
SECTION 15400 - PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections, and incidentals and the performing of operations required to provide a complete and functional plumbing system.
- B. Work shall be in accordance with the current edition of the Maine Internal Plumbing Rules and applicable local ordinances.

1.2 RELATED DOCUMENTS

- A. The drawings and the specifications including Section 15000 "Supplemental General Mechanical Conditions" are hereby made a part of the work of this section.

1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 15000-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section shall be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 15000, Supplemental General Mechanical Requirements, apply are as follows:
 - 1. Piping materials.
 - 2. Valves.
 - 3. Pipe hangers.
 - 4. Fixtures and trim.
 - 5. Miscellaneous equipment.
 - 6. Water heating equipment.
 - 7. Piping, valves and equipment identification.
 - 8. Backflow preventers.
 - 9. Floor drains and cleanouts.
 - 10. Firestopping materials and methods.
 - 11. Pump(s).
 - 12. Elevator pit drainage system.
 - 13. Packaged duplex sewage ejector.
 - 14. Automatic electronic flush valves and faucets.
 - 15. Electric heat trace.
 - 16. Electric heat trace monitoring and alarm system.
 - 17. Flexible pipe joints (expansion joints).
 - 18. Turbine water meter.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Soil and Waste (Sanitary), Vent and Roof Drainage Piping: Schedule 40 PVC or service weight cast iron with push-on joints below grade. Schedule 40 PVC or cast iron "no Hub" above grade.

“Vents thru roof” shall be service weight cast-iron. Roof drain piping shall be heat-traced, as indicated.

- B. Domestic Water Piping and Condensate Drain Piping (Interior): Type “L” hard copper tubing and cast bronze or wrought copper solder fittings.
- C. Domestic (Potable) Water Piping (Exterior): Ductile Iron with mechanical joints, heat-traced, as indicated.
- D. Force Mains: Pressure-rated PVC (SDR 26) with a minimum working pressure of 160 psig, solvent-welded joints, heat-traced, as indicated.
- E. Natural Gas Piping (Interior): Schedule 40 carbon steel with welded or screwed malleable iron fittings per NFPA54 and the gas utility requirements.
- F. Natural Gas Piping (Exterior, Above Grade): “Gastite” corrugated stainless steel tubing with UV-resistant polyethylene jacket conforming to the requirements of ASTM E84 for fire and smoke. The tubing shall be ASTM A240, Type 304, 321 stainless steel.
- G. Exposed Water and Waste Piping at Fixtures: I.P.S. copper with cast brass fittings chrome plated finish, with deep one piece escutcheon plates at traverse points.
- H. Solder: Lead-free (ONLY), Englehard Silvabrite 100, 440°F melting point, ASTM B32.

2.2 NO HUB COUPLINGS

- A. For DWV piping, couplings shall be Clamp-All HI-TORQ125, shall maintain 15 PSI hydrostatic seal, constructed 304SS housing and ASTM C-564 neoprene gasket. Couplings shall meet FM 1680, BOCA and local codes and requirements.

2.3 VALVES

- A. Ball Valves: Apollo, Watts or Nibco, copper alloy with stationary seat ring and chromium plated or stainless steel floating ball per Federal Specification WW-V-35B. Blowout proof stem, reinforced PTFE seal. Sizes 2" and larger shall have threaded ends. Provide lever handle with stem extension as required to allow operation without interfering with pipe insulation.
- B. Gate Valves: Danfoss “Flomatic”, Watts or Nibco, cast-iron, NRS, resilient seat, 200 psi, 125 lb. Flanged connections.
- C. Wastewater Check Valves: Watts, Nibco or Danfoss “Flomatic”, swing-type, cast-iron body with epoxy coating, bronze trim with stainless steel shaft, horizontal swing, Nitrile seal, MSS SP-80, Type 3, Class 125.
- D. Drain Valves: Provide ball valves with 3/4" hose connection and brass cap and chain.
- E. Fixture Service Stop Valves: Angle Loose Key Stop, ASME A112.18M.
 - 1. Each plumbing fixture and item of equipment shall have individual stop valves in the hot and cold supplies.

