



22 00 00
GENERAL PLUMBING REQUIREMENTS

1. GENERAL

A. Related sections:

- i. 00 00 07 – Design Professional Design Process Requirements
- ii. 00 00 08 – Design Professional Documentation Requirements and Deliverables
- iii. 00 00 13 – Designing Learning Environments
- iv. 01 41 26.06 – Dining Services
- v. 01 81 00 – Facility Performance Requirements
- vi. 22 07 00 – Plumbing Insulation
- vii. 22 10 00 – Plumbing Piping
- viii. 22 40 00 – Plumbing Fixtures
- ix. 22 45 00 – Emergency Plumbing Fixtures
- x. 23 05 53 – Identification for HVAC Piping and Equipment
- xi. 23 09 23 – Building Automation and Temperature Control System (BAS)
- xii. Appendix A

B. The Design Professional is recommended to refer to Section 00 00 07 Design Professional Design Process Requirements, Section 00 00 08 Design Professional Documentation Requirements and Deliverables, and Section 01 81 00 Facility Performance Requirements before beginning design.

C. Design Professional shall provide riser diagrams for all plumbing systems.

D. Design Professional shall refer to Section 23 05 53 Identification for HVAC Piping and Equipment for information regarding plumbing identification.

E. Domestic Water:

- i. Provide a valve at each floor in branch line serving that floor (provide 2 valves if system is looped).
- ii. Provide a valve in hot and cold water at entry to each bathroom and at each fixture.
 1. Housing only: In multi-floor residence halls with stacked community restrooms, provide isolation valves for each community restroom.
- iii. Provide a valve in each service (water, gas, comp air, etc.) at entry to each laboratory and at each lab bench, fume hood, and at terminations for equipment. Valves shall be readily accessible, grouped together and located in lockable valve cabinet(s) at entry to the lab.
- iv. Design Professional shall determine need for any application specific additional valves that may be required and show these on the plans.
- v. Hot water: provide re-circulating systems on all systems with dead-leg runs greater than 30 feet.
- vi. Isolation valves shall be provided in readily accessible locations and coordinated with other disciplines as required.
- vii. Provide balancing valves and thermometers in hot water circulation lines to assist in balancing.
- viii. Propress fitting (or other similar mechanical joints) shall not be allowed in new facilities, but may be considered in renovations of existing facilities.

*Revised May 1,
2023*



- ix. For any domestic water sub-metering applications, controls contractor to provide meter and plumbing contractor to install. Refer to Section 23 09 23 Building Automation and Temperature Control System (BAS) for specification details. Plumbing designer to show meter and associated notes on plumbing drawings.
 - x. All thermometer gauges located on domestic plumbing shall be dial type gauges.
- F. Provide floor drains in all toilet rooms.
- G. Provide trap primers for all floor drains and floor sinks except for UGA Housing projects where trap guards shall be used as the basis of design. Plumbing design shall review with UGA PM which types of primer to use for each project and clearly designate which type is used for each location on the drawings.
- H. Ball valves shall be used for plumbing services isolation (no gate valves). For larger pipe sizes other valves other valve types can be submitted to UGA PM for approval (still no gate valves).
- I. Pressure reducing valves (PRVs)
- i. Shall be suitable for the application. Verify the prevailing mains water pressure and consult the manufacturer's engineering department to verify the correct selection of the PRV provided irrespective of any model specified on the drawings.
 - ii. Provide pressure gauge downstream and P/T ports up and downstream of every PRV.
 - iii. Provide an upstream strainer if installed ahead of the PRV.
- J. Design for Learning Environments
- i. Avoid locating high traffic plumbing pipe within the classroom space. When plumbing is provided within a classroom wall, ensure that the wall's sound transmission class (STC) rating is adequate. Avoid plumbing layouts which may cause excessive pipe noise through the effects of water hammer.
 - ii. Whenever a project includes work that will penetrate existing concrete slab (elevated and/or on grade), the Design Professional and/or Construction Professional shall review conditions during design with Project Manager to verify if additional investigative work is needed (x-ray, GPR, ferrosan, etc.).
- K. Strategy for supplying deionized water shall be reviewed with UGA PM to determine if a building, regional, or point of use system is to be used. Also need to confirm required water purity levels (1 MΩ, 18 MΩ, etc.).
- L. If a point of use DI system is utilized, review with UGA PM to determine if a floor drain is needed.
- M. For projects incorporating DI loops design professional shall incorporate the below detail:
- N. Installation of residential-type dishwashers is prohibited. In cases where there is adequate reasoning, a variance must be submitted and approved prior to incorporation into the design.



