ft.)_____ equivalent feet of vent piping. For Power Direct Venting: Water heater(s) shall be suitable for power direct venting using a (4˝ or 6˝) _____ diameter PVC pipe for a total distance of (70 ft or 120 ft.) _____ equivalent feet of vent piping and (70 ft. or 120 ft.)_____ equivalent feet of intake air piping.

Operation of the water heater(s) in a closed system where thermal expansion has not been compensated for (with a properly sized thermal expansion tank) will void the warranty.

**For Technical Information, call 800-527-1953. A. O. Smith Corporation reserves the right to make product changes or improvements without prior notice.**

A. O. Smith
Phone: 1.866.362.9898
www.hotwater.com

# Pro-Size Selection Report

November 16, 2021

## Project Information

| | | | |
|---|---|---|---|
| Project #: | | Prepared for: | GES |
| Project Name: | NIST-School | | |
| Location: | Nationwide | Prepared by: | Yedi |
| Engineer: | GES | | |
| Contractor: | | | |

## Selected Product

**BTH-199 Mxi**

### Cyclone® Mxi Modulating

| | | | |
|---|---|---|---|
| # Heaters: | 2 | Heater Recovery: | 470 USGPH @ 100 °F Rise |
| Model Number: | BTH-199 Mxi | 1st Hour Delivery: | 610 USGPH |
| Heater Storage (ea): | 100 USG | 3 Hour Average: | 517 USGPH |
| Input (ea): | 199,000 Btu/hr | Est. Storage Recovery: | 26 min |
| New External Tanks: | 0 | % Of Demand: | 145% |
| Tank Capacity (ea): | 0 USG | | |
| Total Usable Storage: | 140 USG | | |

This model is iCOMM COMPATIBLE. iCOMM For info call: 1-888-WATER02

| Model Number | Hi Cube Trailer Load Factor | Gallon Capacity | Recovery Capacity GPH 100 Degree Rise | Input BTU/HR | Height | Diameter | Approx. Shipping Weight (lbs.) |
|---|---|---|---|---|---|---|---|
| BTH-199 Mxi | 2.78 | 100 | 470 | 199,000 | 76 | 27.75 | 523 |

- Standard and Low profile concentric vent available
- Vents with PVC, CPVC polypropylene and AL-29-4C Stainless steel
- Venting distances of up to 120' on all models
- Meets or exceed the thermal efficiency and /or standby loss requirements of the U.S. Department of Energy and current edition of ASHRAE/IESNA 90.1
- Meets NSF requirement's (no leg kit needed)
- Up to 98% Thermal Efficiency
- Down-Fired Low-NOx Powered-Burner Design
- Fully Submerged, Spiral-Shaped Condensing Heat Exchanger
- Complies with SCAQMD Rule 1146.2
- Sidewall and Vertical power vent and direct Vent Options
- Space-Saving Design, with Zero Clearance to Combustibles

## Application Loads

### Summary

| | | | |
|---|---|---|---|
| Peak Demand: | 420 USGPH | Temperature Rise: | 100 °F |

Sizing Notes

Hot water loads for pools, hot tubs, or other uses should be considered separately. Restaurant or food service loads should be considered separately if independent water heating equipment is to be used.

### Application Settings

| | | | |
|---|---|---|---|
| Type: | Schools | | |
| Building Use: | Elementary School | Cold Water Temp: | 40 °F |

| | | | |
|---|---|---|---|
| Peak Demand Period: | 1.00 Hours | Stored Water Temp: | 140 °F |
| Equipment: | Water Heaters Only (no external storage) | Approx. Storage: | 25% |
| | | # Storage Tanks: | Not Specified |
| Fuel Type: | Natural Gas | Existing Storage: | None |
| Location: | Indoor | | |
| LoNOx: | Not Required | | |
| UltrasLowNOx: | Not Required | | |
| ASME: | Not Required | | |
| # Heaters: | 2 | | |
| Altitude: | Less than 2000 ft | | |

## Load Data

| | |
|---|---|
| Number of Shower Heads: | 0 |
| Shower Head Flowrate: | 2.5 USGPM |
| Shower Demand Period: | 10 min |
| Shower Recovery Time: | 50 min |
| Students: | 700 |
| Bradley Washfountain (Full): | 0 |
| Bradley Washfountain (Half): | 0 |
| Private Lavatory: | 14 |
| Public Lavatory: | 18 |
| Dishwasher: | 0 @ 100 USGPH |
| Foot Basin: | 0 |
| Kitchen Sink: | 29 |
| Pantry Sink: | 0 |
| Service Sink: | 0 |
| Additional Load: | 0 USGPH |
| Design Oversize: | 0% |

A. O. Smith
Phone: 1.866.362.9898
www.hotwater.com

# Pro-Size Selection Report

November 16, 2021

## Project Information

| | | | |
|---|---|---|---|
| Project #: | | Prepared for: | GES |
| Project Name: | NIST-Multi-family | | |
| Location: | Nationwide | Prepared by: | Yedi |
| Engineer: | GES | | |
| Contractor: | | | |

## Selected Product

**BTH-199 Mxi**

### Cyclone® Mxi Modulating

| | | | |
|---|---|---|---|
| # Heaters: | 2 | Heater Recovery: | 470 USGPH @ 100 °F Rise |
| Model Number: | BTH-199 Mxi | 1st Hour Delivery: | 610 USGPH |
| Heater Storage (ea): | 100 USG | 3 Hour Average: | 517 USGPH |
| Input (ea): | 199,000 Btu/hr | Est. Storage Recovery: | 26 min |
| New External Tanks: | 0 | % Of Demand: | 116% |
| Tank Capacity (ea): | 0 USG | | |
| Total Usable Storage: | 140 USG | | |

This model is iCOMM COMPATIBLE.
iCOMM
For info call: 1-888-WATER02

| Model Number | Hi Cube Trailer Load Factor | Gallon Capacity | Recovery Capacity GPH 100 Degree Rise | Input BTU/HR | Height | Diameter | Approx. Shipping Weight (lbs.) |
|---|---|---|---|---|---|---|---|
| BTH-199 Mxi | 2.78 | 100 | 470 | 199,000 | 76 | 27.75 | 523 |

- Standard and Low profile concentric vent available
- Vents with PVC, CPVC polypropylene and AL-29-4C Stainless steel
- Venting distances of up to 120' on all models
- Meets or exceed the thermal efficiency and /or standby loss requirements of the U.S. Department of Energy and current edition of ASHRAE/IESNA 90.1
- Meets NSF requirement's (no leg kit needed)
- Up to 98% Thermal Efficiency
- Down-Fired Low-NOx Powered-Burner Design
- Fully Submerged, Spiral-Shaped Condensing Heat Exchanger
- Complies with SCAQMD Rule 1146.2
- Sidewall and Vertical power vent and direct Vent Options
- Space-Saving Design, with Zero Clearance to Combustibles

## Application Loads

### Summary

| | | | |
|---|---|---|---|
| Peak Demand: | 526 USGPH | Temperature Rise: | 100 °F |

### Application Settings

| | | | |
|---|---|---|---|
| Type: | Apartment Building | | |
| Building Use: | High Peak Demand | Cold Water Temp: | 40 °F |
| Peak Demand Period: | 1.00 Hours | Stored Water Temp: | 140 °F |
| Equipment: | Water Heaters Only (no external storage) | Approx. Storage: | 25% |
| | | # Storage Tanks: | Not Specified |
| Fuel Type: | Natural Gas | Existing Storage: | None |
| Location: | Indoor | | |

| | |
|---|---|
| LoNOx: | Not Required |
| UltrasLowNOx: | Not Required |
| ASME: | Not Required |
| # Heaters: | 2 |
| Altitude: | Less than 2000 ft |

## Load Data

| | |
|---|---|
| Shower Head Flowrate: | 2.0 USGPM |
| Units w/ 1 Bath: | 32 @ 1.5 persons/unit |
| Units w/ 1-1/2 Bath: | 0 @ 2 persons/unit |
| Units w/ 2 Bath: | 0 @ 2.5 persons/unit |
| Units w/ 2-1/2 Bath: | 0 @ 3 persons/unit |
| Laundry Model 1: | 4 @ 24 lbs |
| Laundry Model 2: | 0 @ 0 lbs |
| Additional Load: | 0 USGPH |
| Design Oversize: | 0% |

# Appendix C

# Correspondence

**NIST Std Ref Bldg Plumbing System Models**

NIST Req./ Ref No.: NB732050-21-01896
LSY Project No: 21042

***Meeting No.:*** 01

***Meeting Date:*** October 6, 2021

***Topic:*** Kick Off Meeting

***Attendees:***

| *Name* | *Organization* | *Telephone* | *Email* |
|---|---|---|---|
| Sandra Smith | NIST-CO | 301-975-6646 | sandra.smith@nist.gov |
| Dan Gilmore | NIST-COR | 301-975-6951 | daniel.gilmore@nist.gov |
| Andrew Persily | NIST | | andrew.persily@nist.gov |
| Stephen Zimerman | NIST | | stephen.zimmerman@nist.gov |
| Vassilis Skardis | GES | 301-216-2871 | vassilis.skardis@salasobrien.com |
| Armando Berger | GES | 301-216-2871 | armando.berger@salasobrien.com |
| Heather Johnson | LSY | 301-495-4261 | hjohnson@lsyarchitects.com |

**1.1. Introductions/ Communications Protocols:**

A. NIST Point of Contact:
   a. COR: Dan Gilmore will be the point of contact for this project for design related issues.
   b. CO: Sandra Smith is the only individual authorized to change the contract and or bind the government.

B. A/E Principal-In-Charge: Heather Johnson

C. GES Plumbing Engineers: Vassilis Skardis and Armando Berger

**1.2. Project Background and Intent:** The purpose of the project is to produce a standard set of plumbing designs to make available to researchers in the U.S. and Canada for study methods to reduce water consumption in buildings. Buildings are one of the highest consumers of water in the country. In the past studies have been done by various researchers and they were unable to compare to peer research due to the discrepancies in the building designs and basic plumbing layouts and assumptions. This project will provide that baseline so research can compare hypotheses in a controlled manner from the same starting point. Research may include hydraulic, thermal or microbial growth in the water systems.

**1.3. Scope of Work:** NIST reviewed the MS Powerpoint and the 7 model buildings.

A. Seven buildings will be developed.
B. Deliverable will be PDF and REVIT files of plumbing design only.
C. The titleblock does not need to include company name and contact info. These documents will be distributed across the country and will be deeply scrutinized.

D. No specifications will be issued. All engineering specifications will be noted on the drawings.
E. Plumbing will be designed per code.
F. LEED is excluded.
G. Cost estimating is excluded.
H. Best practices for sustainability may be more common in some jurisdictions around the country but not others. *LSY will submit an RFI about whether or not sustainable fixtures should be used.*
I. Design shall be per standard commercial conventions, NOT per government requirements. (The government typically has more stringent requirement and those are not applicable for this exercise.)
J. CAD files of the prototypical buildings were issued during the proposal phase. LSY will let NIST know if they are missing any info. (Post Mtg Note: LSY has the CAD file and the MS Powerpoint from the proposal phase.)