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2. Service stop valves exposed in finished areas shall be chrome-plated brass; in non-finished areas, ball valves shall be used in lieu of chromed supplies.
- F. Temperature and Pressure Relief Valves: Bronze body, tested under ANSI Z21.22, AGA and ASME rated, 125 psig/210°F relief settings.
- G. Balancing Valves: Taco Circuit Setter.
1. Bronze or brass body and internals, teflon seats, memory stop, 175 psi working pressure, 250°F working temperature. Balancing devices shall have provisions for connecting a portable differential pressure gauge. Each balancing device shall be sized to provide a differential pressure reading between 2 and 5 feet with the valve full open at design flow rates.
 2. Install per manufacturer's recommendations for adjacent length of straight pipe.
 3. Submittals shall indicate gpm, size, wide open differential pressure meter reading, and actual water pressure drop.
- H. Pressure Reducing Valves: Watts Regulator series 5ULP bronze body, bronze internals, 200 psi working pressure, 200°F maximum temperature, adjustable pressure range 10-25 psig. Provide with inlet strainer (screen).
- I. Automatic Trap Primer: Zurn Model Z-1022, "Sani-Guard" Trap Primer, all-bronze body with integral vacuum breaker, union connection and supply manifold as required to serve floor drain traps. Trap primers shall comply with ANSI/ASSE Standard 1018. Connect to each floor drain trap.
- J. Gas Pressure Regulators: Shall be "Maxitrol" Series 325 or 210 as required to meet pressure and capacity requirements, ANSI Z21.80 compliant, or approved equal, with automatic vent limiting device, AGA-approved and CSA-certified. Furnish for each gas appliance and suitable for the required gas pressures.
- 2.4 PIPE HANGERS
- A. Adjustable Swivel Hangers:
1. Pipe sizes 2" and less: Carpenter and Paterson Fig. 800, oversize for insulated piping systems.
 2. Pipe sizes larger than 2": Carpenter and Paterson Fig. 100, oversize for insulated piping systems.
 3. Exterior pipe hangers shall be galvanized or cadmium-plated.
- B. Riser Clamp: Carpenter and Paterson Fig. 126 CT copper plated for copper piping, Fig. 126 for iron and PVC piping.
- C. Insulation Shields: 18 ga. galvanized steel, 180° wrap, Carpenter and Paterson Fig. 265P, Type H.

