

**SECTION 22 0500 – COMMON PLUMBING MATERIALS AND METHODS****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. The provisions of the General Requirements, Supplementary Requirements, and Division 1 apply to the plumbing work specified in this Division.
- B. The requirements of this Section apply to the plumbing systems specified in these Specifications and in other Division 22 sections.
- C. Provide all items, articles, materials, equipment, operations and/or methods listed, mentioned, shown and/or scheduled on the Drawings and/or in these Specifications, including all labor, supervision, services, permits, fees, and incidentals necessary and required to provide a complete and operable facility with complete systems as shown, specified, and required by applicable codes.
- D. The work shall include, but not be limited to, the following systems:
  - 1. Water, sanitary sewer, and storm sewer service complete per serving utility company requirements.
  - 2. Service and distribution piping including valves, supports, insulation, etc.
  - 3. Complete plumbing systems, including fixtures, trim, equipment, etc.
  - 4. Rough-in and final connection of plumbing equipment and fixtures furnished under other Divisions of this Specification.
  - 5. Piping to and connection of equipment or fixtures furnished outside of these Specifications and Contract but described on the Drawings.
  - 6. Special systems as specified herein.
- E. Advise subcontractor, suppliers, and vendors involved in the work specified in this Section of the applicable requirements.

**1.2 QUALITY ASSURANCE**

- A. All work and materials shall conform to all applicable local and state codes and all federal, state and other applicable laws and regulations. All clarifications and modifications which have been cleared with appropriate authorities are listed under the applicable sections. All electrical products shall bear the label of a recognized testing laboratory such as UL or CSA.
- B. Whenever the requirements of the Specifications or Drawings exceed those of the applicable code or standard, the requirements of the Specifications and Drawings shall govern.
- C. Codes and Standards: Comply with the provisions of the following referenced codes,

standards and specifications:

1. Federal Specifications (FS)
  2. American National Standards Institute (ANSI)
  3. National Electrical Manufacturer's Association (NEMA)
  4. National Fire Protection Association (NFPA)
  5. Underwriters Laboratories, Inc. (UL)
  6. Factory Mutual (FM)
  7. International Building Code (IBC) with State and Local Amendments
  8. International Mechanical Code (IMC) with State and Local Amendments
  9. Uniform Plumbing Code (UPC) with State and Local Amendments
  10. American Society for Testing and Materials (ASTM)
  11. Americans with Disabilities Act (ADA)
  12. International Fire Code (IFC) with State and Local Amendments
  13. Energy Policy Act (EPAAct)
  14. Manufacturers Standardization Society (MSS)
  15. National Sanitation Foundation (NSF)
  16. American Gas Association (AGA)
- D. Each piece of equipment furnished shall meet all detailed requirements of the Drawings and Specifications and shall be suitable for the installation shown. Equipment not meeting all requirements will not be acceptable, even though specified by name. Where two or more units of the same class of equipment are furnished, use product of the same manufacturer; component parts of the entire system need not be products of same manufacturer. Furnish all materials and equipment, new and free from defect and of size, make, type and quality herein specified or approved by the Architect. All materials shall be installed in a neat and professional manner.
- E. All apparatus shall be built and installed to deliver its full rated capacity at the efficiency for which it was designed.
- F. The Drawings and Specifications are complementary. What is called for by one shall be as though called for by both.
- G. Drawings: Do not reference or scale drawings for roughing-in measurements, nor use as shop drawings. Make field measurements and prepare shop drawings as required. Verify all dimensions with dimensioned architectural drawings. Coordinate work with shop drawings of other specification divisions.
- H. Field Wiring: It is the intent of these specifications that all systems shall be complete and operable. Refer to all drawings and specifications, especially the electrical drawings, to determine voltage, phase, circuit ampacity and number of connections provided. Provide all necessary field wiring and devices from the point of connection indicated on the electrical drawings. All equipment shall be installed in compliance with the Electrical Code and the equipment's UL listing. Bring to the attention of the Architect in writing, all conflicts, incompatibilities, and/or discrepancies prior to bid or as soon as discovered.

## 1.3 WORK OF OTHER CONTRACTS

- A. Work under this contract shall be conducted in a manner to allow for the future installations of such equipment or items listed in other sections of this Specification.

## 1.4 WORK OF OTHER DIVISIONS

- A. Work under this Division shall be conducted in a manner to cooperate with the installation of such equipment or items as specified in other Divisions.
- B. HVAC piping systems, fuel piping systems, fire suppression piping systems, and control devices and control wiring relating to the heating and air conditioning systems are specified under other Divisions of these Specifications except for provisions or items specifically noted on the Drawings or specified herein.
- C. Consult all Drawings and Specifications in this project and become familiar with all equipment to be installed. Coordinate all aspects of the construction with the other trades on the job to ensure that all work and materials required to provide a complete and operational facility are included in the bid.
- D. All sections of Division 22 are interrelated and shall be considered in their entirety when interpreting any material, method, or direction listed in any section of Division 22. Individual sections are not written for specific subcontractors or suppliers but for the General Contractor.