22 07 00
PLUMBING INSULATION

1. GENERAL

A. Related sections:

- i. 22 00 00 – General Plumbing Requirements
- ii. 22 10 00 – Plumbing Piping

B. All hot and tempered water piping shall be insulated. Cold water piping insulation is not mandatory but should be provided if required by project conditions.

2. PRODUCTS

A. Insulation shall be pre-formed fiberglass pipe insulation with vapor barrier and an all service jacket.



22 10 00
PLUMBING PIPING

1. GENERAL

A. Related sections:

- i. 22 00 00 – General Plumbing Requirements
- ii. 22 07 00 – Plumbing Insulation
- iii. 22 40 00 – Plumbing Fixtures
- iv. 22 45 00 – Emergency Plumbing Fixtures

2. PRODUCTS

- A. Under slab sanitary sewer piping shall be PVC. Buried sanitary sewer piping from 5 feet outside the building shall be ductile iron piping. Above-grade sanitary sewer piping shall be cast iron pipe with cast iron fittings.
- B. All sanitary mains leaving the building and under the slab (4" and larger) shall be camera-ed at the end of the warranty period.
- C. Water piping, buried within 5 feet of building, and below slab shall be ductile iron pipe with ductile iron or gray iron fittings.
- D. Domestic water piping above grade shall be type "L" copper pipe.
- E. Acid resistant waste and vent piping shall be polypropylene or polyvinylidene fluoride (PVDF).
- F. Fuel gas piping above grade shall be type "K" copper pipe or steel pipe, schedule 40.
- G. Strategy for supplying deionized water shall be reviewed with UGA PM to determine if a building, regional, or point of use system is to be used.
- H. In addition, the required water purity levels shall be confirmed (1 MΩ, 18 MΩ, etc.).
- I. If a point of use DI system is utilized, review with UGA PM to determine if a floor drain is needed.



22 11 23
FACILITY NATURAL GAS PIPING

1. GENERAL

- A. Related sections:
 - i. 22 00 00 – General Plumbing Requirements
 - ii. 11 53 13 – Laboratory Fume Hoods
- B. For new construction, renovations, and FMD work order requests, natural gas shall not be routed inside of a building without a variance except as listed below. It will not be provided solely for convenience. If a variance is approved, the Design Professional and Contractor shall route the natural gas so that all piping is easily accessible (for example, not encased in concrete slab).
 - i. For an existing building that has natural gas inside the building extending into research laboratories and support spaces, an existing Primary Investigator / Team may request additional extension of natural gas within their existing lab without a variance being required.
 - ii. For an existing building that has natural gas inside the building extending into research laboratories, if there is a change of Primary Investigator / Team and related users for an existing lab space with natural gas, a variance request will be required.



22 15 13
COMPRESSED AIR PIPING

1. GENERAL

- A. Related sections:
 - i. 22 00 00 – General Plumbing Requirements

2. PRODUCTS

- A. Piping shall be hard-drawn copper and shall be rated for the distribution pressure and any necessary safety factor.
- B. Provide isolation valves at each floor.
- C. Provide drains at low points in system.

3. EXECUTION

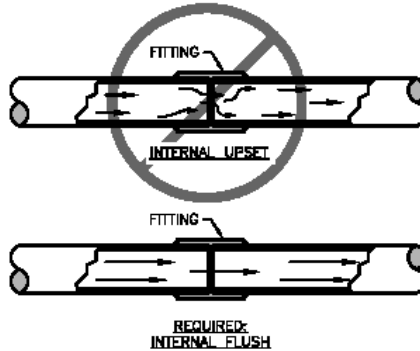
- A. All compressed air piping systems shall be pressure tested for 8 hours minimum at 40 psi or minimum required by code (whichever is greater). The test shall be witnessed by an owner appointed representative.
- B. Refer to detail below for installation guidelines.