**1.4. Schedule:** A preliminary project schedule was reviewed. LSY will request a time extension based on the date of the kick-off meeting so that can be issued when S. Smith corrects the contract completion date in the award. The total design will be completed 266 days from the kick-off meeting which is June 29,2022. A revised schedule is attached.

**Action Items:**

| Item No. | Date | Action Item | Individual Responsible | Date Due | Date Completed |
|---|---|---|---|---|---|
| 1.4 | 10-6-21 | Revised Schedule | H.Johnson | 10-13-21 | 10-12-21 |

*These minutes represent my understanding of items discussed. They will be considered correct and complete unless notice to the contrary is provided within five days.*

Sincerely,

Heather Johnson, AIA, LEED AP BD + C, NCARB

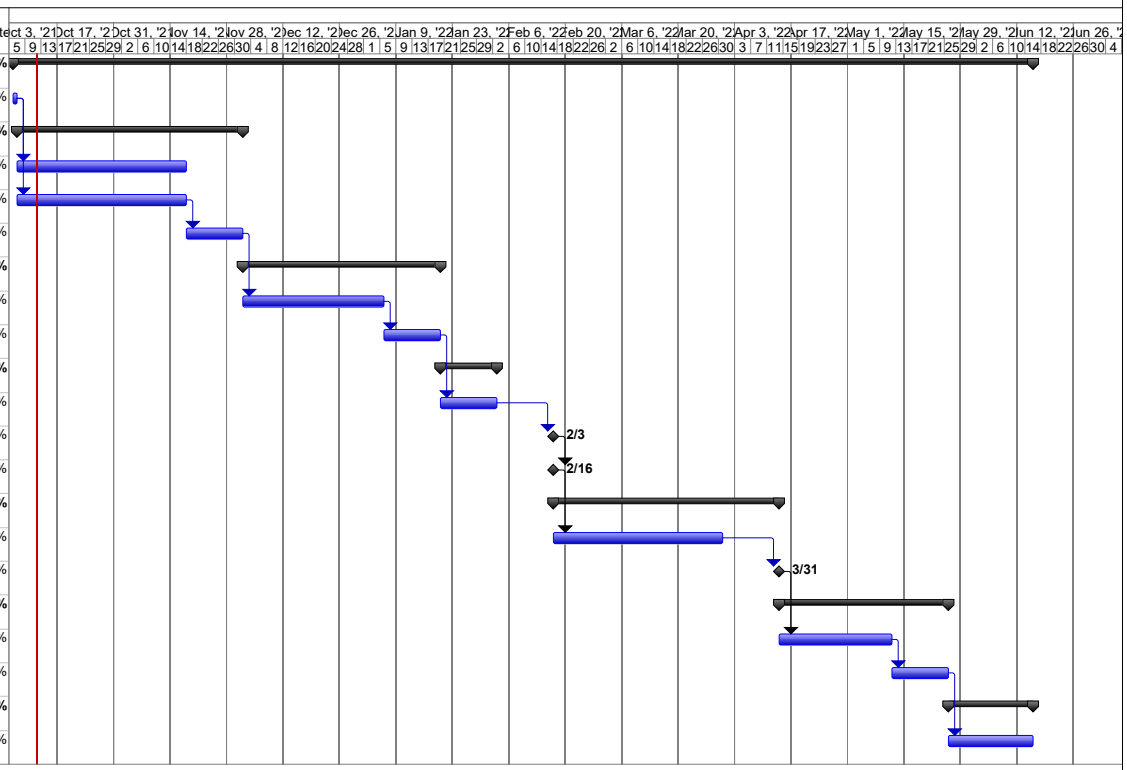
Attachments: REVISED Schedule
SOW
MS Powerpoint from NIST

# NIST Std Ref Bldg Plumbing System Models Schedule

LSY # 21042

Tue 10/12/21

| ID | Task Name | Duration | Start | Finish | Predeces | % Complete |
|---|---|---|---|---|---|---|
| 1 | **Design** | **181 days** | **Wed 10/6/21** | **Wed 6/15/22** | | **0%** |
| 2 | Kick Off Mtg | 1 day | Wed 10/6/21 | Wed 10/6/21 | | 0% |
| 3 | **Schematic Design - ARCH** | **40 days** | **Thu 10/7/21** | **Wed 12/1/21** | | **0%** |
| 4 | Develop ARCH schematic design | 30 days | Thu 10/7/21 | Wed 11/17/21 | 2 | 0% |
| 5 | Develop Options Report for IBC & IPC Compliance | 30 days | Thu 10/7/21 | Wed 11/17/21 | 2 | 0% |
| 6 | NIST SD Review/ Meeting | 10 days | Thu 11/18/21 | Wed 12/1/21 | 5 | 0% |
| 7 | **Design Development-ARCH** | **35 days** | **Thu 12/2/21** | **Wed 1/19/22** | | **0%** |
| 8 | Further Develop ARCH Designs | 25 days | Thu 12/2/21 | Wed 1/5/22 | 6 | 0% |
| 9 | NIST Review/ Meeting | 10 days | Thu 1/6/22 | Wed 1/19/22 | 8 | 0% |
| 10 | **Final ARCH Design** | **10 days** | **Thu 1/20/22** | **Wed 2/2/22** | | **0%** |
| 11 | Develop Final ARCH layouts | 10 days | Thu 1/20/22 | Wed 2/2/22 | 9 | 0% |
| 12 | NIST Review / Meeting | 10 days | Thu 2/3/22 | Wed 2/16/22 | 11 | 0% |
| 13 | NIST Sign off on ARCH layouts | 0 days | Wed 2/16/22 | Wed 2/16/22 | 12 | 0% |
| 14 | **50% Plumbing Design** | **40 days** | **Thu 2/17/22** | **Wed 4/13/22** | | **0%** |
| 15 | Dwg Development | 30 days | Thu 2/17/22 | Wed 3/30/22 | 13 | 0% |
| 16 | NIST Review/ Meeting | 10 days | Thu 3/31/22 | Wed 4/13/22 | 15 | 0% |
| 17 | **70% Plumbing Design** | **30 days** | **Thu 4/14/22** | **Wed 5/25/22** | | **0%** |
| 18 | Dwg Development | 20 days | Thu 4/14/22 | Wed 5/11/22 | 16 | 0% |
| 19 | NIST Review/ Meeting | 10 days | Thu 5/12/22 | Wed 5/25/22 | 18 | 0% |
| 20 | **100% Plumbing Design** | **15 days** | **Thu 5/26/22** | **Wed 6/15/22** | | **0%** |
| 21 | Dwg Development | 15 days | Thu 5/26/22 | Wed 6/15/22 | 19 | 0% |




| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | aTask | | Rolled Up Milestone | ◇ | Group By Summary | | Manual Task | | Finish-only |
| | Progress | | Rolled Up Progress | | Deadline | ⇩ | Duration-only | | |
| Date: Tue 10/12/21 | Milestone | ◆ | Split | | Inactive Task | | Manual Summary Rollup | | |
| | Summary | | External Tasks | | Inactive Milestone | ◇ | Manual Summary | | |
| | Rolled Up Task | | Project Summary | | Inactive Summary | | Start-only | ⊏ | |

AE STATEMENT OF WORK

Standard Reference Building Plumbing System Models

May 2021

**Background:**

This work involves designing premise plumbing systems for three residential and four commercial buildings (listed below and with elementary architectural drawings provided at the end of this document), including the addition of any architectural features that are required to define the plumbing systems, such as the addition of fixtures.

Residential:
R1: Single family, detached home – Floor Plan DH-A(7) (Total Floor Area: 107.0 $m^2$, 1152 $ft^2$)
R2: Single family, detached home – Floor Plan DH-F(4) (Total Floor Area: 329.4 $m^2$, 3,546 $ft^2$)
R3: Mid-rise Apartment (Floors: 4; Units/Floor: 8; Floor area/Unit: 65.2 $m^2$, 702 $ft^2$, Total Floor Area 2,302 $m^2$, 24,780 $ft^2$)

Commercial:
C1: Medium Office (Floors: 3; Floor area: 4,982.2 $m^2$, 53,628 $ft^2$)
C2: Stand-alone Retail (Floors: 1; Floor area: 2,294 $m^2$, 24,692 $ft^2$)
C3: Primary School (Floors: 1; Floor area: 6,871 $m^2$, 73,958 $ft^2$)
C4: Full-Service Restaurant (Floors: 1; Floor area: 511 $m^2$, 5,500 $ft^2$)

NIST will provide floor plans for the residential buildings and conceptual schematics for the commercial buildings based on previous efforts. The plumbing designs will be documented in a subsequent NIST report, which will be publicly available along with the design drawings with the A&E firm's name listed. These designs are intended to be used by researchers and various private and public sector stakeholders to support standardized analyses of premise plumbing system performance in the future.

**Period of Performance:** 266 days

**Design to Construction Estimate:** $1,900,000

**Requirements:**

1. AE shall provide Part "A" Architect Engineering design services in accordance with 48 CFR 836.606-73 (a).

   *The total cost of the architect or engineer services contracted for must not exceed 6 percent of the estimated cost of the construction project plus any fees for related services and activities such as those shown in paragraph (c) of 48 CFR 836.606-73*

   a. Design services shall include the following

1. Proposer shall provide Revit plumbing design based on owner defined architecture (reference Residential and Commercial Buildings list above, and elementary architectural plans found at the end of this document) for a variety of commercial and residential applications in LOD 300 environment. Elementary architectural plans are provided for the proposer's use in fully developing Revit models required for the design engineer to move forward with the specified plumbing models.
    a. LOD 200 – Approximate Geometry
       The Model Element is graphically represented within the Model as a generic system, object, or assembly with approximate quantities, size, shape, location, and orientation. Any information derived from LOD 200 elements must be considered approximate.
    b. LOD 300 - Precise Geometry
       The Model Element is graphically represented within the Model as a specific system, object, or assembly in terms of quantity, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element. The project origin is defined, and the element is located accurately with respect to the project origin.
    c. Refer to Model Properties at the end of this document for additional requirements.
2. Proposer will provide a complete and coordinated submission of modeling work at the following milestones:
    a. Schematic Design Phase
    b. Design Development Phase – LOD 200
    c. Final Model Submissions – LOD 300
        i. 50% Working Documents Phase
        ii. 70% Working Documents Phase
        iii. 100% Working Documents Phase
3. Proposer will coordinate with NIST regarding plumbing elements and devices.
4. Proposer will provide Revit design of project related architectural and plumbing systems. Project limits will include the building to 5-feet outside of the project building's footprint.
5. Plumbing systems included within the scope of services are:
    a. Sanitary waste and vent
    b. Potable water
    c. Perimeter/under-slab drainage
    d. Including selection of plumbing fixtures
6. Proposer will assist NIST to establish and document plumbing design requirements.
7. Proposer will submit to NIST all deliverables in electronic format for all packages.