2.5 FIXTURES AND TRIM

- A. (P-1) Water Closet: Floor-mounted, flush-valve type, Kohler Model K-4350 “Wellcomme”, elongated bowl, white vitreous china, low consumption (1.6 gpf), shall flush with 30 psi water pressure at valve.
1. Flush Valve: Sloan Royal Model 111 or Delany. Furnish with bumper stop, vacuum breaker and stop valve.
 2. Seat: Church Model 9500C, heavy weight solid plastic, open front, external check hinges, for elongated bowl, white color.
 3. Wall carrier: Furnish with Zurn, Wade or Smith concealed wall carrier.
 4. The flush valve shall be electronic automatic sensing, Geberit or Sloan “Optima” series. Furnish with 120V. transformers, strainers, solenoid valves, electrical boxes and wiring per the manufacturers recommendations.
- B. (P-2) Water Closet: ADA-compliant, floor-mounted, Kohler Model K-4368, “Highcliff”, elongated bowl, white vitreous china, low consumption. Final installation shall meet ADA guidelines and ANSI A117.1.
1. Flush Valve: Sloan Royal Model 111 or Delany. Furnish with bumper stop, vacuum breaker and stop valve.
 2. Seat: Church Model 9500C, heavy weight solid plastic, open front, external check hinges, for elongated bowl, white color.
 3. Wall carrier: Furnish with Zurn, Wade or Smith concealed wall carrier.
 4. The flush valve shall be electronic automatic sensing, Geberit or Sloan “Optima” series. Furnish with 120V. transformers, strainers, solenoid valves, electrical boxes and wiring per the manufacturers recommendations.
- C. (P-3) Urinal: Wall-hung, flush-valve type, Kohler Model K-5016-T, “Dexter”, white vitreous china, low consumption (1.0 gpf), urinal lip shall extend a minimum of 14" from finished wall.
1. Flush Valve: Sloan Royal Model 186-1 or Delany. Furnish with vacuum breaker and stop valve.
 2. Carrier: Wade or Jay R. Smith concealed wall carriers.
 3. ADA urinals shall be installed with front rim a maximum of 17" above finished floor. Final installation shall meet ADA guidelines and ANSI A117.1.
 4. The flush valve shall be electronic automatic sensing, Geberit or Sloan “Optima” series. Furnish with 120V. transformers, strainers, solenoid valves, electrical boxes and wiring per the manufacturers recommendations.
- D. (P-4, P-4(T)) Lavatory, Wall Hung: Kohler “Pinoir”, with shroud, Model K-2035, 22"x18", white vitreous china, faucet holes on 4" centers, front edge shall extend a minimum of 17" from rear finished wall.

1. Faucet: Geberit Model 115.711.21.1 with internal temperature control, Chicago-Faucets or Bradley, automatic battery-operated electronic chrome-plated mixing gooseneck faucet with temperature selection, vandal-resistant, ADA-compliant with a 0.5 GPM aerator. The electronics and battery shall be housed in the vandal-resistant spout. The battery shall be 6 volt lithium. Furnish with integral check-screens and adjustable limit stop. Supplies shall be chrome-plated with key-operated stops. Installation shall be ADA-compliant and in accordance with the manufacturers recommendations.
 2. Drain: perforated grid strainer with bright metal finish.
 3. Hanger/Carrier: As furnished by the manufacturer.
 4. Trap: Chrome-plated, cast copper alloy, 1-1/4" P-trap with cleanout plug. Adjustable with connected elbow and nipple to wall.
 5. ADA lavatories shall be installed at 34" above finished floor. Final installation of lavatory and accessories shall meet ADA guidelines and ANSI A117.1.
- E. (P-4A, P-4A(T)) Lavatory, Countertop: Kohler "Pennington", Model K-2196, 20"x17", white vitreous china, faucet holes on 4" centers, front edge shall extend a minimum of 17" from rear finished wall.
1. Faucet: Geberit Model 115.711.21.1 with internal temperature control, Chicago-Faucets or Bradley, automatic battery-operated electronic mixing gooseneck faucet with temperature selection, vandal-resistant, ADA-compliant with a 0.5 GPM aerator. The electronics and battery shall be housed in the vandal-resistant spout. Furnish with integral check-screens and adjustable limit stop. Supplies shall be chrome-plated with key-operated stops. Installation shall be ADA-compliant and in accordance with the manufacturers recommendations.
 2. Drain: perforated flat grid strainer with bright metal finish.
 3. Trap: Chrome-plated, cast copper alloy, 1-1/4" P-trap with cleanout plug. Adjustable with connected elbow and nipple to wall. Insulate trap and supplies with Truebro Model 102 insulation kit with PVC cover.
 4. ADA lavatories shall be installed at 34" above finished floor. Final installation of lavatory and accessories shall meet ADA guidelines and ANSI A117.
- F (P-4(T)), (P-4A(T)): Same as "D" and "E" above, except with automatic trap primer piped to floor drain.
- G. (P-6(T)) Prison Lavatory and Water Closet: Combination unit, Acorn 1950-series, or Bradley, Model 1950-1-DMS-2-GT-TT-TE, 18" wide rectangular lavatory, 16 gauge Type 304 stainless steel with seamless welds. The finish shall be satin. Accessories shall include a soap dish. Provide a wall mounting bracket and wall anchoring system. All fasteners shall be vandal-proof.
1. The lavatory faucet shall be "Penal-Trol", concealed, vandal-proof hot and cold supply mechanical metering faucet with integral spout.