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2023*

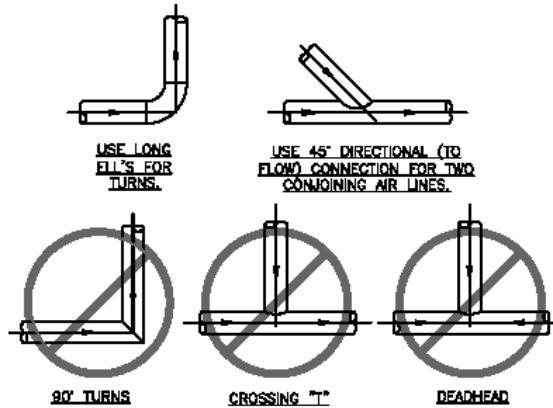


**COMPRESSED AIR PIPING DETAILS
TO ASSIST IN KEEPING SYSTEM PRESSURE DROPS LOW.**

NOTE: COPPER PREFERRED PIPING MATERIAL



GUIDELINES FOR PIPING INSTALLATION:



NOTE:

1. NO CROSSING TEES AND DEAD HEADS.
2. INTERCONNECTING PIPING 20 FT/SEC VELOCITY OR LESS.
3. DISTRIBUTION HEADER 30 FT/SEC VELOCITY OR LESS.
4. FEED TO PROCESS SHOULD BE 35 FPS OR LESS.



22 40 00
PLUMBING FIXTURES

1. GENERAL

- A. Related sections:
 - i. 22 00 00 – General Plumbing Requirements
 - ii. 22 10 00 – Plumbing Piping
 - iii. 06 61 00 – Solid Surface Fabrications
 - iv. 09 00 00.01 – Custodial Storage
- B. Flow rates for fixtures and fitting shall comply with or be less than GA State Amendments to International Plumbing Code, Table 604.4.

2. PRODUCTS

- A. Sensor actuated flush valves and faucets are not allowed. If the Design Professional feels that circumstances for a particular project warrant sensor actuated flush valves, the Design Professional shall discuss with Project Manager and determine if a variance request should be submitted.
- B. Acceptable manufactures and/or products are:
 - i. Lavatories – Sensor Type Faucets (if allowed)
 - a. Equal to Sloan: ETF 600 (Hardwire)
 - b. Equal to Sloan: SF2350 (Battery)
 - c. Equal to Speakman Sensorflo: S-8701 (Battery)
 - ii. Lavatories – Meeting faucets require pre-approval by the Project Manager
 - a. American Standard
 - b. Delta – Housing Only: Basis of Design
 - c. Encore
 - d. Kohler
 - e. Moen
 - f. T&S Brass
 - iii. Teaching Labs – Two Handle Faucets with Vacuum Breaker in Spout
 - a. Chicago
 - b. T&S Brass
 - c. Water Saver
 - iv. Urinals 0.5 GPF Max
 - a. Equal to American Standard: Washbrook 6590.001 (0.5 GPF)
 - b. Equal to Crane: 7399 (0.5 GPF)
 - c. Equal to Zurn: Z5738 (0.125 GPF)
 - d. Equal to Zurn: Z5798 (0.125 GPF)
 - v. Urinals – Sensor Flushometers (if allowed)
 - a. Equal to Sloan: Optima 186 ES-S Series
 - b. Equal to Zurn: ZEG6003EV (for pint urinal)
 - vi. Urinals – Manual Flushometers
 - a. Equal to Sloan: 186 HEU Series (0.125 GPF and 0.5 GPF)
 - b. Equal to Zurn: Z6003AV-ULF (for 0.125 GPF urinal) Z6003AV-EWS (0.5 GPF)
 - vii. Water Closets
 - a. Equal to American Standard: AFWALL 3351.001/3461.001 (1.28 GPF)