## 1.5 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES (SUBMITTALS)

- A. Submit in accordance with Division 1 full technical and descriptive shop drawing data on proposed materials and equipment as detailed in each section.
- B. The Contractor shall verify that all equipment submitted can be delivered and installed within the time constraints of the construction period.
- C. Include the manufacturer, type, style, catalog number, complete specification, certified dimensions, provided options or accessories, and description of physical appearance for each item and option submitted. Reproduction of catalog data sheets shall be clean and legible to show all details, including gauge of metal used.
- D. Include only information on exact equipment to be installed, not general catalogs of the manufacturer. Where sheets show proposed equipment as well as other equipment, identify proposed equipment with arrow or similar concise method. Product data not indicating specific product and included options may be rejected.
- E. Submit with each copy a transmittal letter verifying that all included equipment submittals have been carefully considered for quality, dimensions, function, and have been coordinated with the Drawings and Specifications. Guarantee that proposed

materials will meet or exceed the quality and function of those specified.

- F. Include field wiring diagrams and connection diagrams for all control and/or low voltage systems, including floor plans.
- G. Submittal Review: The submittal review process is a means to provide quality control. The action noted to be taken (or where conflicts with the contract documents are not noted) shall not be interpreted by the Contractor as automatic "change orders." Approval of the data for substitution and shop drawings shall not eliminate the Contractor's responsibility for compliance with Drawings or Specifications, nor shall it eliminate the responsibility for freedom from errors of any sort in the data discovered prior to or after the review process. Deviations, discrepancies, and conflicts between the submittals and the Contract Documents shall be called to the Architect's attention in writing at the time of transmittal of the data.
- H. Unless otherwise directed or permitted by Division 1, submittal data shall be in a 3-ring plastic binder with a clear plastic sleeve and a project identification sheet inserted. Arrange submittals numerically with specification sections identified on divider tabs. All required division 22 sections shall be submitted at one time.

#### 1.6 PRODUCT SUBSTITUTION

- A. Materials other than those specified may be approved for this project providing a written request is submitted to the Architect prior to bid in accordance with Instructions to Bidders. Requests shall include complete specifications, dimensions, manufacturer and catalog number for each item for which approval is desired. If, in the opinion of the Architect, the material is not complete or if it is not an acceptable substitute, he may reject it. The Architect's evaluation will be based solely on the material submitted.

#### 1.7 CHANGE ORDERS

- A. All supplemental cost proposals by the Contractor shall be accompanied by a complete itemized breakdown of labor and materials without exception. At the Architect's request, the Contractor's estimating sheets for the supplemental cost proposals shall be made available to the Architect. Labor must be separated and allocated for each item of work.

#### 1.8 RECORD DOCUMENTS

- A. Project Record (As-Installed) Drawings:
  - 1. Maintain a set of record drawings on the job site as directed in Division 1.
  - 2. Keep Drawings clean, undamaged, and up to date.
  - 3. Record and accurately indicate the following:
    - a. Depths, sizes, and locations of all buried and concealed piping and all cleanouts, whether concealed or exposed, dimensioned from permanent building features.
    - b. Locations of all valves with assigned tag numbers.

- c. Changes, additions, and revisions due to change orders, obstructions, etc. Eradicate extraneous information.
  - d. Locations of tracer wire terminal points.
  - e. Model numbers of installed equipment.
  4. Make Drawings available when requested by Architect or Owner for review.
  5. Submit as part of the required Project Closeout documents. Final submittal will be in the form of reproducible drawings.
  6. Quality of entire set of project record drawings to match the quality of the contract documents; quality to be judged by Architect. Computer-aided design drafting (CADD) shall be used to complete project record drawings. Use standards set in contract documents. Note field modifications, all addenda and change order items on project record drawings. If deficiencies are found in either the quality or the accuracy of the drawings, they will be returned unapproved. Additional review of subsequent submissions shall be at the Contractor's expense.
- B. Operating and Maintenance Manuals: Submit five (5) sets of Operating and Maintenance Instructions, including manufacturer's service data, wiring diagrams, and parts lists and vendors for all serviceable items of equipment, valve charts, balancing data, final control diagrams showing final set points, and any additional equipment added by change order. Unless otherwise directed, information shall be bound in three-ring, vinyl covered, loose-leaf binders organized with index and thumb-tab markers for each classification of equipment or data.
- C. Instruction Manual: Submit separate Instruction Manual 15 days prior to scheduling the required Instruction Period. Include the following:
1. Description of each system and operational sequences.
  2. Seasonal system adjustments.
  3. Description and normal settings for time clocks, thermostats, fan and other motor switches, etc.
  4. Normal valve settings.
  5. Emergency measures upon system failure.
  6. Cross reference information furnished by manufacturer in the Operating and Maintenance Manual above.

#### 1.9 WARRANTY

- A. Furnish, prior to application for final payment, three copies of written and signed guarantee effective a period of one year from date of completion and acceptance of entire project; agree to correct, repair and/or replace defective materials and/or equipment or the results of defective workmanship without additional expense to the Owner. Where no response satisfactory to the Owner has occurred within three working days from the written report of a warranty covered defect, the Contractor shall agree to pay for the cost of repair of the reported defect by a Contractor of the Owner's choice.
- B. Where the manufacturer's guarantee exceeds one year, the longer guarantee shall govern and include the Contractor's labor.