Prison Water Closet: Acorn Model 2105-W-1-CN, or Bradley, siphon jet, off-floor toilet constructed of 16 gauge Type 304 welded stainless steel. The fixture shall have an elongated bowl, with integral seat and sanitary high polish finish. Furnish with concealed Sloan or Delany flush

valve and wall anchoring system. Accessories shall include a toilet paper holder. All fasteners shall be vandal-proof. Furnish with automatic trap primers and pipe to floor drains.

- H. (P-12) Mop Basin: Powers-Fiat MSB-2424, molded stone, 24"x24"x10" with 1" wide shoulders; 3" stainless steel drain with combination dome strainer and lint basket.
1. Faucet: Powers-Fiat Service Faucet #830-AA, chrome-plated with vacuum breaker, integral stops, adjustable wall brace, pail hook, and 3/4" hose thread on spout.
 2. Hose and Hose Bracket: Powers-Fiat #832-AA, 30" long heavy duty, 5/8" size, cloth reinforced, rubber hose with 3/4" chrome coupling at one end; 5"x3", 18 gauge, stainless steel bracket with rubber grip.
 3. Caulk around sink at floor and walls with white silicone caulk.
 4. Provide 1/2" chrome-plated hose bibb by Chicago-Faucets with vacuum breaker at each mop sink.
- I. (P-13) ADA Bi-Level Water Cooler: Elkay "Swirlflo" BiLevel Fountain, Model LRPBM28C, or Halsey-Taylor, stainless steel finish, front push bar, lead free, ADA compliant, wheelchair accessible. ADA compliant fountain shall be at the right or left of the unit, as indicated on the Architectural drawings, non-ADA fountain on the opposite side of the unit. The unit shall be capable of cooling 8.0 GPH of 80°F. water to 50°F. with 90°F. ambient. Motor shall be 1/5 hp., 120v. The bubbler shall be "Flexi-Guard".
Furnish with integral water filter.
- J. Acceptable fixture manufacturers are as follows: American-Standard, Eljer, Crane, Just, Elkay, Kohler, and Universal-Rundle.

2.6 MISCELLANEOUS EQUIPMENT

- A. Floor Drains (FD) and Roof Drains (RD): Floor drains shall be Zurn Z-415, cast iron body with 2" or 3" bottom or side outlet, as indicated, combination invertible membrane clamp and adjustable collar. Floor drains shall have "deep seal" traps and trap primer connection. Roof drains shall be Zurn Z100ERC with extension, sump and underdeck clamp.
1. Floor drain strainer: 7" diameter Zurn "Type B", polished nickel-bronze.
- B. Floor Cleanout (FCO): Zurn Z-1400 adjustable floor cleanout, cast iron body, with gas and watertight ABS tapered thread plug. Provide size equal to piping served with maximum size of 4". Covers shall be as follows:
1. Concrete floor finishes: Scoriated round polished bronze top.
 2. Sheet tile finishes: Scoriated square polished bronze top recessed to receive tile.
 3. Carpeted finishes: Scoriated round polished bronze top and carpet marker.
- C. Wall Cleanout (WCO): Sanitary tee with threaded raised nut or countersunk-nut cleanout plug located behind Zurn Z-1468 round stainless steel wall access cover.
- D. Water Hammer Arrestor (Shock Absorber): Plumbing and Drainage Institute listed.