- b. Equal to American Standard: Madera 3451.001
- c. Equal to Crane: 3346NS (Wall)
- d. Equal to Crane: 3H701 (ADA Floor)
- e. Equal to Kohler: K04325 (Wall)
- viii. Water Closets – Manual Flushmeters
 - a. Equal to Sloan: 111-1.28 (1.28 GPF)
 - b. Equal to Zurn: Z-6000AV-HET (1.28 GPF)
- ix. Water Coolers / Bottle Filling Station: Wall mounted electric drinking fountain shall be complete filtered bi-level dual fountain cooler and bottle filling station, ADA compliant, no touch sensor activation on bottle filler, cooler shall have push bar activation, water filter, flexible bubblers, refrigerated unit, 8 GPH of 50F water at 90F ambient and 80F inlet water, lead free design; equal to Elkay LZSTL8WSLK. (Single Unit: Elkay EZH2O model # LZS8WSLK) Provide 17 gauge, chrome plated cast brass P-trap with cleanout and flexible ½-inch supply with wheel handle angle valve.
- x. Kitchen Sinks – 18 Gauge
 - a. Double Bowl – Equal to Elkay LR 3322
 - b. Single Bowl – Equal to Elkay LR 2522
 - c. Bar Sink – Equal to Elkay BCR 15
- xi. Kitchen Faucets
 - a. Equal to Wolverine Brass
 - b. Equal to Moen
- xii. Service Sink – 24 inches x 24 inches x 17 inches
 - a. Equal to Stern Williams SBC-1700BP
- xiii. Service Sink Faucet
 - a. Equal to Wolverine
 - b. Equal to T&S
 - c. Equal to Kohler
- xiv. Laundry Sink – 23 inches x 21 ½ inches x 33 ½ inches
 - a. Equal to Fiat FL1
 - b. Equal to Mustee
- xv. Laundry Sink Faucet
 - a. Equal to Wolverine
 - b. Equal to T&S
 - c. Equal to Moen
- xvi. Wall Hung Lavatory – China
 - a. Equal to Kohler K2005-0
- xvii. Drop-In Vanity Sink / China
 - a. Equal to Kohler K2196-4-0
- C. For UGA Housing Only (New Construction) – Acceptable products**
 - i. Water Closet – Dorm Rooms: Floor mounted, tank type, two piece vitreous china toilet with bottom outlet, elongated bowl, universal height, chrome trip lever, 1.28 gallons per flush (GPF), cotton color; equal to Toto CST744ELG(#01).
Seat (Dorm Rooms): Commercial plastic elongated seat with closed front and cover. Seat and cover shall include soft close hinge system, cotton color; equal to Toto SS154 (#01).



- ii. ADA Water Closet: ADA Toilets with roll up area on right side of fixture shall be provided with right hand chrome trip level; equal to Toto CST744ELRG.
- iii. Water Closet – Public Areas: Wall mounted, flush valve type with bottom outlet, 1.28 GPF, elongated bowl; equal to American Standard A2257101020. Seat (Public Area): Elongated open front seat less cover; equal to Toto SC534. Flush Value shall be chrome plated brass, exposed, diaphragm type with vacuum breaker; Sloan Royal 111-1.28 or equal by Toto or Zurn.
- iv. ADA Water Closet – Public Areas: Same as Water Closet – Public Areas except ADA toilets in public areas shall be ADA height: American Standard A2257101020. Flush handle shall be installed on wide roll up side of fixture.
- v. Urinal: ADA compliant, wall hung, vitreous china, 0.125 GPF (pint), washout type flush action, ¾-inch inlet top spud, 2-inch outlet, cotton color; equal to Toto UT105UG(#01). Flush Valve: manual operated, exposed, 0.125 GPF flush (pint), chrome plated brass valve with vacuum breaker and adjustable tailpiece; Sloan 186-0.13 or equal by Toto or Zurn.
- vi. Dorm Room Vanity Sink: Sink basin shall be integral counter mounted type. Faucet: ADA compliant, chrome plated brass, 4-inch center set single handle faucet with metal pop-up waste assembly, adjustable temperature limit stop and 1.5 GPM laminar flow aerator; Basis of Design is Delta Commercial with Delta aerator.
- vii. ADA Dorm Room Vanity Sink: Same as Dorm Room Vanity Sink except with offset tailpiece and insulation kit on piping below fixture.
- viii. Counter Lavatories – Public Areas: Fixture: 17 inches x 13 inches (overall) 18 gauge, type 304 under mount stainless steel lavatory with undercoating and overflow assembly; equal to Elkay ELU1511 or equal by Just Manufacturer. Faucet: ADA compliant, chrome plated brass, 4-inch center set single handle faucet with grid drain waste assembly, adjustable temperature limit stop and 0.5 GPM aerator; Basis of Design is Delta Commercial with Delta aerator.
- ix. Wall Hung Lavatory: ADA compliant, 21 inches x 18 inches wall hung, vitreous china lavatory, 4-inch faucet centers, front overflow; equal to Toto LT307.4. Faucet: ADA compliant, chrome plated brass, 4-inch center set single handle faucet with grid drain waste assembly, adjustable temperature limit stop and 0.5 GPM aerator; Basis of Design is Delta Commercial with Delta aerator.
- x. Dorm Showers: Enclosures shall include solid surface panels and shower pans. Provide 2-inch shower drain with stainless steel strainer and securing nut in each shower compartment; equal to Zurn FD-2270. Valve and trim shall be manual pressure balancing mixing valve with check stops, lever handle and low flow showerhead (1.5 GPM). Equal to Delta valve with Delta head. Provide with chrome plated arm and flange; Basis of Design is Delta Commercial. Provide Rinse Ace diverter between shower arm and head at each fixed showerhead; Rinse Ace WCRA-4050.
- xi. ADA Dorm Shower: Enclosures shall include solid surface panels and shower pans as specified by the Architect. Provide 2-inch shower drain with stainless steel strainer and securing nut in each shower compartment; equal to Zurn FD-2270. Valve and trim shall be manual pressure balancing mixing valve with check stops, level handle and low flow showerhead (1.5 GPM). Basis of Design is Delta