## PART 2 - PRODUCTS

## 2.1 GENERAL

- A. General: Provide all new materials and equipment, identical to apparatus or equipment in successful operation for a minimum of two years. Provide materials of comparable quality omitted here but necessary to complete the work. Maximum allowable variation from stated capacities, minus 5% to plus 10% as approved in each case.
- B. Compatibility: Provide products which are compatible with other portions of the work and provide products with the proper or correct power and fuel-burning characteristics, and similar adaptations for the project.
- C. Efficiency: Service (Domestic) Water Heating Equipment shall comply with ASHRAE Standard 90.1-2019 and the State Energy code. Where equipment efficiencies are indicated, the use of alternate or substitute manufacturer's equipment with lower efficiencies is not permitted.
- D. Potable water components: Potable water piping, fittings, and valves not limited to faucets, mixing valves, or pressure reducing valves shall not exceed state or federal standards for lead content and shall be certified under NSF/ANSI 61 .
- E. Storage and Handling:
  - 1. Delivery: Deliver to project site with manufacturer's labels intact and legible.
  - 2. Handling: Avoid damage.
  - 3. Storage: Inside protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping.

## 2.2 MOTORS

- A. General: Motors shall conform to UL, CSA, and NEMA MG-1 and bear a permanently attached nameplate indicating compliance and motor characteristics. Provide motors meeting UL 507 standard where applicable.
- B. Manufacturers: General Electric, Lincoln, Baldor, Wagner, Westinghouse or accepted substitute. Where selection of motor manufacturer is within Contractor's control (independent of equipment selection), provide motors produced by a single manufacturer to the greatest extent possible.
- C. Temperature Rating: Class B insulation, except where otherwise indicated or required for service indicated.
- D. Starting Capability: As required for service indicated, but not less than 5 starts per hour.
- E. Phases and Current: 1/3 horsepower and smaller capacitor-start, capacitor-run single-phase; 1/2 horsepower and larger, squirrel-cage induction polyphase. Coordinate with

actual current characteristics; specified in Division 16 and use no 230/460 voltage motors on 208 voltage power or vice versa.

- F. Service Factor: 1.15 for polyphase; 1.25 for single-phase.
- G. Construction: General purpose, continuous duty; NEMA design "B", except "C" for high starting torque applications.
- H. Frames: For single phase motor sizes NEMA No. 48, except 56 for heavy-duty applications. NEMA "T" frames for 1 horsepower and larger polyphase motors. Special frame types as required for close coupled pumps and similar applications.
- I. Bearings: Ball or roller, and design for thrust where applicable; double shielded and regreasable, except provide permanently sealed where not accessible for greasing. Sleeve-type bearings permitted only where indicated for fractional (1/6 hp or less) horsepower motors with direct drive loads. Minimum L-10 bearing life of 40,000 hours when used with minimum pitch sheaves per NEMA Table 14-1.
- J. Enclosure Type: Unless otherwise indicated, open drip-proof for normal concealed indoor use, guarded where exposed to employees or occupants. Type II for outdoor use, except weather-protected Type I where adequately housed. **[Totally enclosed where explosion-proof motors are required.]**
- K. Overload Protection: Built-in thermal with internal sensing device for stopping motor, and for signaling where indicated on single phase motors.
- L. Speed: Not faster than synchronous speeds of 1800 RPM except on some pumps as approved in each case.
- M. Efficiency: The manufacturer's highest (NEMA premium) efficiency motors tested under procedures recommended by NEMA MG-1 (IEEE Standard 112, Test Method B). Intermittent duty motors, operating less than 6 hours per day, shall comply with EPA/EISA standards. Submit manufacturer's data if motor nameplate does not indicate minimum efficiency. Nominal full load efficiencies for 460 volt, 1800 rpm motors:

<u>HP</u>	<u>Efficiency %</u>
1-1/2	87.5
2	89.5
3	89.5
5	89.5
7-1/2	91.0
10	91.7
15	93.0
20	93.0
25	93.6

- N. Inverter Duty Motors: Where motors are controlled by an adjustable frequency drive, provide motors labeled "Inverter Duty," complying with NEMA MG1-31, and meeting the requirements of the adjustable frequency drive manufacturer.

### 2.3 STARTERS AND SWITCHES

- A. Manufacturers: General Electric, ITE, Allen Bradley, Square D, Cutler-Hammer, Cerus Industrial or accepted substitute. Provide starters by same manufacturer throughout project.
- B. General: Provide each motor with starter or switch as approved and recommended by manufacturer of motor or equipment of which motor is a part.
- C. Starter Characteristics: Type I general purpose enclosure with padlock ears and supports for mounting as indicated. Starter type and size as recommended by motor manufacturer. Use no starter smaller than NEMA Size 1.
- D. Manual Switches: Provide on motors 1/3 horsepower and smaller except where automatic control or interlock is indicated. Include pilot light. Provide overload protection where not protected by internal motor overload protection.
- E. Magnetic Starters: Provide for 1/2 horsepower and larger motors, and for smaller motors on automatic control or with interlock switch. Full voltage, across the line, single speed, non-reversing except where otherwise required. Include power on and running pilot lights, on-off-auto selector switch, external reset button, overload relay on each phase, and devices for coordination with control system (including fused transformer for control circuit).