8. Proposer will comply with 2018 International Plumbing Code.
9. Proposer will utilize BIM design, LOD 300 using Revit® 2019 in preparation of work for respective project milestone submissions.

b. Schematic Design Phase
    1. Upon written authorization from the Project Officer, Proposer will commence with professional services for the Schematic Design Phase.
        a. Proposer will review the approved project program and identify plumbing systems necessary to support the various project program functions.
        b. Proposer will attend the Design Initiation Meeting (DIM)
        c. Proposer will prepare a Basis of Design Narratives for architectural requirements and plumbing systems proposed for the project.
        d. Proposer shall attend a minimum of three (3) WebEx project coordination meetings and follow-up WebEx meetings as required to coordinate with NIST.
        e. Proposer will attend one (1) final NIST review meeting via WebEx.

c. Design Development Phase
    1. Upon written authorization from the Project Officer and based on an approved Schematic Design, Proposer will commence with professional services for the Design Development Phase.
        a. From Revit® model files developed by the proposer, produce preliminary plumbing design drawings at 1/8" = 1'-0". Proposer will produce large scale drawings of kitchens, bathrooms, restrooms, and selected plumbing intense spaces at 1/4" = 1'-0".
        b. Proposer will develop plumbing riser diagrams and details in sufficient detail to convey concept of design for cost estimating purposes.
        c. Proposer will attend a minimum of two (2) WebEx coordination meetings with follow-up sessions as required to coordinate with the Architect.
        d. Proposer will attend one (1) WebEx Owner review meeting.
        e. Proposer will update the Schematic Design Phase narratives for architectural and plumbing systems proposed for the project.
        f. Proposer will not be required to prepare Division 22 outline specifications.

d. Working Documents Phase
    1. Upon written authorization from the Project Officer, and based on approved Design Development Documents, proposer will prepare the Final Working Documents (Models).

a. From Revit® model files developed by the proposer, produce plumbing design drawings at 1/8” = 1’-0”. Proposer will produce large scale drawings of kitchens, bathrooms, restrooms, and selected plumbing intense spaces at 1/4" = 1’-0”.
b. Proposer will provide selective riser diagrams within the submission and updated plumbing diagrams and details with the 50% Working Document submission.
c. Proposer will provide completed riser diagrams with the 70% Working Document submission.
d. Proposer will attend a minimum of three (3) coordination meetings and follow-up sessions (via WebEx) as required to coordinate with the Project Officer.
e. Proposer will attend two (2) WebEx review meetings with NIST.
f. Proposer will update the Design Development Phase narratives for plumbing systems proposed for the project.
g. Proposer will not be required to prepare Plumbing, Division 22 Specifications.

2. AE shall provide Part “B” Architect Engineering design services in accordance with 48 CFR 836.606-73 (c).

*The 6 percent fee limitation does not apply to the following architect or engineer services:*

***(1)** Investigative services including but not limited to:*

***(i)** Determination of program requirements, including schematic or preliminary plans and estimates;*

***(ii)** Determination of feasibility of proposed project;*

***(iii)** Preparation of measured drawings of existing facility;*

***(iv)** Subsurface investigation;*

***(v)** Structural, electrical, and mechanical investigation of existing facility; and*

***(vi)** Surveys: topographic, boundary, utilities, etc.*

***(2)** Special consultant services that are not normally available in organizations of architects or engineers and that are not specifically applied to the actual preparation of working drawings or specifications of the project for which the service are required.*

***(3)** Other:*

***(i)** Reproduction of approved designs through models, color renderings, photographs, or other presentation media;*

***(ii)** Travel and per diem allowances other than those required for the development and review of working drawings and specifications;*

***(iii)*** *Supervision or inspection of construction, review of shop drawings or samples, and other services performed during the construction phase; and*

***(iv)*** *All other services that are not an integral part of the production and delivery of plans, designs, and specifications.*

***(4)*** *The cost of reproducing drawings and specifications for bidding and their distribution to prospective bidders and plan file rooms.*

a. Non-Design (Part B) services shall be as follows:
    1. Task #1 – AE shall attend a project kick off meeting as scheduled by the contracting specialist.
    2. Task #2 – AE shall review, copy, and evaluate the seven (7) NIST-defined standard reference buildings in hard copy or electronic format.
    3. Task #3 – AE shall generate SD Level architectural plans for the seven (7) NIST-defined buildings.
    4. Task #4 – AE shall prepare options report for IBC and IPC compliance.
    5. Task #5 – AE shall meet with NIST for SD package review. Provide meeting minutes to be used in DD package development.
    6. Task #6 – AE shall generate DD Level architectural plans for the seven (7) NIST-defined buildings.
    7. Task #7 – AE shall meet with NIST for DD package review. Provide meeting minutes to be used in 50% package development.
    8. Task #8 – AE shall finalize architectural models for the seven (7) NIST-defined buildings. Meet with NIST for approval/sign-off. Architectural base models are now completed.
    9. Task #9 – AE shall meet with NIST for 50% plumbing package review. Provide meeting minutes to be used in 70% package development.
    10. Task #10 – AE shall meet with NIST for 70% plumbing package review. Provide meeting minutes to be used in 100% package development.
    11. Task #11 – AE shall provide cost estimates for each of the seven (7) models at 70% design.
    12. Task #12 – AE shall meet with NIST for 100% package review. Provide meeting minutes.
    13. Task #13 – AE shall provide cost estimates for each of the seven (7) models at 100% design.
b. Non-Design (Post Construction Award Services (PCAS)) services not applicable.

**Deliverables:**

a. AE shall provide a Schematic Design (SD) submittal (without specifications) within **45** calendar days of receipt of Government Notice to Proceed (NTP).
    a. AE shall submit one PDF set and one complete Revit model for review.

b. NIST will review and comment on the SD submittal within **14** calendar days receipt of the Package.

c. AE shall provide a Design Development (DD) submittal (without specifications) within **45** calendar days of receipt of NIST comments.
    a. AE shall submit one PDF set and one complete Revit Model set for review.
    b. AE shall include a Navisworks file of Revit model.

d. NIST will review and comment on the DD submittal within **14** calendar days receipt of the basis of design.

e. AE shall provide a 50% design submittal (without specifications) within **45** calendar days of receipt of NIST comments.
    a. AE shall submit one PDF set and one complete Revit Model for review.
    b. AE shall include a Navisworks file of Revit model.

f. NIST will review and comment on the 50% submittal within **14** calendar days receipt of the basis of design.

g. AE shall provide a 70% design submittal (without specifications) within **45** calendar days of receipt of NIST comments.
    a. AE shall submit one PDF set and one complete Revit Model for review.
    b. AE shall include a Navisworks file of Revit model.
    c. AE shall submit one independent estimate to the COR.

h. NIST will review and comment on the 70% submittal within **14** calendar days receipt of the basis of design.

i. AE shall provide a 100% design submittal (with specifications) within **30** Calendar days of receipt of NIST comments.
    a. AE shall submit one PDF set and one complete Revit Model for review.
    b. AE shall include a Navisworks file of Revit model.
    c. AE shall submit two independent estimates from two independent firms to the COR. In the event there is a 10% discrepancy between the two estimates, the AE shall prepare a report identifying the discrepancy and remedies to resolve the discrepancy.

**Total – 266 Days**

**CAD/BIM**

1. Drawings shall be prepared in accordance with United States Army Corps of Engineers A/E/C CAD/BIM Technology Center: A/E/C CAD Standard, ERDC/ITL TR-19-7 A/E/C CAD Standard Release 6.1.

2. Drawings shall be prepared in AUTODESK Revit version 2019 or higher

**Invoicing:** *Refer to Base contract for specific invoicing instructions*

1. Contractor shall invoice the government based on AE provided schedule of values. Schedule of values shall be associated with the deliverables identified in paragraph 3 – "Deliverables".

**END OF STATEMENT OF WORK**

**PLUMBING MODEL PROPERTIES**

Working directly with NIST (researchers / end user), develop model elements and parameters (to ultimately be populated by the researcher / end user) tailored for specific computer models of hydronic behavior in a variety of plumbing systems. The researcher / end user shall ultimately have the ability to view and modify the instance properties (parameters) for piping as described below. Reporting based on the various parameter applications shall be output defined by the Revit programming structure and not a custom algorithm:

Calculated Pressure Drop

Displays the pressure drop for an entire network. (This parameter is only available on mechanical equipment that uses the Pump classification and when you have enabled analysis for closed loop hydronic piping networks on the Hydronic Networks tab in the Mechanical Settings dialog.)

Calculated Flow

Displays the flow for an entire network. (This parameter is only available on mechanical equipment that uses the Pump classification and when you have enabled analysis for closed loop hydronic piping networks on the Hydronic Networks tab in the Mechanical Settings dialog.)

System Classification

Defines the system for the connectors that are located on equipment. (For example, piping equipment could have a system classification of Hydronic Supply, Hydronic Return, Sanitary, Vent, Domestic Hot Water, Domestic Cold Water, and so on. These values are pre-defined classifications within Revit.)

System Type

Defines the system types for an MEP system. You can duplicate an existing system type to create additional system types as needed for the model. (For example, if you need a system type for high pressure supply air, duplicate the Supply Air system type, rename it, and change the properties as needed.)

System Name

A name that uniquely identifies a system, it may be user-defined or automatically generated.

System Abbreviation

A user-defined abbreviation for a system.

Loss Method

Defines the loss method for the selected fitting.

Loss Method Settings

Defines the loss method settings used when calculating pressure drop for a pipe fitting.

Pipe Segment
Defines the content used for a pipe section.

Diameter
Defines the nominal diameter for a pipe section.

Connection Type
Defines the type of connection for a pipe fitting or section, such as welded, threaded, grooved, glued, soldered, or flanged.

Roughness
Defines the roughness for a pipe section.

Material
Defines the material for a pipe section.

Schedule/Type
Displays the schedule or type for the selected pipe.

Segment Description
A user-defined description for a pipe segment.

Invert Elevation
Defines the elevation for the bottom of the pipe, with respect to the outside diameter.

Section
Defines a run of segments and fittings that have the same velocity, for example, the same flow, size, and shape.

Area
Defines the surface area of pipes, ducts, conduits, and cable trays.

Critical Path
Indicates whether the selected pipe is on the critical path of the network. Revit calculates the pressure drop of each path and specifies the one with the largest pressure drop as the critical path. You can set up a view filter or system color fill scheme to display the critical path.

Additional Flow
Defines the additional flow for the selected pipe.

Flow
Displays the flow rate for the pipe or pipe connector.

Reynolds Number

This value is calculated using the following formula:

$\mathrm{Re} = DV\rho/\mu$ , where
$\mathrm{Re} = Reynolds\ number, dimensionless$
$D = Internal\ diameter\ of\ Pipe\ (ft)$
$V = Average\ velocity\ (fps)$
$\rho = Fluid\ density\ at\ mean\ temperature\ (lb_m/ft^3)$
$\mu = Dynamic\ viscosity\ of\ fluid\ (lb_m/ft * s)$

Relative Roughness

This value is calculated using the following formula:

$\frac{\varepsilon}{D}$ , where
$D = Internal\ diameter\ of\ Pipe\ (ft)$
$\varepsilon = Absolute\ roughness\ of\ pipe\ wall\ (ft)$

Flow State

The flow state is determined by the value of the Reynolds Number. A Reynolds Number less than 2,000 is considered laminar flow. A Reynolds Number greater than 4000 is considered turbulent flow. Numbers between 2,000 and 4,000 are unpredictable and no loss calculation is made. There are two types of turbulent flow: transition and complete turbulence.