Schedule:

- "A" - Size #100 PDI - 0-11 Fixture Units
- "B" - Size #200 PDI - 12-32 Fixture Units
- "C" - Size #300 PDI - 33-60 Fixture Units

- E. Vacuum Breaker: Watts Model N36, 3/4" size, 20 CFM capacity.
- F. Strainer: Watts Series 777, MIL-S-16293, bronze body wye-type, 200 WOG rating, screwed end connections, 20 mesh stainless steel, monel, or bronze screen.
- G. Backflow Preventors (BFP): Conforming to AWWA C506, FCCHR-USC Manual Section 10, and UL listed. Types, sizes and capacities scheduled.
 - 1. Reduced Pressure Zone (RPZ): Reduced pressure principle type; bronze body with stainless steel internals. Provide bronze body ball valves, test cocks, and air gap fittings.
 - 2. Double Check (DC): Double check backflow assembly with test ports, bronze body with stainless steel springs, corrosion resistant internals, stop and waste ball valves.
 - 3. Atmospheric Double Check (DCA): Double check continuous pressure type with atmospheric port for low hazard applications, 250°F maximum water temperature, bronze body, stainless steel internals with rubber seals and integral strainer.
- H. Wall Faucet (for non-freezing area): Woodford Model 24, 3/4" size, brass body, with wheel handle and vacuum breaker.
- I. Freezeless Wall Hydrant: Woodford Model 65 series, brass body, automatic draining, with vacuum breaker-backflow preventer, 3/4" hose thread nozzle, chrome finish, loose tee key.
- J. Thermometers: Tel-Tru Model D5A-series battery operated, or Ashcroft, 5" round dial, adjustable angle, with Type 304 stainless steel case. The digital display shall include 1" high LCD digits. The thermometer display shall be in °F. and have a minimum battery life of five (5) years. Accuracy shall be +/- 1% of the displayed value or 1°, whichever is greater. Provide with heat transfer fluid to fill the sealed interstitial space between bulb and well. Evidence of the transfer fluid leaking shall be cause for refilling and sealing the well.
 - 1. Thermowell: Provide with brass thermometer wells projecting a minimum of 2" into the pipe with extension to face of insulation. Provide with heat transfer fluid to fill interstitial space between bulb and well.
 - 2. Minimum range: 30°F to 240°F for domestic hot water systems.
- K. Pressure Gauges: Tel-Tru or Ashcroft Type 1005, Grade B, 3-1/2" dial, ANSI B40.1, drawn steel case, white background dial with black figures, clear glass window, brass movement, beryllium copper bourdon tube, 0 to 100 PSI range, accuracy shall be within 2% over middle half of scale and 3% over the remainder. Provide with shut off petcock and restrictor.
- L. Elevator Pit Drainage System: Stancor, Inc., Model SE50 "Oil-Minder System", or approved equal, ½ HP., 3600 RPM, 120V., 2" discharge with float switch. A NEMA 4X control panel and a self-cleaning, hermetically sealed, stainless steel oil sensing probe shall alarm if oil is sensed. The pump shall be submersible with discharge check valve. The equipment shall be UL-listed.

- M. Turbine Water Meter: Hersey "Horizon", or approved equal, ANSI Class 150, flanged connections, bronze body and stainless steel and thermoplastic components. The meter shall have a maximum 1.0 psig pressure drop at a flow rate of 300 gallons per minute.

2.7 WATER HEATING EQUIPMENT (EWH)

- A. Electric Water Heaters (EWH): AO Smith, State Industries or approved equal packaged unit of make, model, and performance as scheduled on Drawings; UL 732 and ASHRAE 90A (1982 requirements) compliant, glass-lined or other approved lined tank with replaceable magnesium anode rods and heavy gauge steel jacket with baked enamel finish, factory installed ASME rated temperature and pressure relief valve, and adjustable range thermostat. Set to provide 120°F water temperature. Hot and cold water connections shall be 1".
1. Electric elements: Shall be immersion-type, dual element, non-simultaneous, 4500 watt, Incoloy sheathed electric heating elements, 208V.-1Ph..
 2. The water heaters shall have a three (3) year free replacement warranty in commercial service for labor and materials.
 3. Installation shall be in accordance with the manufacturer's recommendations.