### 2.4 GUARDS

- A. Provide guards in accordance with State Safety Code and OSHA requirements over all rotating equipment including belts, shafts and couplings. Drive guards over belts and sheaves shall include 2-1/2" diameter access opening at shaft ends for speed counter.

### 2.5 ACCESS PANELS

- A. Manufacturers: Inryco/Milcor, Bilco, Elmdor, Karp, Potter-Roemer or accepted substitute. Inryco/Milcor Style DW, K, or M panels as required by construction.
- B. Construction: Flush style, fire rated in fire rated partitions and ceilings. Provide flush key cylinder locks on all access panels less than 8' above the floor in public spaces. Turn keys over to owners at project completion. Screwdriver latches on all others.

### 2.6 EXPANSION JOINTS AND LOOPS

- A. Flexible Expansion/Seismic Loop: Factory fabricated assembly consisting of two elbows and return bend or three elbows, and two lengths of flexible hose to allow free movement in three axis. Return bend or elbow shall include a drain/vent fitting. Hose



shall be corrugated metal style with metal overbraid compatible with the piping materials. Connections to match piping system except connection 2" and larger shall be flanged style. Metraflex "Metraloop" or Unisource "Uni-loops".

## 2.7 METERS AND GAUGES

- A. General: Install meters and gauges where shown on the plans or specified elsewhere in these specifications.
- B. Pressure-Temperature Test Plugs:
1. 1/4" or 1/2" NPT fitting of solid brass capable of receiving either an 1/8" OD pressure or temperature probe and rated for zero leakage from vacuum to 1000 psig. Neoprene valve core for temperatures to 200 deg. F., Nordel to 350 deg. F.
  2. Provide for each test plug a pressure gauge adapter with 1/16" or 1/8" OD pressure probe.
  3. Furnish a test kit containing one 2-1/2" dial pressure test gauge of suitable range, one gauge adapter with 1/16" or 1/8" OD probe and two 5" stem pocket test thermometers – one 0 to 220 degrees F and one 50 to 550 degrees F. Turn the kit over to the Architect.
  4. Cisco "P/T Plugs," Peterson "Pete's Plug" or approved substitute.
- C. Thermometers: Liquid-in-glass, adjustable stem, separable sockets, plus 30 to 240 degrees F range (unless indicated otherwise). Weiss numbers are listed. Equivalent Taylor, Trerice, Weksler or approved substitute. Install with well.
1. Wide case (9") in equipment rooms and all major equipment items. Weiss "9VU" Series.
  2. Narrow case (7") in all other locations. Weiss "7VU" Series.
- D. Pressure Gauges: Install on discharge of all pumps and where shown on Drawings 4-1/2" dial, stainless steel case pressure gauges with pulsation dampers and stop cocks. ANSI-ASME B40.1 Grade 1A. Select range for normal operation in middle third of scale. Weiss 4CT or equivalent Ashcroft, Marsh, Trerice, Weksler.

## 2.8 VALVES

- A. General: Provide factory fabricated valves of the type, body material, temperature and pressure class, and service indicated. Bronze gate, globe and check valves shall comply with MSS-SP-80. Ball valves shall comply with MSS-SP-110. Iron gate and globe valves shall comply with MSS-SP-70. Iron check valves shall comply with MSS-SP-71. Butterfly valves shall comply with MSS-SP-67. Valve size same as connecting pipe size.
- B. Acceptable Manufacturers: Milwaukee, Crane, Grinnell, Nibco, Hammond, Stockham, Legend, Watts, Apollo, Webstone, and Walworth. Grooved end valves Victaulic, Tyco-Grinnell, Gruvlock, or accepted substitute. NIBCO numbers are given except as noted. Where possible, provide valves from a single manufacturer.

- C. Valve styles: Domestic hot and cold water.
1. Valves 2" and Smaller:
    - a. Ball: Two-piece, bronze body, full port, 600 psi WOG, Fig. T/S-585-80LF or NIBCO T/S-585-HP-LF.
    - b. Check: Bronze body, swing check, 200 psi WOG, T/S-413B (bronze disc) or T/S-413Y-LF (Teflon disc).
    - c. Globe (shutoff): Bronze body, Teflon disc, 200 psi WOG, T/S-211Y.
    - d. Globe (throttling): Bronze body, full stainless steel plug disc, 600 psi WOG, T-276AP.
  2. Valves 2" through 12":
    - a. Ball: Three-piece, bronze body, full port, 600 psi WOG, T/S-595Y-LF.
    - b. Butterfly: Ductile iron body, aluminum bronze disc, 200 psi WOG, Lugged body – LD-2000, Wafer body – WD-2000, Grooved body – GD-4765.
    - c. Gate (to 3"): Bronze body, non-rising stem, 200 psi WOG, T/S-133.
    - d. Gate (4" to 12"): Iron body, bronze trim, non-rising stem, solid wedge, bolted bonnet, 200 psi WOG, F-619.
    - e. Check (2 1/2" and larger): Iron body, bronze trim, Class 125, F-9138-33 (swing type).
- D. Insulated Valves: Install extended-stem valves in all piping specified as insulated, and arrange in the proper manner to receive insulation.
- E. Selection of Valve Ends (Pipe Connections): Select and install valves with ends matching the types of pipe/tube connections.