Friction Factor

Friction factor used in Darcy-Weisbach equation is calculated based on the flow state:

$f = \frac{64}{Nr}$ , where
$f = Friction\ factor$
$Nr = Reynolds\ number$

Velocity

This value is calculated using the following formula:

$$V = \frac{Flow\ Rate\ (feet^3/Second)}{Flow\ Area\ (feet^2)}$$

Friction

The pressure loss for a specific length unit of pipe.

Pressure Drop

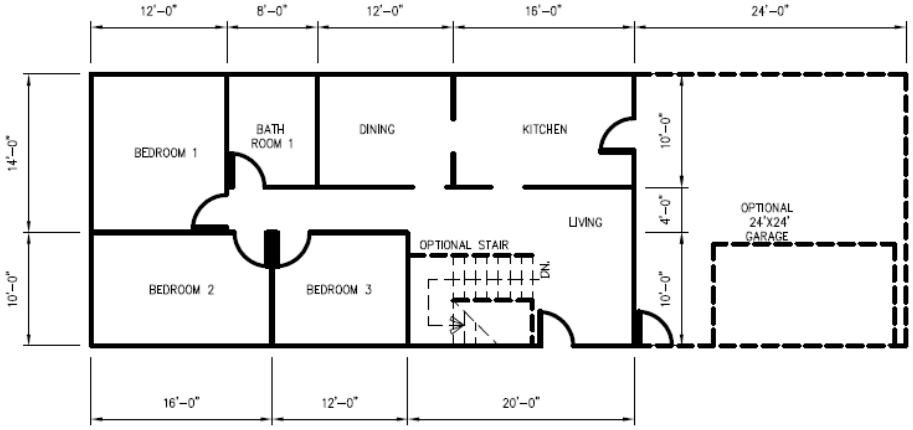
Displays the pressure drop for the selected pipe, fitting, or connector.

<End of Plumbing Model Properties>

**ELEMENTARY ARCHITECTURAL DRAWINGS**

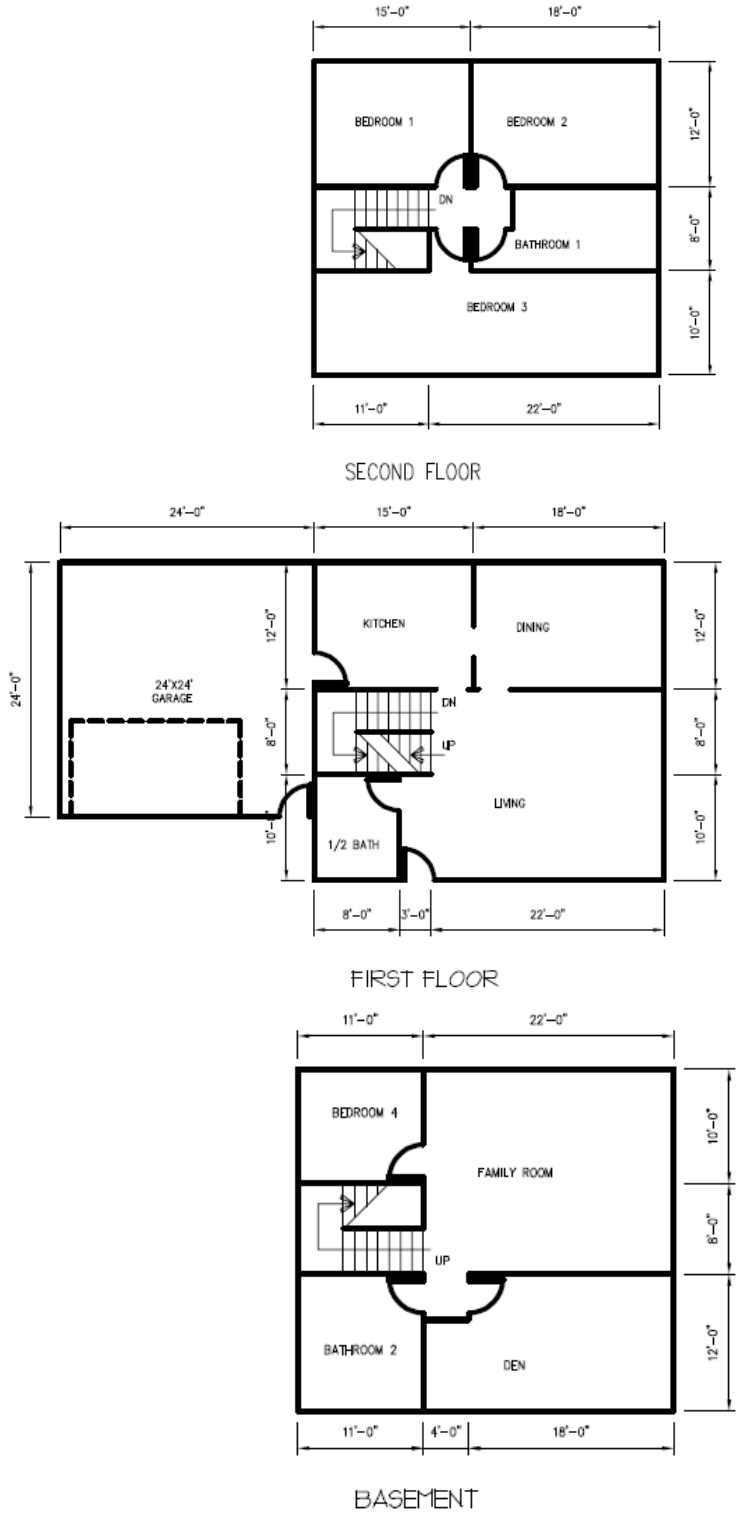
Residential:

Single family, detached home – Floor Plan DH-A(7)



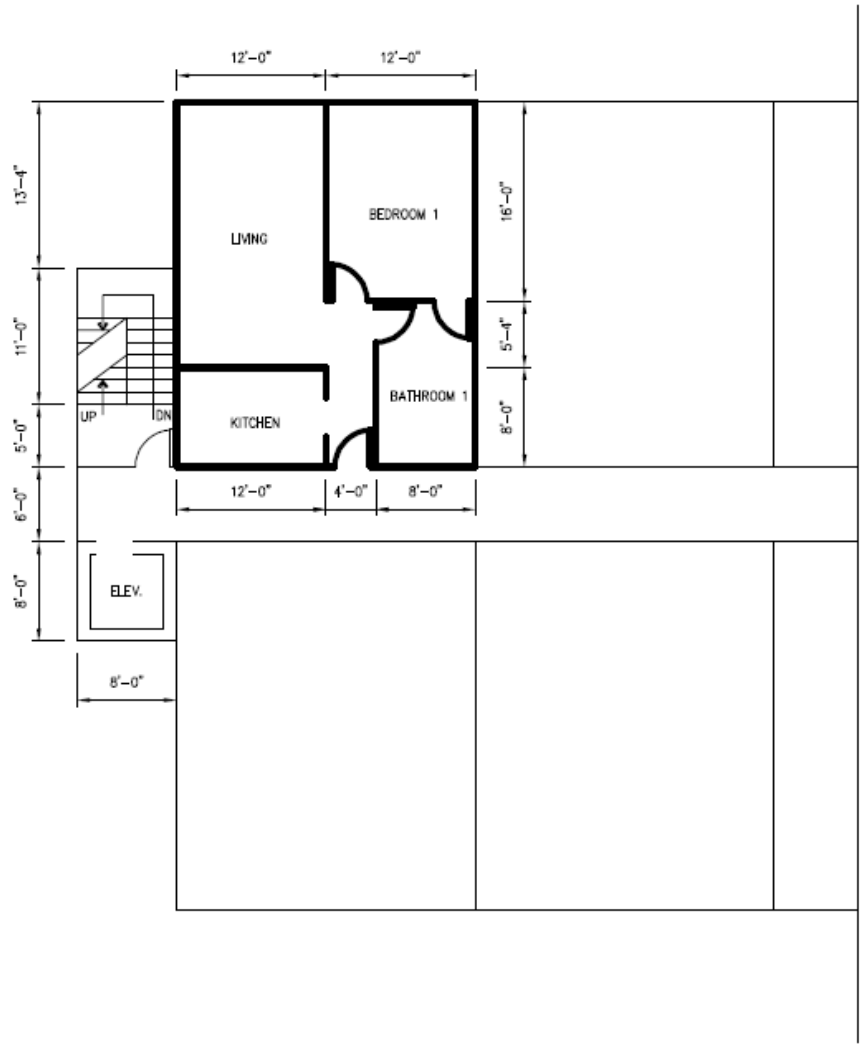

RESIDENTIAL BUILDING: SINGLE FAMILY–DETACHED HOME
FLOOR PLAN DH–A (7) (FLOOR AREA: 107.0 m2, 1152 ft2)
NOT TO SCALE

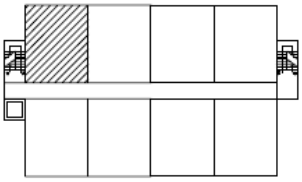
Single family, detached home – Floor Plan DH-F(4)




**RESIDENTIAL BUILDING: SINGLE FAMILY–DETACHED HOME**
**FLOOR PLAN DH–H (4) (FLOOR AREA: 329.4 m2, 3,546 ft2)**
NOT TO SCALE

Mid-rise Apartment



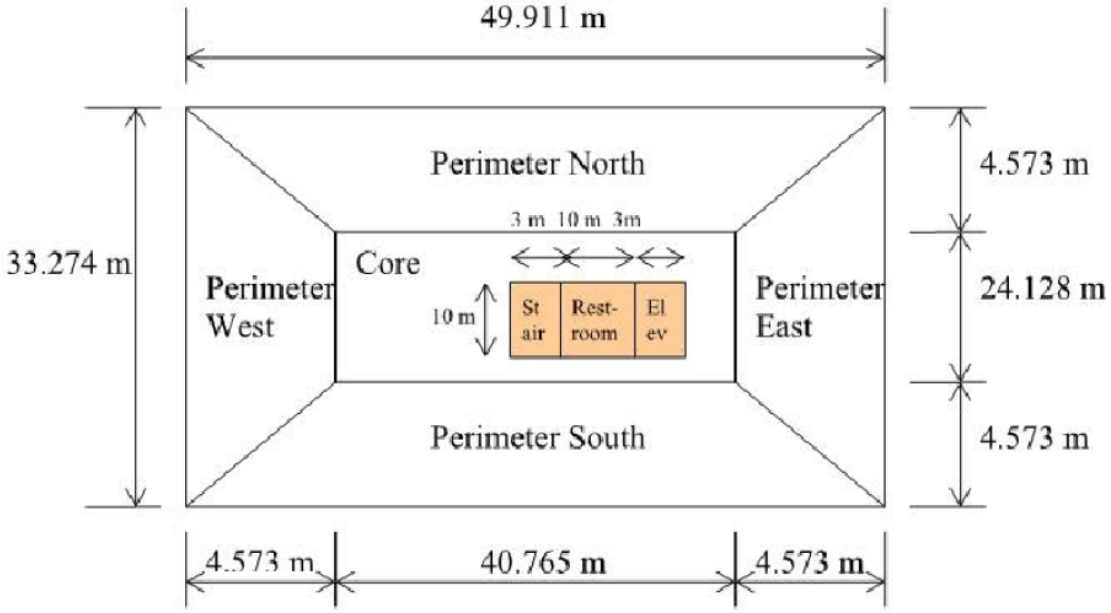
FLOOR LAYOUT

RESIDENTIAL BUILDING:
MID-RISE APARTMENT FLOORS: 4; UNITS/FLOOR: 8;
FLOOR AREA / UNIT: 65.2 m2, 702 ft2, TOTAL: 2,302 m2, 24,780 ft2