2.8 PIPING, VALVE, AND EQUIPMENT IDENTIFICATION

- A. Piping identification: Provide plastic "wrap-around" identification markers indicating flow and fluid flowing for the following:
1. Domestic Hot Water
 2. Recirculated Domestic Hot Water
 3. Domestic Cold Water
 4. Vent Piping
 5. Exposed Above-ground Sanitary Drain Piping
 6. Condensate Drain Piping
 7. Roof Drain Piping
 8. Gas piping
 9. Force Mains
- B. Markers shall be placed 30-50 ft. apart for piping in accessible areas.
- C. Markers shall be placed outside the pipe insulation and in the most obvious location for viewing.
- D. Valve Tags:
1. Attach to each valve a 1-1/2" round or octagonal brass tag with 1/2" indented numerals filled with a durable black compound. In addition to the valve numbers, each tag shall identify the system it controls. Service stop valves exposed in finished areas need not be tagged.
 2. Tags shall be securely attached to stems of valves with copper or brass "S" hooks, or chains.
 3. Valve charts shall be provided for each piping system and shall consist of schematic drawings of piping layouts, showing and identifying each valve and describing its function. Upon completion of the work, one (1) copy of each chart, sealed to rigid

backboard with clear lacquer placed under glass and framed, shall be hung where directed. Two (2) additional unmounted copies shall be delivered to the Resident.

4. Tags and charts shall be coordinated with Section 15700 Heating System and when completed this work shall have been done sequentially.
- E. Equipment Identification: Provide laminated plastic nameplates for equipment, pumps, mixing valves, backflow preventers, and balancing valves. Nameplates shall be laminated 0.125-inch thick melamine plastic conforming to Fed. Spec. L-P-387, black with white center core. Surface shall be a matte finish, corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be 1.0 inch by 2.5 inches. Lettering shall be minimum of 0.25-inch high normal block lettering.

2.9 PACKAGED DUPLEX SEWAGE EJECTOR

- A. Shall include two (2) Myers Model V3WHV, Goulds, Weil, or approved equal, submersible 3" non-clog wastewater pumps suitable for commercial wastewater applications. The pumps shall include two vane rounded port impellers and a modified constant velocity volute. The motors shall be oil-filled for maximum heat dissipation and continuous bearing lubrication. The motor housing, seal housing, cord cap and volute case shall be constructed of Class 30, ASTM A48-76 cast-iron. The enclosed 2-vane impeller shall be constructed of Class 65 ASTM A536-80 ductile iron. The mechanical seal shall be single, Type 21 carbon/ceramic. The pump/motor shaft shall be Type 416 stainless steel. Fasteners shall be 300 series stainless steel.
- B. The pumps shall have 2-1/2" solids handling capability, with 6" impeller, 3.0 Hp., 208V.-3Ph. motors, 1750 RPM. Capacity shall be 150 GPM at a total dynamic head of 45 Feet, vertical discharge. The pumps shall be listed by CSA and ETL.
- C. The sump basin shall be 48" diameter of molded fiberglass reinforced polyester resin with a smooth and impervious finish. The minimum wall thickness shall be 1/4". The basin cover shall be Myers Type "AM" extruded aluminum with an access opening suitable for pump installation/removal. The access cover shall have a flush aluminum drop handle and an automatic hold open arm with a red vinyl grip. Hinges shall be stainless steel with tamper-proof stainless steel bolts and nuts. The depth of the basin and location of the inlet shall be field-coordinated.
- D. The duplex control panel shall be Myers CWHV-series and shall include combination magnetic motor starters and disconnect switches for each pump, "Hand-Off-Auto" switches, float switches (four (4) level), solid-state alternator relay, individual pump circuit breakers, control circuit transformer with primary fusing, separate control and alarm circuit fuses, override relay and NEMA 3R weathertight enclosure. The panel shall be UL approved and conform to the National Electrical Code, constructed of 14 gauge painted steel. A local and remote "audible-visual" alarm bell or horn and light with "test" and "silence" switches shall be provided for "high" and "critical high" level.
- E. Installation shall be in accordance with the manufacturers recommendations.