## 2.9 HANGERS AND SUPPORTS

- A. General: Provide factory-fabricated horizontal piping hangers, clamps, hanger rod, inserts, supports, etc., of the indicated MSS type and size. The Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry Practice SP-58 and SP-69 are referenced in this section.
- B. Manufacturers: B-Line, Grinnell, Anvil, Superstrut, Tolco, Erico, or accepted substitute. Grinnell figure numbers in parentheses where applicable (or other manufacturers as noted).
- C. Corrosion Protection: Provide materials which are zinc plated or factory painted to prevent corrosion. Prevent electrolysis in the support of copper tubing by the use of hangers and supports which are copper plated, plastic coated, or by other recognized industry methods.
- D. Seismic Requirements: Provide seismic restraints in accordance with OSSC Section 1613. Design restraint systems in accordance with "Seismic Restraint Manual: Guidelines for Mechanical Systems," Second Edition, 1998, SMACNA, or "A Practical Guide to Seismic Restraint" ASHRAE RP-812, 1999.

## E. Horizontal Piping Hangers and Supports:

1. Adjustable Clevis Hanger: MSS Type 1 (Fig. 260).
2. Adjustable Band Hanger: MSS Type 7 (Fig. 97), fabricated from steel.
3. Adjustable Swivel-Band Hanger: MSS Type 10 (Fig. 70).
4. Clamp: MSS Type 4 (Fig. 212, 216).
5. Double-Bolt Clamp: MSS Type 3 (Fig. 295A, 295H), including pipe spacers.
6. Adjustable Saddle-Support: MSS Type 36 (Fig. 258) and MSS Type 37 (Fig. 259), including saddle, pipe and reducer. Fabricate base-support from steel pipe and include cast-iron flange or welded-steel plate.
7. Channel Support System: Galvanized, 12 gauge channel and bracket support systems, single or double channel as indicated on the Drawings or as required by piping and equipment weights. Grinnell "Power Strut" channel. Acceptable Manufacturers: Super Strut, Globestrut, Bee, Kindorf or Unistrut.

## F. Vertical Pipe Clamps:

1. Two-Bolt Riser Clamp: MSS Type 8 (Fig. 261).
2. Four-Bolt Riser Clamp: MSS Type 42 include pipe spacers at inner bolt-holes.

## G. Hanger Attachment:

1. Hanger Rod: Rolled threads, zinc plated. Right hand threaded.
2. Turnbuckles: MSS Type 13 (Fig. 230).
3. Weldless Eye-Nut: MSS Type 17 (Fig. 290).
4. Malleable Eye-Socket: MSS Type 16 (Fig. 110R).
5. Clevises: MSS Type 14 (Fig. 299).

## H. Building Attachments:

1. Concrete Inserts: MSS Type 18 (Fig. 282), steel or Grinnell Power-Strut PS349 continuous channel. Acceptable Manufacturers: Michigan Hanger, Globestrut, Unistrut, Super Strut.
2. Clamps: MSS Type 19 (Fig. 285, 281), Type 20, 21 (Fig. 225, 226, 131), Type 23 (Fig. 86, 87, 88), Type 25 (Fig. 227), Type 27 through 30 where applicable.

## 2.10 IDENTIFICATION MARKERS

## A. Pipe Markers:

1. Adhesive pipe markers of width, letter size and background color conforming to ANSI A13.1.
2. Acceptable Manufacturers: Brady B946 with arrow banding tape or similar Seaton, Zeston, MSI.

## B. Nameplates:

1. Engraved nameplates, 1/16" thick, laminated 2-ply plastic, bottom ply white, outer ply black, letters formed by exposing bottom ply.
2. Size: 2" by 4" nameplates with 1/4" high letters.

C. Valve Tags:

1. 2" diameter, 18-gauge polished brass tags with 3/16" chain hole and 1/4" high stamped, black-filled service designation.
2. Acceptable Manufacturers: Seaton, Brady, MSI.

## 2.11 CONCRETE FOR MECHANICAL WORK

A. Classes and Applications: Provide strength classes with the following cement content and water/cement ratios for the indicated applications and similar required applications:

1. 4000 psi Class: 565 pounds cement/yard (6.0 sacks); 0.57 water/cement ratio. Provide 4000 Class for tanks, vaults, beam-type foundations and similar structures.
2. 3000 psi Class: 500 pounds cement/yard (5.25 sacks); 0.68 water/cement ratio. Provide 3000 Class for miscellaneous underground structural concrete, reinforced encasement, block type foundations (with smallest dimension at least 0.2 times largest dimension), curbs, pads, inertia blocks (unframed type), and similar structural support work.
3. 2500 psi Class: 450 pounds cement/yard (4.75 sacks); 0.75 water/cement ratio. Provide 2500 Class for plain encasement, thrust blocks, filling steel-framed units, and similar work.
4. Rough Grouting Class: 565 pounds cement/yard (6.0 sacks): 0.75 water-cement ratio; adjust aggregate sizes to facilitate placement. Use for rough grouting, not for setting equipment bases.
5. Backfill Class (Lean Concrete): 375 pounds cement/yard (4.0 sacks); 0.87 water/cement ratio. Use for backfilling where excavations are extended below point of support for mechanical work.