NOT TO SCALE

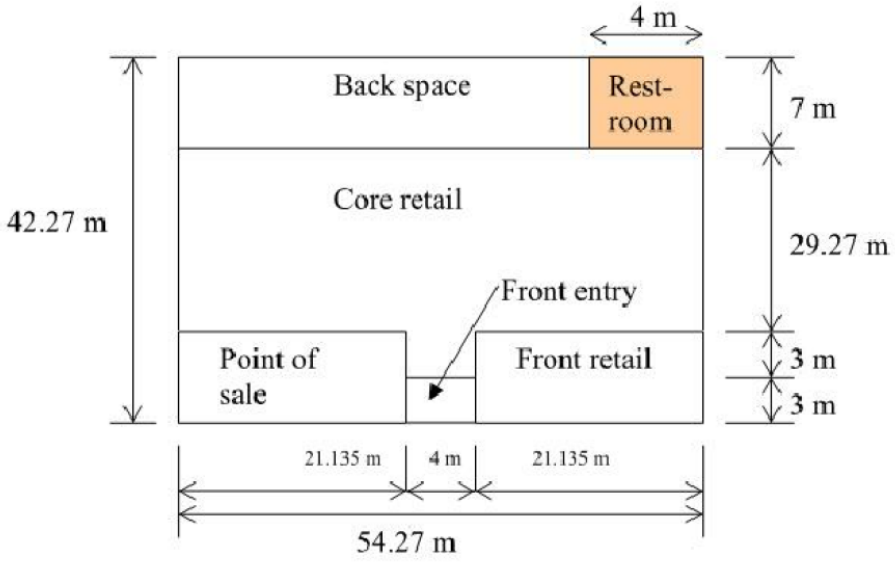
Commercial:

Medium Office



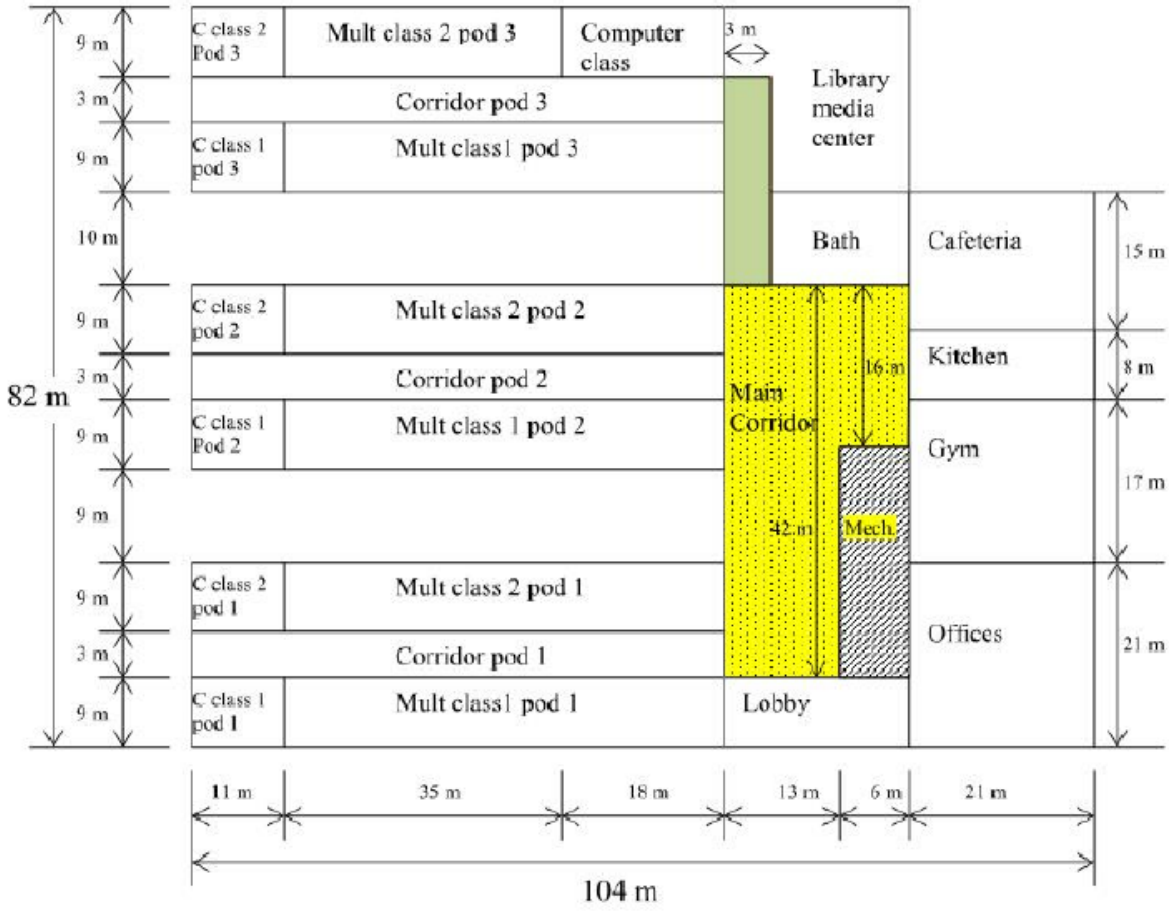

COMMERCIAL BUILDING: MEDIUM OFFICE
FLOORS: 3; FLOOR AREA: 4,982 m2, 53,628 ft2)
NOT TO SCALE

Stand-alone Retail



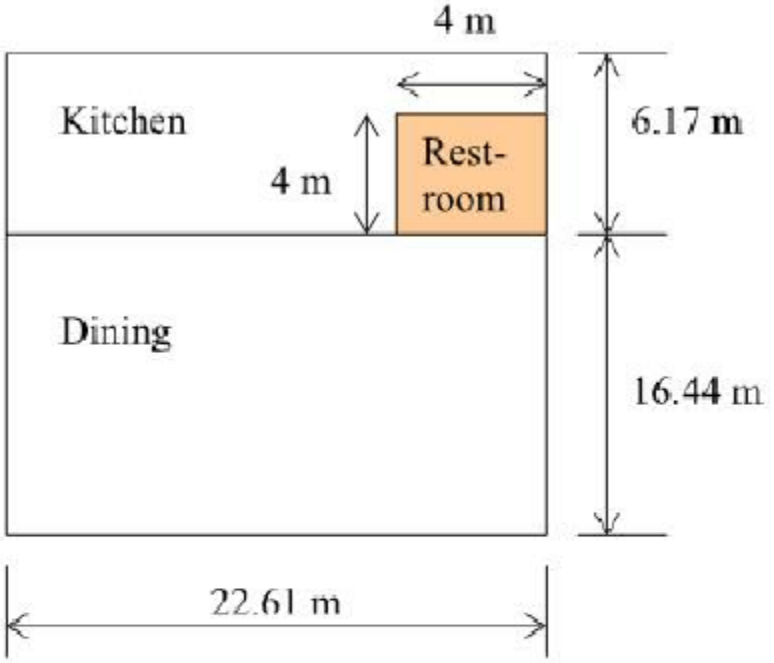

COMMERCIAL BUILDING: STAND-ALONE RETAIL
FLOORS: 1; FLOOR AREA: 2,294 m2, 24,692 ft2)
NOT TO SCALE

Primary School




COMMERCIAL BUILDING: PRIMARY SCHOOL
FLOORS: 1; FLOOR AREA: 6,871 m2, 73,958 ft2)
NOT TO SCALE

Full-Service Restaurant




COMMERCIAL BUILDING: FULL-SERVICE RESTAURANT
FLOORS: 1; FLOOR AREA: 511 m2, 5,500 ft2)
NOT TO SCALE

# Standard Reference Building Plumbing System Models NB7322050-21-01896

National Institute of Standards and Technology
Virtual Site Visit
July 26, 2021

## Standard Reference Building Plumbing System Models

This work involves designing premise plumbing systems for three residential and four commercial buildings (listed in SOW and with elementary architectural drawings provided), including the addition of any architectural features that are required to define the plumbing systems, such as the addition of fixtures.

3 Residential; 4 Commercial

## Motivations

Support consistent analysis of plumbing system performance of energy and water use, water quality.

Prototype buildings for energy and ventilation/indoor air quality analysis exist and have been very useful

Planning for future NIST laboratory facilities.

There are no buildings to visit & no existing conditions to verify– this is a drawing/engineering effort.

Construction plans will be posted/shared with researchers

## Existing prototype buildings

NIST "Suite of Homes"

- 209 dwellings
- Based on DOE Residential Energy Consumption Survey
- Used for ventilation and indoor air quality research

DOE commercial prototype buildings

- 16 buildings
- Based on DOE Commercial Energy Consumption Survey
- Used for building energy forecasting and energy efficiency standards development

## Prototype Buildings - Residential

2 single family, detached homes from NIST's Suite of Homes

Floor plans/schematics and DWG files (and CONTAM models) for buildings:

- DH-A (7) (1,152 sq ft)
- DH-H (4) (3,546 sq ft)

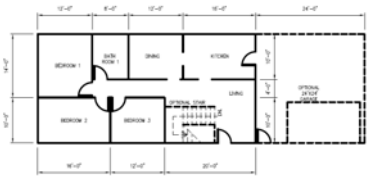
1 mid-rise apartment building from NIST's Suite of Homes

Floor plan/schematic and DWG file (and CONTAM model) for building:

- APT-3A (9) (4 floors, 8 units/floor, 24,780 sq ft total)

## Prototype Buildings - Residential

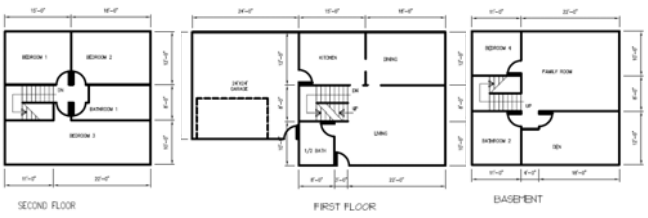
*(continued…)*



RESIDENTIAL BUILDING: SINGLE FAMILY–DETACHED HOME
FLOOR PLAN DH–A (7) (FLOOR AREA: 107.0 m2, 1152 ft2)

## Prototype Buildings - Residential

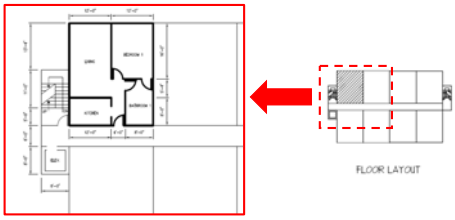
*(continued…)*




RESIDENTIAL BUILDING: SINGLE FAMILY-DETACHED HOME
FLOOR PLAN DH-H (4) (FLOOR AREA: 329.4 m2, 3,546 ft2)
NOT TO SCALE

## Prototype Buildings - Residential

*(continued…)*




RESIDENTIAL BUILDING:
MID-RISE APARTMENT FLOORS: 4; UNITS/FLOOR: 8;
FLOOR AREA / UNIT: 65.2 m2, 702 ft2, TOTAL: 2,302 m2, 24,780 ft2
NOT TO SCALE

## Prototype Buildings - Commercial

Department of Energy (DOE), Pacific Northwest National Laboratory (PNNL)

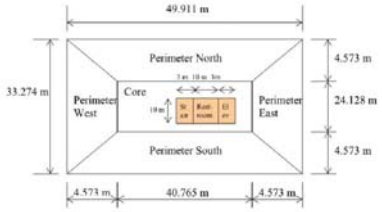
Floor plans/schematics (and CONTAM models) for buildings:

- Medium Office (3 floors, 53,628 sq ft)
- Stand Alone Retail (24,692 sq ft)
- Primary School (73,958 sq ft)
- Full-Service Restaurant (5,500 sq ft)

Schematic layouts available, but no DWG files.