2.10 ELECTRIC HEAT TRACE

- A. Piping: Shall be Thermon TSX series, RayChem, or approved equal. Heat trace shall be suitable for freeze-protection service on metallic or nonmetallic piping systems, self-limiting with 16 gauge nickel-plated bus wires, semiconductive heating matrix, fluoropolymer dielectric insulation, tinned copper braid and fluoropolymer overjacket. Accessories shall include splice kits, termination kits, identification labels, and electronic high limit thermostats set at 45⁰F. Heat trace shall be suitable

for 208V.-1PH. operation. Installation shall be in accordance with the manufacturers recommendations and under their direct supervision. Operational testing shall be performed in accordance with the manufacturers recommendations.

- B. Ejector Sump Tank: Shall be Raychem Model RHS-L-2, Thermon, or approved equal, electric tank heating pad. The electric heating pad shall be suitable for fiberglass or plastic tanks, 208V.-1PH. Construction shall consist of a fiber-reinforced silicone rubber top layer, silicone rubber base containing Nichrome heating wire. Furnish with an electric thermostat suitable for maintaining the tank contents at 45⁰F. Furnish with the Model RHS-INSTALLATION KIT. The system shall be FM-approved. Installation shall be in accordance with the manufacturers recommendations.
- C. Roof Areas, Gutters and Downspouts: Thermon “SnoTrace” RGS or RayChem, system for roof and gutter snow and ice melting. The heat trace shall be self-regulating, 208V.-1PH. Installation shall be in accordance with the recommendations of IEEE 515.1 and the manufacturers recommendations and with recommended accessories, including termination kits, power kits, and clips. In-line and tee splices shall not be used. Furnish with dedicated NEMA-4 power distribution and contactor panels. Controls shall include and ambient sensing thermostat and automatic ice sensor for each system.
- D. Testing: All heating cables shall be tested with a 2,500 Vdc megohmmeter (megger) between the heating cable bus wires and the heating cable metallic braid. The test shall be performed a minimum of two (2) times, as recommended by the manufacturer. Testing and corrective action shall be taken until the results are acceptable to the manufacturers representative.

2.11 ELECTRIC HEAT TRACE MONITORING AND ALARM SYSTEM

- A. Each electric heat trace circuit shall be continuously monitored by a Nelson Model CM-1 Circuit Monitor, or approved equal. The system shall be a scanning microprocessor-based system with LED display that sequentially monitors and displays each circuit number and the status of each heat-trace circuit. The system shall be capable of continuous automatic monitoring of voltage, amperage and continuity. The installation shall include sensors, programming, sensor cards and continuity monitoring devices, as required. The input voltage shall be 120V. Installation shall be in accordance with the manufacturers recommendations.
- B. Install a “Continuity Monitoring Device” at the far end of each heat trace circuit. Install a remote “Audible-Visual Alarm” with “Silence” pushbutton, as indicated.

2.12 FLEXIBLE PIPE JOINTS (EXPANSION JOINTS)

- A. Expansion joints shall be Proco Model 240 / 242, non-metallic expansion joints with an engineered molded style twin sphere designed bellows. Construction shall be EPDM rubber with stainless steel flanges, suitable for maximum operating temperatures of 230⁰F.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.

2. Verify that plumbing may be installed in strict accordance with pertinent codes and regulations and the reviewed Shop Drawings.