## 2.12 PENETRATION FIRE STOPPING

- A. Through-penetration fire stopping system tested and listed by Underwriters Laboratories. Hilti, 3M, Metacaulk, SpecSeal, or approved.
- B. Select system for proper application based on wall construction, type of penetrating item, wall rating, etc.

## PART 3 - EXECUTION

### 3.1 LAYOUT AND COORDINATION

- A. Site Examination: Before starting work, carefully examine site and all contract

Drawings. Become thoroughly familiar with conditions governing work on this project. Verify all indicated elevations, building measurements, roughing-in dimensions and equipment locations before proceeding with any of the work.

- B. Utility Locations: The location of existing utilities, wires, conduits, pipes, ducts, or other service facilities are shown in a general way only on the Drawings and are taken from existing records. Ascertain whether any additional facilities other than those shown on the plans may be present and determine the exact location and elevations of all utilities prior to commencing installation.
- C. Sleeves, Inserts, Cast-in-Place Work: Provide sleeves, inserts, anchoring devices, cast-in-place work, etc. which must be set in concrete sequenced at the proper time for the project schedule.
- D. Coordination:
  - 1. The drawings are based on equipment of a certain manufacturer and may be identified as such. Where alternate manufacturers or approved substitutes are incorporated into the work, any required design changes are the responsibility of the Contractor. Such changes may include changes in utility or system connection sizes, location, or orientation, service clearances, structural support or acoustic considerations.
  - 2. Where the work must be sequenced and positioned with precision in order to fit into the available space, prepare accurate scale shop drawings showing the actual physical dimensions required for the installation and submit prior to purchase/fabrication/installation of any of the elements involved in the coordination.
  - 3. Cooperate with other trades in furnishing material and information for sleeves, bucks, chases, mountings, backing, foundations and wiring required for installation of mechanical items.
  - 4. Coordinate all work with other trades and determine in advance where interfacing of the mechanical work and other work are required to be connected together. Provide all materials and equipment to make those connections. Submit shop drawings showing required connections where special conditions exist.
- E. Discrepancies: Report immediately any error, conflict or discrepancy in Plans, Specifications and/or existing conditions. Do not proceed with any questionable items of work until clarification of same has been made. Should rearrangement or re-routing of piping be necessary, provide for approval the simplest layout possible for that particular portion of the work.

### 3.2 UTILITY COORDINATION

- A. Utility Coordination: Coordinate all aspects of the incoming plumbing utility services indicated with the city engineer, serving utility, and the off-street improvements Contractor. Requirements of the utility company which exceed the provisions made on the Drawings or covered by these Specifications shall take precedence. Provisions

made on the Drawings or Specifications in excess of the utility company's requirements shall take precedence. No additional compensation will be allowed the Contractor for connection fees or additional work or equipment not covered in the Drawings or Specifications which are a result of policies of the serving utilities.

### 3.3 CONTINUITY OF EXISTING SERVICES

- A. Existing water, power, heat, ventilation, air conditioning and other services shall remain in service during new construction work. Coordinate any interruption of these services with the Owner's representative a minimum of twenty-four (24) hours in advance. Arrange work to minimize number and extent of all interruptions.
- B. Protect from damage active utilities existing and evident by reasonable inspection of the site whether shown or not on the Drawings. Protect, relocate or abandon utilities encountered in the work which are not shown on the Drawings or evident by inspection of the work as directed by the Architect. Maintain continuity of all utility services to existing buildings.
- C. All necessary service interruptions of utilities shall be scheduled with the Director of Physical Plant. Minor interruptions will require a minimum of forty-eight (48) hours prior notification. Major shut down of any utility is to be scheduled between the hours of 5:30 p.m. and 6:00 a.m. and will require a minimum of seven (7) days prior notice.

### 3.4 EQUIPMENT REMOVAL

- A. All removed mechanical equipment is the property of the Contractor unless indicated otherwise. Disconnect and remove all such equipment from the project property. Cap all piping in walls, below floors, and/or above ceilings in finished rooms.
- B. Disable electrical circuits by disconnection of both ends and make safe with wire nuts or other approved methods. Remove wire and conduit to concealed locations.
- C. Reused Equipment: Reconnect piping, wiring and/or controls to restore original equipment functions unless indicated otherwise.

### 3.5 MECHANICAL EQUIPMENT WIRING

- A. Provide all mechanical equipment motors, automatic temperature, limit, float and similar control devices required, with wiring complete from power source indicated on Electrical Drawings.
- B. Provide properly rated motor overload and undervoltage protection and all manual or automatic motor operating devices for all mechanical equipment.
- C. Equipment and systems shown on the Drawings and/or specified, are based upon requirements of specific manufacturers which are intended as somewhat typical of several makes which may be approved. Provide all field wiring and/or devices

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necessary for a complete and operable system including controls for the actual selected equipment/system.

- D. Provide all starters for mechanical motors. Review Electrical Specifications and Drawings to determine which mechanical motor starters will be provided under the Electrical Specification Sections and provide all others.