## Prototype Buildings - Commercial

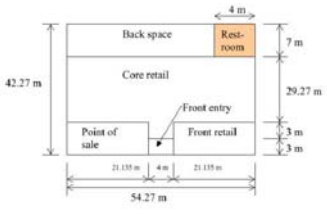
*(continued…)*




COMMERCIAL BUILDING: MEDIUM OFFICE
FLOORS: 3; FLOOR AREA: 4,982 m2, 53,628 ft2)

## Prototype Buildings - Commercial

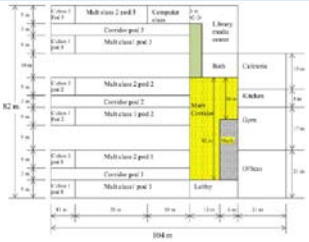
*(continued…)*




COMMERCIAL BUILDING: STAND-ALONE RETAIL
FLOORS: 1; FLOOR AREA: 2,294 m2, 24,692 ft2)

## Prototype Buildings - Commercial

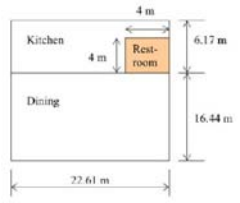
*(continued…)*



COMMERCIAL BUILDING: PRIMARY SCHOOL
FLOORS: 1; FLOOR AREA: 6,871 m2, 73,958 ft2)

## Prototype Buildings - Commercial

*(continued…)*




COMMERCIAL BUILDING: FULL-SERVICE RESTAURANT
FLOORS: 1; FLOOR AREA: 511 m2, 5,500 ft2)

## Building Department

These plans won't be built at NIST, so NIST Authority Having Jurisdiction will not be reviewing plans.

Follow SOW for code requirements.

Assume this is a design project that will be submitted for building permit approval from a regulatory body as noted in SOW.

No construction specifications needed.

## Discussion

**NIST Std Ref Bldg Plumbing System Models**

NIST Req./ Ref No.: NB732050-21-01896
LSY Project No: 21042

***Meeting No.*:** 02

***Meeting Date*:** November 3, 2021

***Topic:*** Project Coordination Meeting

***Attendees:***

| *Name* | *Organization* | *Telephone* | *Email* |
|---|---|---|---|
| Dan Gilmore | NIST-COR | 301-975-6951 | daniel.gilmore@nist.gov |
| Andrew Persily | NIST | | andrew.persily@nist.gov |
| Heather Johnson | LSY | 301-495-4261 | hjohnson@lsyarchitects.com |
| Tribhuvan Tuladhar | LSY | 301-495-4269 | ttulahar@lsyarchitects.com |
| Armando Berger | GES | 301-216-2871 | armando.berger@salasobrien.com |

**2.1. Project Coordination Review:** T. Tuladhar presented the current architectural floorplans and reviewed each one. The following are comments gathered from the conversation.

A. Single Family House:
   a. Layout acceptable add hose bibs front and back of the house.

B. Multi-family Four storied
   a. Include information regarding ADA adaptable units approx. 5% of the units designed

C. Retail - Stand Alone
   a. No exception taken

D. Full-service Restaurant
   a. AE to complete kitchen layout for plumbing fixtures and connection design

E. Medium Office Building
   a. Building and plumbing fixtures numbers to meet IPC and IBC code requirement for egress and ADA handicap accessibility. Drinking fountains will be added per code.

F. Primary School

   a. School student population considered approx. 700 students. Plumbing fixtures discussed for kindergarten and first grade students. Upper grade student class rooms layout to complete.

   b. The mechanical room in the DOE sketch is not located on an exterior wall. This is not typical. The design team would like to modify the sketch to make it more believable. Andy will check with the DOE team who created the sketch to see if this should be changed. The design team will follow layout of the school per sketch

provided by the DOE for energy optimization, until further direction is provided by Andy next week.

c. The DOE sketch of the school did show a health clinic. LSY will add one into the sketch, as it is also programmatically required for schools. It would have a toilet room and a separate hand wash sink.

**2.2. Schedule:** Project schedule to remain unchanged. Next SD submission Nov 17, 2021.

**Action Items:**

| Item No. | Date | Action Item | Individual Responsible | Date Due | Date Completed |
|---|---|---|---|---|---|
| 2.1.F | 11-3-21 | Location of the mechanical room | A. Persily | 11-6-21 | |
| 2.2 | 11-3-21 | SD Submission | Trib Tuladhar | 11-17-21 | |

*These minutes represent my understanding of items discussed. They will be considered correct and complete unless notice to the contrary is provided within five days.*

Sincerely,

Tribhuvan Tuladhar

Project Manager LSY

## Tribhuvan Tuladhar

**From:** Gilmore, Daniel J. (Fed) <daniel.gilmore@nist.gov>
**Sent:** Tuesday, November 9, 2021 8:25 AM
**To:** Tribhuvan Tuladhar
**Cc:** Zimmerman, Stephen M. (Fed); Persily, Andrew K. (Fed)
**Subject:** EXT Primary School

Tribhuvan,

The following is our response for the school model. Please advise if you need any additional information:

We want LSY to leave the primary school mechanical room in its location per our schematic, even if it's a little strange. LSY may add a note to the drawing along the lines of: The mechanical room location is atypical but is located without exterior access to be consistent with the DOE prototype building on which it is based.

Thanks
Dan

# Appendix D

# Scope of Work

C.1 Revised Statement of Work

AE STATEMENT OF WORK

Standard Reference Building Plumbing System Models

**Revised August 9, 2021**

**Background:**

This work involves designing premise plumbing systems for three residential and four commercial buildings (listed below and with elementary architectural drawings provided at the end of this document), including the addition of any architectural features that are required to define the plumbing systems, such as the addition of fixtures.

Residential:
R1: Single family, detached home – Floor Plan DH-A(7) (Total Floor Area: 107.0 $m^2$, 1152 $ft^2$)
R2: Single family, detached home – Floor Plan DH-F(4) (Total Floor Area: 329.4 $m^2$, 3,546 $ft^2$)
R3: Mid-rise Apartment (Floors: 4; Units/Floor: 8; Floor area/Unit: 65.2 $m^2$, 702 $ft^2$, Total Floor Area 2,302 $m^2$, 24,780 $ft^2$)

Commercial:
C1: Medium Office (Floors: 3; Floor area: 4,982.2 $m^2$, 53,628 $ft^2$)
C2: Stand-alone Retail (Floors: 1; Floor area: 2,294 $m^2$, 24,692 $ft^2$)
C3: Primary School (Floors: 1; Floor area: 6,871 $m^2$, 73,958 $ft^2$)
C4: Full-Service Restaurant (Floors: 1; Floor area: 511 $m^2$, 5,500 $ft^2$)

NIST will provide floor plans for the residential buildings and conceptual schematics for the commercial buildings based on previous efforts. The plumbing designs will be documented in a subsequent NIST report, which will be publicly available along with the design drawings with the A&E firm's name listed. These designs are intended to be used by researchers and various private and public sector stakeholders to support standardized analyses of premise plumbing system performance in the future.

**Period of Performance:** 266 days

**Design to Construction Estimate:** $1,900,000

**Requirements:**

1. AE shall provide Part "A" Architect Engineering design services in accordance with 48 CFR 836.606-73 (a).

   *The total cost of the architect or engineer services contracted for must not exceed 6 percent of the estimated cost of the construction project plus any fees for related services and activities such as those shown in paragraph (c) of 48 CFR 836.606-73*

   a. Design services shall include the following

a.1. Proposer shall provide Revit plumbing design based on owner defined architecture (reference Residential and Commercial Buildings list above, and elementary architectural plans found at the end of this document) for a variety of commercial and residential applications in LOD 300 environment. Elementary architectural plans are provided for the proposer's use in fully developing Revit models required for the design engineer to move forward with the specified plumbing models.

a.1.1.a. LOD 200 – Approximate Geometry

The Model Element is graphically represented within the Model as a generic system, object, or assembly with approximate quantities, size, shape, location, and orientation. Any information derived from LOD 200 elements must be considered approximate.

a.1.1.b. LOD 300 - Precise Geometry

The Model Element is graphically represented within the Model as a specific system, object, or assembly in terms of quantity, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element. The project origin is defined, and the element is located accurately with respect to the project origin.

a.1.1.c. Refer to Model Properties at the end of this document for additional requirements.

a.2. Proposer will provide a complete and coordinated submission of modeling work at the following milestones:

a.2.1.a. Schematic Design Phase

a.2.1.b. Design Development Phase – LOD 200

a.2.1.c. Final Model Submissions – LOD 300

a.2.1.c.i. 50% Working Documents Phase

a.2.1.c.ii. 70% Working Documents Phase

a.2.1.c.iii. 100% Working Documents Phase

a.3. Proposer will coordinate with NIST regarding plumbing elements and devices.

a.4. Proposer will provide Revit design of project related architectural and plumbing systems. Project limits will include the building to 5-feet outside of the project building's footprint.

a.5. Plumbing systems included within the scope of services are:

a.5.1.a. Sanitary waste and vent

a.5.1.b. Potable water

a.5.1.c. Perimeter/under-slab drainage

a.5.1.d. Including selection of plumbing fixtures

a.6. Proposer will assist NIST to establish and document plumbing design requirements.

a.7. Proposer will submit to NIST all deliverables in electronic format for all packages.

a.8. Proposer will comply with 2018 International Plumbing Code.

a.9. Proposer will utilize BIM design, LOD 300 using Revit® 2019 in preparation of work for respective project milestone submissions.

b. Schematic Design Phase

b.1. Upon written authorization from the Project Officer, Proposer will commence with professional services for the Schematic Design Phase.

b.1.1.a. Proposer will review the approved project program and identify plumbing systems necessary to support the various project program functions.

b.1.1.b. Proposer will attend the Design Initiation Meeting (DIM)

b.1.1.c. Proposer will prepare a Basis of Design Narratives for architectural requirements and plumbing systems proposed for the project.

b.1.1.d. Proposer shall attend a minimum of three (3) WebEx project coordination meetings and follow-up WebEx meetings as required to coordinate with NIST.

b.1.1.e. Proposer will attend one (1) final NIST review meeting via WebEx.

c. Design Development Phase

c.1. Upon written authorization from the Project Officer and based on an approved Schematic Design, Proposer will commence with professional services for the Design Development Phase.