3.2 INSTALLATION OF PIPING

- A. Provide and erect in accordance with the best practice of the trade piping shown on the drawings and as required to complete the intended installation. Make offsets as shown or required to place piping in proper position to avoid other work and to allow the application of insulation and finish painting to the satisfaction of the Resident.
- B. The size and general arrangements, as well as the methods of connecting piping, valves, and equipment, shall be as indicated, or so as to meet the requirements of the Resident.
- C. Piping shall be erected so as to provide for the easy and noiseless passage of fluids under working conditions.
- D. Install unions to facilitate removal of equipment.
- E. Copper pipe shall be reamed to remove burrs.
- F. Connections between copper and steel piping shall be made with brass fittings.
- G. Solder joints shall be made with lead free solder. Clean surfaces to be soldered and use a paste flux. Wash joints with sodium bicarbonate and water to remove corrosive effects of heated solder paste. Caution: Lead-bearing solder is not permitted.
- H. Pipe penetrations through walls, floors and ceilings shall have pipe sleeves and shall be in accordance with Section 15000 "Supplemental General Mechanical Requirements". Traverse points of piping shall be escutcheoned with split chrome floor and ceiling plates and spring anchors, where visible to occupancy.
- I. Provide a cleanout in the vertical position at the base of each sanitary and storm (roof) drain riser.
- J. Sanitary and vent piping shall be sized and installed at 1/4" per foot slope or as indicated and in no case less than 1/8" per foot.

3.3 PIPE HANGERS

- A. Impact driven studs are prohibited.
- B. Copper Tubing: supported at intervals with rod sizes as follows, double nuts on hangers and on beam clips.

Copper Size	Hanger Intervals	Rod Sizes
1/2"	5'	3/8"
3/4"	6'	3/8"
1"	6'	3/8"
1-1/4"	8'	3/8"
1-1/2"	8'	3/8"
2"	10'	3/8"

- C. Cast Iron Pipe: Supported at intervals with rod sizes as follows, double nuts on hangers and on beam clips.

Cast Iron Size	Hanger Intervals	Rod Sizes
1-1/2"	5'	3/8"
2"	5'	3/8"
2-1/2"	5'	1/2"
3"	6'	1/2"
4"	7'	5/8"

- D. PVC Pipe: Supported at 4 foot intervals.
- E. Verticals: Supported by use of clamp hangers at every story height, and at not more than 6 feet intervals for copper piping 1-1/4" and smaller size.

3.4 CLOSING IN UNINSPECTED WORK

- A. General: Cover up or enclose work after it has been properly and completely reviewed.
- B. If any of the work is covered or enclosed prior to required inspections and review, uncover the work as required for the test and review. After review, tests and acceptance, repairs and replacements shall be made by the appropriate trades with such materials as necessary for the acceptance by the Resident and at no additional cost to the Owner.

3.5 CLEANUP AND CORROSION PREVENTION

- A. Upon completion of the work thoroughly clean and flush piping systems to the sewer with water.
- B. Fixtures, piping and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.
- C. Caulk around fixtures at floor and wall.
- D. Before covering is applied to piping systems, clips, rods, clevises and other hanger attachments, and before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces. When corrosion is from the effects of hot solder paste, the areas shall be cleaned and polished and a wash of bicarbonate of soda and water used to neutralize the acid condition.

3.6 DISINFECTING

- A. After the entire potable water system is completed, cleaned and tested, and just before the building is ready to be occupied, disinfect the system as follows: After flushing the mains, introduce a water and chlorine solution for a period of not less than three hours before final flushing of the system.

3.7 TESTS

- A. Sanitary soil, waste and vent piping: Fill with water to top of vents, and test as required by Code.
- B. Water piping shall be tested to a pressure of 100 lbs. per square inch for at least 30 minutes. Pressure drop in this period shall not exceed two pounds per square inch. Leaks shall be repaired and system retested. Notify the Resident 24 hours before test is to be performed.

3.8 INSTRUCTIONS

- A. On completion of the project, provide a competent technician to thoroughly instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner.

3.9 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07840 "Firestopping and Smoke Barrier Caulking". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

* END OF SECTION *