- valve with Delta head. Provide with chrome plated arm and flange. Provide with ADA hand held showerhead (1.5 GPM) on slide bar; Basis of Design is Delta. Diverter to control showers heads shall be provided; Basis of Design is Delta. Provide Rinse Ace diverter between shower arm and head at each fixed showerhead; Rinse Ace WCRA-4050.
- xii. Kitchen Sink – Apartment: 30 inches x 18 inches x 5 ½ inches deep, two compartment, 18 gauge, under mount, type 304 stainless steel sink with drain opening in center rear of each compartment; equal to Elkay ELUHAD3118 or equal by Just Manufacturer. Provide basket strainers with tailpiece. Sink faucets shall be 8-inch center set with 8-inch spout with single handle faucet, ceramic disc cartridge with 1.5 GPM aerators, side spray; Basis of Design is Delta Commercial. Provide 17-gauge chrome plated offset tailpiece and 17-gauge chrome plated cast brass p-trap with cleanout. Provide supplies to wall with wheel handle angle stops.
- xiii. Kitchen Sink – Student Kitchen: 30 inches x 18 inches x 5 ½ inches deep, two compartment, 18 gauge, under mount, type 304 stainless steel sink with drain opening in center rear of each compartment; equal to Elkay ELUHAD3118 or equal by Just Manufacturer. Provide basket strainers with tailpiece. Sink faucets shall be 8-inch center set with 8-inch spout with single handle faucet, ceramic disc cartridge with 1.5 GPM aerators, and no side spray. Basis of Design is Delta Commercial faucet with Delta Commercial aerator. Provide 17-gauge chrome plated offset tailpiece and 17 gauge chrome plated cast brass p-trap with cleanout. Provide supplies to wall with wheel handle angle stops.
- xiv. Kitchen Sink – Catering Kitchen: 30 inches x 18 inches x 5 ½ inches deep, two compartment, 18 gauge, under mount, type 304 stainless steel sink with drain opening in center rear of each compartment; equal to Elkay ELUHAD3118 or equal by Just Manufacturer. Provide basket strainers with tailpiece. Sink faucets shall be 8-inch center set with 8-inch spout with single handle faucet, ceramic disc cartridge with 1.5 GPM aerators, and no side spray. Basis of Design is Delta Commercial faucet with Delta Commercial aerator. Provide 17-gauge chrome plated offset tailpiece and 17 gauge chrome plated cast brass p-trap with cleanout. Provide supplies to wall with wheel handle angle stops.
- xv. Service Sinks: 24 inches x 24 inches x 12 inches deep, floor type, terrazzo mop sink with stainless steel caps and wall guards; equal to Stern Williams SBC-1700-BP or comparable product by Fiat. Faucet shall be chrome plated brass and include vacuum breaker spout with hose thread outlet, pail hook, wall support, integral check stops, service stops, lever handles with color indicators, 1/4 turn ceramic disc cartridge; equal to Delta.
- xvi. Laundry Sinks: 23 inches x 21 ½ inches x 33 ½ inches tall, molded stone floor mounted sink on metal legs. Legs shall be white baked enamel angle legs that slip into molded sockets with leveling devices. Equal to Fiat FL1 or equal by Mustee. Faucet shall be deck mounted, chrome plated metal construction, 4-inch center set, 5 ½-inch spout, small lever style handles; Basis of Design is Delta Commercial.
- xvii. Water Coolers: Wall mounted electric drinking fountain shall be complete filtered bi-level dual fountain cooler and bottle filling station, ADA compliant, no



touch sensor activation on bottle filler, cooler shall have push bar activation, water filter, flexible bubblers, refrigerated unit, 8 GPH of 50 °F water at 90 °F ambient and 80 °F inlet water, lead free design; Equal to Elkay LZSTL8WSLK. Provide 17 gauge, chrome plated cast brass P-trap with cleanout and flexible ½-inch supply with wheel handle angle valve.