c.1.1.a. From Revit® model files developed by the proposer, produce preliminary plumbing design drawings at 1/8" = 1'-0". Proposer will produce large scale drawings of kitchens, bathrooms, restrooms, and selected plumbing intense spaces at 1/4" = 1'-0".

c.1.1.b. Proposer will develop plumbing riser diagrams and details in sufficient detail to convey concept of design for cost estimating purposes.

c.1.1.c. Proposer will attend a minimum of two (2) WebEx coordination meetings with follow-up sessions as required to coordinate with the Architect.

c.1.1.d. Proposer will attend one (1) WebEx Owner review meeting.

c.1.1.e. Proposer will update the Schematic Design Phase narratives for architectural and plumbing systems proposed for the project.

c.1.1.f. Proposer will not be required to prepare Division 22 outline specifications.

d. Working Documents Phase

d.1. Upon written authorization from the Project Officer, and based on approved Design Development Documents, proposer will prepare the Final Working Documents (Models).

d.1.1.a. From Revit® model files developed by the proposer, produce plumbing design drawings at 1/8" = 1'-0". Proposer will produce large scale drawings of kitchens, bathrooms, restrooms, and selected plumbing intense spaces at 1/4" = 1'-0".

d.1.1.b. Proposer will provide selective riser diagrams within the submission and updated plumbing diagrams and details with the 50% Working Document submission.

d.1.1.c. Proposer will provide completed riser diagrams with the 70% Working Document submission.

d.1.1.d. Proposer will attend a minimum of three (3) coordination meetings and follow-up sessions (via WebEx) as required to coordinate with the Project Officer.

d.1.1.e. Proposer will attend two (2) WebEx review meetings with NIST.

d.1.1.f. Proposer will update the Design Development Phase narratives for plumbing systems proposed for the project.

d.1.1.g. Proposer will not be required to prepare Plumbing, Division 22 Specifications.

2. AE shall provide Part "B" Architect Engineering design services in accordance with 48 CFR 836.606-73 (c).

*The 6 percent fee limitation does not apply to the following architect or engineer services:*

***(1)** Investigative services including but not limited to:*

***(i)** Determination of program requirements, including schematic or preliminary plans and estimates;*

***(ii)** Determination of feasibility of proposed project;*

***(iii)** Preparation of measured drawings of existing facility;*

***(iv)** Subsurface investigation;*

***(v)** Structural, electrical, and mechanical investigation of existing facility; and*

***(vi)** Surveys: topographic, boundary, utilities, etc.*

***(2)** Special consultant services that are not normally available in organizations of architects or engineers and that are not specifically applied to the actual preparation of working drawings or specifications of the project for which the service are required.*

***(3)** Other:*

***(i)*** *Reproduction of approved designs through models, color renderings, photographs, or other presentation media;*

***(ii)*** *Travel and per diem allowances other than those required for the development and review of working drawings and specifications;*

***(iii)*** *Supervision or inspection of construction, review of shop drawings or samples, and other services performed during the construction phase; and*

***(iv)*** *All other services that are not an integral part of the production and delivery of plans, designs, and specifications.*

***(4)*** *The cost of reproducing drawings and specifications for bidding and their distribution to prospective bidders and plan file rooms.*

a. Non-Design (Part B) services shall be as follows:
    1. Task #1 – AE shall attend a project kick off meeting as scheduled by the contracting specialist.
    2. Task #2 – AE shall review, copy, and evaluate the seven (7) NIST-defined standard reference buildings in hard copy or electronic format.
    3. Task #3 – AE shall generate SD Level architectural plans for the seven (7) NIST-defined buildings.
    4. Task #4 – AE shall prepare options report for IBC and IPC compliance.
    5. Task #5 – AE shall meet with NIST for SD package review. Provide meeting minutes to be used in DD package development.
    6. Task #6 – AE shall generate DD Level architectural plans for the seven (7) NIST-defined buildings.
    7. Task #7 – AE shall meet with NIST for DD package review. Provide meeting minutes to be used in 50% package development.
    8. Task #8 – AE shall finalize architectural models for the seven (7) NIST-defined buildings. Meet with NIST for approval/sign-off. Architectural base models are now completed.
    9. Task #9 – AE shall meet with NIST for 50% plumbing package review. Provide meeting minutes to be used in 70% package development.
    10. Task #10 – AE shall meet with NIST for 70% plumbing package review. Provide meeting minutes to be used in 100% package development.
    11. Task #11 – **Deleted.**
    12. Task #12 – AE shall meet with NIST for 100% package review. Provide meeting minutes.
    13. Task #13 – **Deleted**

b. Non-Design (Post Construction Award Services (PCAS)) services not applicable.

**Deliverables:**

a. AE shall provide a Schematic Design (SD) submittal (without specifications) within **45** calendar days of receipt of Government Notice to Proceed (NTP).
    a. AE shall submit one PDF set and one complete Revit model for review.

b. NIST will review and comment on the SD submittal within **14** calendar days receipt of the Package.

c. AE shall provide a Design Development (DD) submittal (without specifications) within **45** calendar days of receipt of NIST comments.
    a. AE shall submit one PDF set and one complete Revit Model set for review.
    b. AE shall include a Navisworks file of Revit model.

d. NIST will review and comment on the DD submittal within **14** calendar days receipt of the basis of design.

e. AE shall provide a 50% design submittal (without specifications) within **45** calendar days of receipt of NIST comments.
    a. AE shall submit one PDF set and one complete Revit Model for review.
    b. AE shall include a Navisworks file of Revit model.

f. NIST will review and comment on the 50% submittal within **14** calendar days receipt of the basis of design.

g. AE shall provide a 70% design submittal (without specifications) within **45** calendar days of receipt of NIST comments.
    a. AE shall submit one PDF set and one complete Revit Model for review.
    b. AE shall include a Navisworks file of Revit model.
    c. **Deleted**

h. NIST will review and comment on the 70% submittal within **14** calendar days receipt of the basis of design.

i. AE shall provide a 100% design submittal (with specifications) within **30** Calendar days of receipt of NIST comments.
    a. AE shall submit one PDF set and one complete Revit Model for review.
    b. AE shall include a Navisworks file of Revit model.
    c. **Deleted**

**Total – 266 Days**

**CAD/BIM**

1. Drawings shall be prepared in accordance with United States Army Corps of Engineers A/E/C CAD/BIM Technology Center: A/E/C CAD Standard, ERDC/ITL TR-19-7 A/E/C CAD Standard Release 6.1.

2. Drawings shall be prepared in AUTODESK Revit version 2019 or higher

**Invoicing:** *Refer to Base contract for specific invoicing instructions*

1. Contractor shall invoice the government based on AE provided schedule of values. Schedule of values shall be associated with the deliverables identified in paragraph 3 – "Deliverables".

**END OF STATEMENT OF WORK**

**PLUMBING MODEL PROPERTIES**

Working directly with NIST (researchers / end user), develop model elements and parameters (to ultimately be populated by the researcher / end user) tailored for specific computer models of hydronic behavior in a variety of plumbing systems. The researcher / end user shall ultimately have the ability to view and modify the instance properties (parameters) for piping as described below. Reporting based on the various parameter applications shall be output defined by the Revit programming structure and not a custom algorithm:

Calculated Pressure Drop

Displays the pressure drop for an entire network. (This parameter is only available on mechanical equipment that uses the Pump classification and when you have enabled analysis for closed loop hydronic piping networks on the Hydronic Networks tab in the Mechanical Settings dialog.)

Calculated Flow

Displays the flow for an entire network. (This parameter is only available on mechanical equipment that uses the Pump classification and when you have enabled analysis for closed loop hydronic piping networks on the Hydronic Networks tab in the Mechanical Settings dialog.)

System Classification

Defines the system for the connectors that are located on equipment. (For example, piping equipment could have a system classification of Hydronic Supply, Hydronic Return, Sanitary, Vent, Domestic Hot Water, Domestic Cold Water, and so on. These values are pre-defined classifications within Revit.)

System Type

Defines the system types for an MEP system. You can duplicate an existing system type to create additional system types as needed for the model. (For example, if you need a system type for high pressure supply air, duplicate the Supply Air system type, rename it, and change the properties as needed.)

System Name

A name that uniquely identifies a system, it may be user-defined or automatically generated.

System Abbreviation

A user-defined abbreviation for a system.

Loss Method

Defines the loss method for the selected fitting.

Loss Method Settings

Defines the loss method settings used when calculating pressure drop for a pipe fitting.

Pipe Segment
Defines the content used for a pipe section.

Diameter
Defines the nominal diameter for a pipe section.

Connection Type
Defines the type of connection for a pipe fitting or section, such as welded, threaded, grooved, glued, soldered, or flanged.

Roughness
Defines the roughness for a pipe section.

Material
Defines the material for a pipe section.

Schedule/Type
Displays the schedule or type for the selected pipe.

Segment Description
A user-defined description for a pipe segment.

Invert Elevation
Defines the elevation for the bottom of the pipe, with respect to the outside diameter.

Section
Defines a run of segments and fittings that have the same velocity, for example, the same flow, size, and shape.

Area
Defines the surface area of pipes, ducts, conduits, and cable trays.

Critical Path
Indicates whether the selected pipe is on the critical path of the network. Revit calculates the pressure drop of each path and specifies the one with the largest pressure drop as the critical path. You can set up a view filter or system color fill scheme to display the critical path.

Additional Flow
Defines the additional flow for the selected pipe.

Flow
Displays the flow rate for the pipe or pipe connector.

Reynolds Number

This value is calculated using the following formula:

Re , where
Re

Relative Roughness

This value is calculated using the following formula:

, where

Flow State

The flow state is determined by the value of the Reynolds Number. A Reynolds Number less than 2,000 is considered laminar flow. A Reynolds Number greater than 4000 is considered turbulent flow. Numbers between 2,000 and 4,000 are unpredictable and no loss calculation is made. There are two types of turbulent flow: transition and complete turbulence.

Friction Factor

Friction factor used in Darcy-Weisbach equation is calculated based on the flow state:

, where

Velocity

This value is calculated using the following formula:

Friction

The pressure loss for a specific length unit of pipe.

Pressure Drop

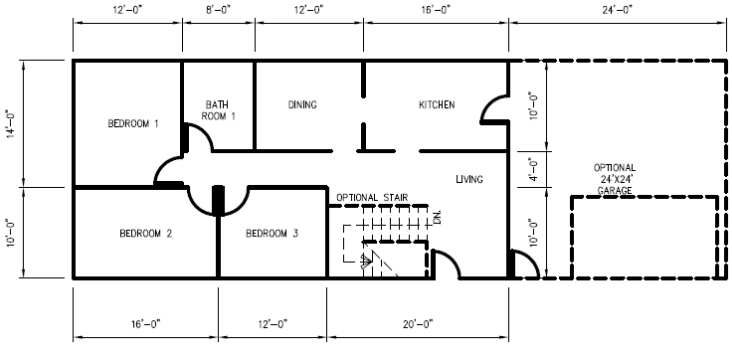
Displays the pressure drop for the selected pipe, fitting, or connector.