### 3.6 GENERAL INSTALLATION

- A. Locating and Positioning Equipment: Observe all Codes, Regulations and good common practice in locating and installing mechanical equipment and material so that completed installation presents the least possible hazard. Maintain adequate clearances for repair and service to all equipment and comply with Code requirements.
- B. Arrangement: Arrange piping parallel with primary lines of the building construction, and with a minimum of 7' overhead clearance in all areas where possible. Unless indicated otherwise, conceal all piping. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance. Give right-of-way to piping which must slope for drainage. Set all equipment level or as recommended by manufacturer. Under no conditions shall beams, girders, footings or columns be cut for mechanical items. Casting of pipes into concrete is prohibited unless so shown on Drawings.
- C. Drip Pans: Locate pan immediately below piping and equipment, and extend a minimum of 6" on each side and lengthwise 18" beyond equipment being protected above and below including electrical switchgear and panelboards. Fabricate pans 2" deep, of reinforced 20 gauge galvanized sheet metal with watertight seams and rolled or hemmed edges. Provide 3/4" drainage piping, properly discharged to over floor drain or as shown on the Drawings.
- D. Access Panels: Provide access panels with proper backing reinforcement for all equipment, dielectric unions, valves and items requiring service and installed above ceilings, behind walls, or in furring, complete with correct frame for type of building construction involved. Exact size, number and location of access panels are not necessarily shown on Drawings. Use no panel smaller than 12" by 12" for simple manual access or smaller than 16" x 20" where personnel must pass through.
- E. Adjusting: Adjust and calibrate all automatic mechanical equipment, mixing valves, flush valves, float devices, etc. Adjust flow rates at each piece of equipment or fixture.
- F. Building Vapor Barrier: Wherever the building insulation vapor barrier is penetrated by piping, hangers, conduits, etc., provide clear self-adhesive tape recommended by the insulation manufacturer around the penetrations.
- G. Concrete Work: Coordinate with other work, particularly other concrete work and accessories. Comply with applicable provisions of Section [ **03310** ] for mechanical work concrete, including formwork, reinforcement, mix design, materials (use mix

designs and materials accepted for Division 3 work where possible), admixtures, accessories, (including waterstops), placing of wet concrete, finishing, curing, protecting, testing, submittals and other requirements of the concrete work.

- H. Housekeeping Pads: Construct minimum 3" thick with chamfered edges using 3000 psi concrete. Provide #4 reinforcing bars 8" on center in each direction and within 4" of each edge, centered in pad thickness. Provide ½" dowel with 3" embedment into floor slab for each 2 square feet of pad area. Dowels and equipment anchor bolts shall be spaced a minimum of 6" from pad edges.

### 3.7 VALVE INSTALLATION

- A. General: Comply with the following requirements:
1. Install valves where required for proper operation of piping and isolation of equipment, including valves in branch lines to isolate sections of piping, and where shown on the drawings. Install valves at low points in piping systems that must be drained for service or freeze protection.
  2. Locate valves in accessible spaces (or behind access panels) and so that separate support can be provided when necessary.
  3. Install valves with stems pointed up, in the vertical position where possible, but in no case with stems pointed downward from a horizontal plane.
- B. Insulated Valves: Install extended-stem valves in all piping specified as insulated, and arrange in the proper manner to receive insulation.
- C. Valve Access: Provide access panels to all valves installed behind walls, in furring or otherwise inaccessible.
- D. Lubricant-Seal: Select and install plug valves with lubricant-seal except where frequent usage is indicated or can be reasonably expected to occur.

### 3.8 INSTALLATION OF HANGERS AND SUPPORTS

- A. General: Proceed with the installation of hangers, supports and anchors only after the required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) the proper placement of inserts, anchors and other building structural attachments.
1. Install hangers, supports, clamps, and attachments to support piping and equipment properly from the building structure. Use no wire or perforated metal to support piping, and no supports from other piping or equipment. For exposed continuous pipe runs, install hangers and supports of the same type and style as installed for adjacent similar piping.
  2. Prevent electrolysis in the support of copper tubing by the use of hangers and supports which are copper plated or by other recognized industry methods.
  3. Support piping independently of any fire sprinkler piping.



4. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at panel points only. Do not drill beam or joist flanges for hanger attachment.

B. Provisions for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units. Install specified seismic restraints to restrict excessive movement.
2. Install hangers and supports so that equipment and piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
3. Install hangers and supports to provide the indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded. Comply with the following installation requirements:
  - a. Clamps: Attach clamps, including spacers (if any), to piping outside the insulated piping support. Do not exceed pipe stresses allowed by ANSI B31.
  - b. Insulated Pipe Supports: Insulated pipe supports shall be supplied and installed on all insulated pipe and tubing.
  - c. Load Rating: All insulated pipe supports shall be load rated by the manufacturer based upon testing and analysis in conformance with ASME B31.1, MSS SP-58, MSS SP-69 and MSS SP-89.
  - d. Support Type: Manufacturer's recommendations, hanger style and load shall determine support type.
  - e. Insulated Piping Supports: Where insulated piping with continuous vapor barrier or where exposed to view in finished areas is specified, install hard maple wood insulation shields (Elcen Fig. 216) or steel pipe covering protection shields (MSS type 39) at each hanger.