- xviii. Bath Tub at Apartment: Tub fixture to be 60 inches x 30 inches x 14 inches high enameled cast iron tub with structural composite backing, slip resistant surface, integral apron; Kohler K-715 or equal by American Standard or Toto. Valve and trim shall be manual pressure balancing mixing valve with check stops, lever handle and low flow showerhead (1.5 GPM). Basis of Design is Delta Commercial valve with Delta Commercial head. Provide with chrome plated arm and flange; equal to Delta Commercial. Provide with ADA hand held showerhead (1.5 GPM) on slide bar; equal to Delta Commercial. Diverter to control shower heads shall be provided; equal to Delta Commercial. Provide chrome plated brass tub spout equal to Delta Commercial. Provide Rinse Ace diverter between shower arm and head at each fixed shower head; Rinse Ace WCRA-4050.



22 45 00
EMERGENCY PLUMBING FIXTURES

1. GENERAL

A. Related sections:

- i. 22 00 00 – General Plumbing Requirements

2. PRODUCTS

A. Emergency showers shall be equal to the Speakman Company – SE238 Life Saver or Guardian GBF1670 Emergency Shower.

- i. Emergency showers shall be third-party certified to meet or exceed the provisions of current edition of ANSI Z358.1.
- ii. Shower head height shall be at 8' AFF.

B. Eye / face washes shall be equal to Guardian G1750P or Speakman SE-580.

3. EXECUTION

A. Emergency showers shall be isolated from the main lab space via partition walls so that runoff of water and chemicals is not directed back into the main lab space along the floor.

B. A floor drain shall be provided at each emergency shower.



22 52 00.1

DOMESTIC WATER HEATERS – STEAM-FIRED

1. GENERAL

A. Related sections:

- i. 23 00 00 – General Mechanical Requirements (HVAC)

2. PRODUCTS

A. Water Heater Type

- i. For high or low pressure steam semi-instantaneous domestic water heater that doesn't require storage.
- ii. Heater shall provide 90-99 percent efficiency with 2-pass helical coil heat exchanger that self descales.
- iii. Manufacturer shall provide 10-year warranty.

B. Controls

- i. The water heater shall have a feed forward monitoring system with fully modulating steam control valve for +/- 4 degree Fahrenheit water outlet.
- ii. Control panel shall be provided with BACnet card.

C. Basis of Design

- i. Aerco Water Wizard

3. EXECUTION

- A. The water heater shall be started up by factory trained representative.
- B. Startup paperwork to be provided to Owner.



22 52 00
DOMESTIC WATER HEATERS

1. GENERAL

- A. Related sections:
 - i. 23 00 00 – General Mechanical Requirements (HVAC)
- B. This specification is applicable for 199,000 BTU / Hr input and greater, and greater than 119 gallons storage.

2. PRODUCTS

- A. Boiler Types:
 - i. Gas source shall be specified as follows:
 - a. High efficiency condensing water heaters shall be specified.
 - b. Water heaters shall be fully modulating with a minimum of 4-to-1 turn-down.
 - ii. Electric shall be specified as follows:
 - a. Water heater trim shall be equipped with electronic low water cutoff, immersion operating thermostat, immersion temperature limiting device, drain valve, and ASME rated temperature and pressure relief valve.
- B. Controls:
 - i. Water heater shall employ an electronic operating control with digital temperature readout. Operator shall be capable of connecting to a building automation system through serial connection using BACnet protocol.
 - ii. Water heaters provide BAS connectivity for remote visibility of the following minimum points:
 - a. Modulation rate (%)
 - b. Outlet Temp
 - c. Runtime (hours)
 - d. Enable / disable
 - e. Manual override
 - f. Alarm
- C. Certification and Standards:
 - i. Water heater shall bear the ASME HLW stamp and be National Board listed.
 - ii. Gas-fired units, when tested to the ANSI Z21.10.3 efficiency standard, result shall be no less than 94% thermal efficiency at full firing rate.
 - iii. Manufacturer must be ISO 9001 QMS Certified.
- D. Basis of Design:
 - Gas: PVI Industries or equal
 - Electric: PVI Industries or equal

3. EXECUTION

- A. Condensing water heaters shall be provided with acid neutralization kits.
- B. The water heaters shall be started by a factory authorized representative.
- C. The BAS shall not control the water heater(s), but shall only monitor.
- D. Drain valves and pressure relief valves shall be piped to a drain in a code-approved manner.
- E. Warranty:



- i. Covering manufacturing or material defects, waterside / fireside corrosion, leaks, and/or production of rusty water and/or chloride stress corrosion cracking – 15 years (8 years non-prorated), on-site labor, freight, and parts.