<End of Plumbing Model Properties>

**ELEMENTARY ARCHITECTURAL DRAWINGS**

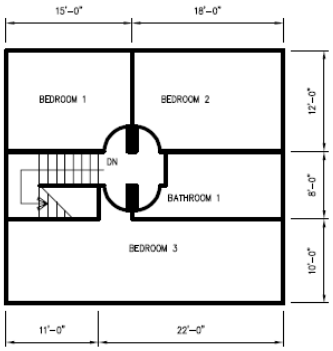
Residential:

Single family, detached home – Floor Plan DH-A(7)

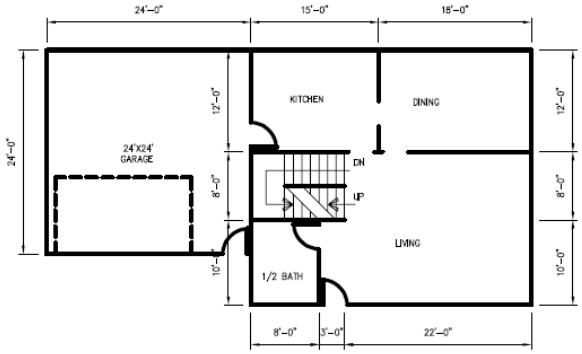



RESIDENTIAL BUILDING: SINGLE FAMILY–DETACHED HOME
FLOOR PLAN DH–A (7) (FLOOR AREA: 107.0 m2, 1152 ft2)
NOT TO SCALE

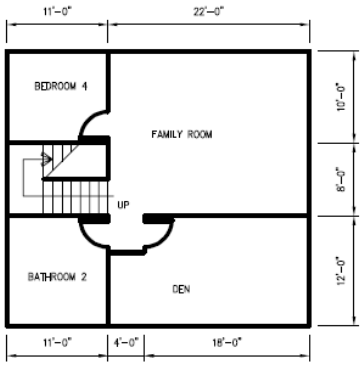
Single family, detached home – Floor Plan DH-F(4)




SECOND FLOOR



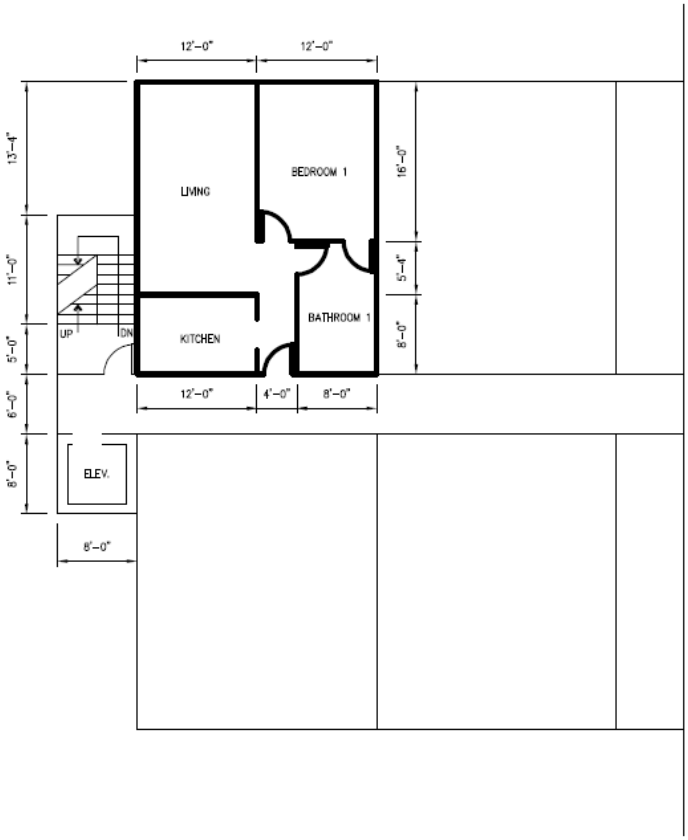

FIRST FLOOR

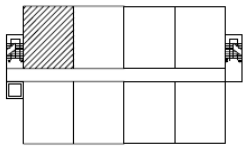



BASEMENT

RESIDENTIAL BUILDING: SINGLE FAMILY-DETACHED HOME
FLOOR PLAN DH-H (4) (FLOOR AREA: 329.4 m2, 3,546 ft2)
NOT TO SCALE

Mid-rise Apartment



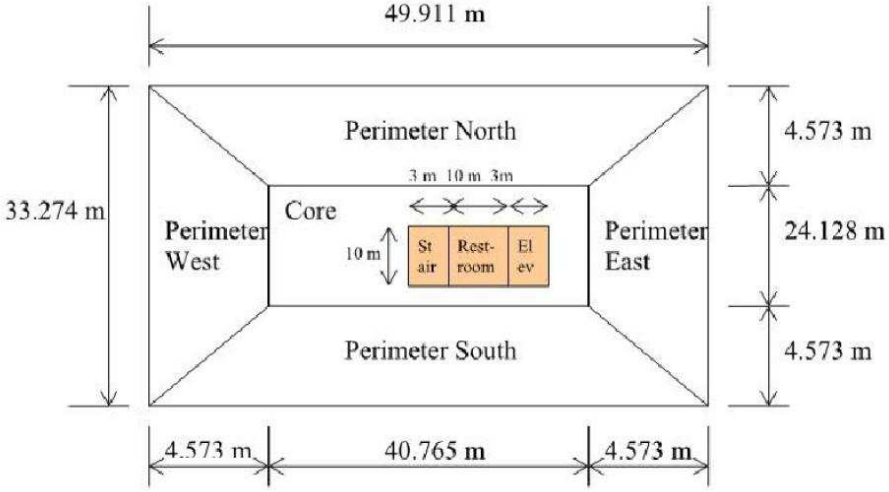


FLOOR LAYOUT

RESIDENTIAL BUILDING:
MID-RISE APARTMENT FLOORS: 4; UNITS/FLOOR: 8;
FLOOR AREA / UNIT: 65.2 m2, 702 ft2, TOTAL: 2,302 m2, 24,780 ft2
NOT TO SCALE

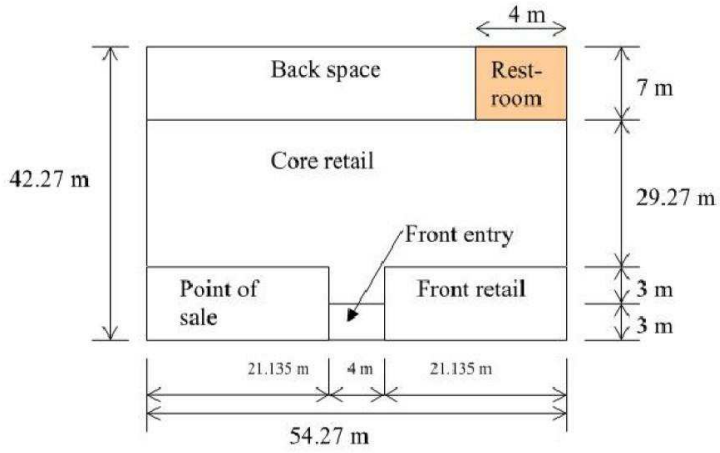
Commercial:

Medium Office



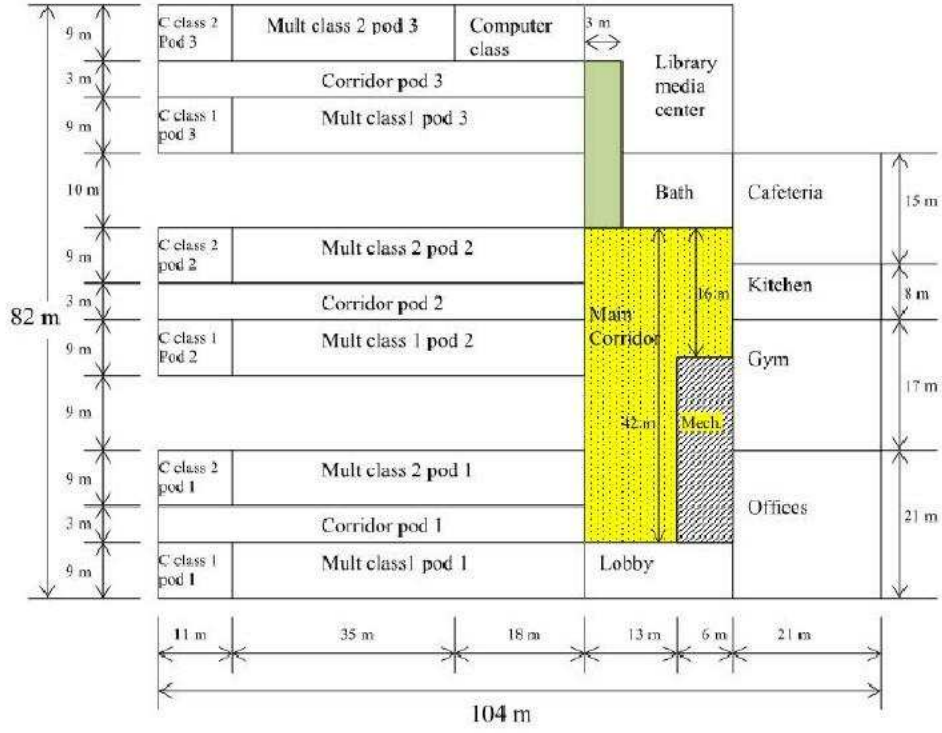

COMMERCIAL BUILDING: MEDIUM OFFICE
FLOORS: 3; FLOOR AREA: 4,982 m2, 53,628 ft2)
NOT TO SCALE

Stand-alone Retail



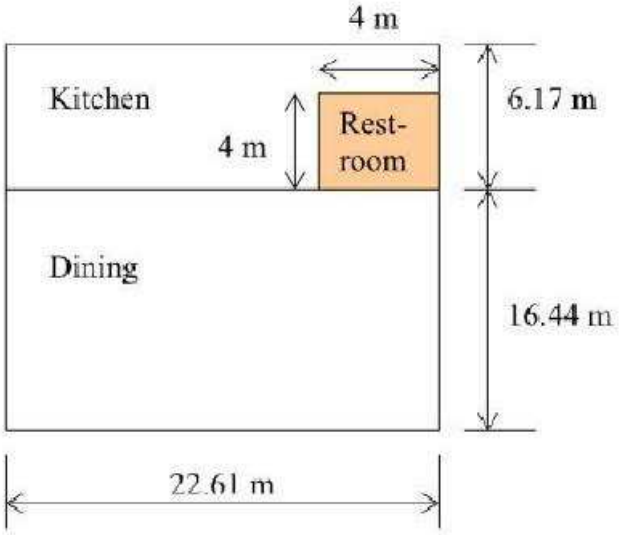

COMMERCIAL BUILDING: STAND-ALONE RETAIL
FLOORS: 1; FLOOR AREA: 2,294 m2, 24,692 ft2)
NOT TO SCALE

Primary School




COMMERCIAL BUILDING: PRIMARY SCHOOL
FLOORS: 1; FLOOR AREA: 6,871 m2, 73,958 ft2)
NOT TO SCALE

Full-Service Restaurant




COMMERCIAL BUILDING: FULL-SERVICE RESTAURANT
FLOORS: 1; FLOOR AREA: 511 m2, 5,500 ft2)
NOT TO SCALE