C. Pipe Support:

1. Vertical Spacing: Support at base, at equivalent of every floor height (maximum 10' as required by Code) and just below roof line.
2. Screwed or Welded Steel or Copper Piping: Maximum hanger spacing shall be as follows:

	<u>Steel</u>	<u>Copper</u>
1-1/4" and smaller	7' span	6' span
1-1/2" pipe	9' span	6' span
2" pipe	10' span	10' span
2-1/2" & larger	12' span	10' span

3. Cast Iron Soil Pipe:
  - a. Hubless and Compression Joint: At every other joint except when developed length exceeds 4', then at each joint.
  - b. Additional Support: Provide at each horizontal branch and/or at concentrated loads to maintain alignment and prevent sagging.
4. Glass Pipe: Maximum 3' hanger spacing or as recommended by manufacturer.

5. Polyvinyl Chloride, Polypropylene and Other Plastic Pipe: Maximum hanger spacing and minimum rod diameters as follows:
  - a. Continuous support 1/2" to 4" pipe size Fee & Mason No. 109 channels with Fee & Mason No. 108 hanger. Lay pipe directly into the channel with fittings or couplings placed in spaces between channel sections. Secure piping to the channel at intervals between hangers with a few turns of vinyl electrical tape.
  - b. Non-Continuous Support: Maximum 4' spans or shorter if required by manufacturer for temperatures and pipe schedule.
  - c. Arrange supports to allow free movement, but restrict upward movement of lateral runs so as not to create reverse grade on drainage pipe. Use double bolt clamp or band hanger with restraint (Tolco fig. 25).
6. Install additional hangers or supports at concentrated loads such as pumps, valves, etc. to maintain alignment and prevent sagging.
7. Support Rod: Hanger support rods sized as follows:

<u>Pipe and Tube Size</u>		<u>Rod Size</u>	
<u>Inches</u>	<u>mm</u>	<u>Inches</u>	<u>mm</u>
1/2" to 4"	12.7 to 101.6	3/8"	9.5
5" to 8"	127.0 to 203.2	1/2"	12.7
10" to 12"	254.0 to 304.8	5/8"	15.9

- D. Adjust hangers and supports to bring piping to proper levels and elevations.
- E. Provide all necessary structural attachments such as anchors, beam clamps, hanger flanges and brackets in accordance with MSS SP-69. Attachments to beams wherever possible. Supports suspended from other piping, equipment, metal decking, etc., are not acceptable.
- F. Horizontal banks of piping may be supported on common steel channel member spaced not more than the shortest allowable span required on the individual pipe. Maintain piping at its relative lateral position using clamps or clips. Allow lines subject to thermal expansion to roll axially or slide. Size channel struts for piping weights.
- G. Installation of drilled-in concrete anchors shall comply with the manufacturers instructions for working load, depth of embedment, and spacing between anchors and from the edge of the slab. Use only wedge style anchors.
- H. Seismic Restraints: Install restraints where recommended in SMACNA "Seismic Restraint Manual." Show analysis of supporting structure, anchorages, and restraints in accordance with OSSC Section 1613 and reference ASCE standard. Seismic restraint system components shall be approved by the California Office of Statewide Health Planning and Development (OSHDP). Acceptable Manufacturers: Amber/Booth, Mason Industries, Tolco, or approved.
- I. Cast Iron joint restraints: Provide on all no-hub cast iron pipe joints 3" or larger and more than 10 feet below the nearest connected plumbing fixture or roof drain. Holdrite or approved substitute.

### 3.9 PLUMBING SYSTEM IDENTIFICATION

- A. Piping System: Indicate each pipe system by its generic name (abbreviated) as shown/scheduled/specified; except vent and drainage piping. Comply with ANSI A13.1 for marker locations, letter sizes, and colors. Include arrows to show direction of flow and "Electric Traced" signs to identify heat cable wrapped piping. Locate pipe labels in accessible areas as follows:
1. Near each valve, meter, gauge, or control device.
  2. Near equipment such as pumps, heat exchangers, water heaters, etc.
  3. At piping branch connections.
  4. At penetrations (each side) of walls, ceilings, and floors.
  5. At access panels and doors.
  6. At 25 foot maximum intervals. Provide a minimum of 1 label above each room where lift out ceiling is installed. Reduce intervals in congested areas such as mechanical rooms.
- B. Valve Identification: Tag all valves with brass disc and chain. Prepare valve charts indicating valve number, size, location, function and normal position. Use no duplicate numbers in Plumbing and Heating systems. Mount glazed frames containing one set of valve charts in the building mechanical room.
- C. Equipment: Provide engraved plastic-laminate signs at locations of major equipment such as heat exchangers, pumps, etc. Identify equipment in field same as on drawings. Permanently mount in an appropriate and effective location.
- D. Operation Tags: Where needed for proper and adequate information on operation and maintenance of mechanical systems, provide tags of plasticized card stock, either pre-printed or hand printed to convey the message; example: "DO NOT CLOSE THIS VALVE EXCEPT WHEN THE PUMP IS OFF."

### 3.10 EQUIPMENT CONNECTIONS

- A. Provide complete plumbing connections for all items of equipment requiring such connections, including incidental piping, fittings, trim and labor necessary for a finished working installation.
- B. Verify the rough-in and finish requirements for all equipment provided under other Divisions of the work and requiring plumbing connections with equipment supplier and installer prior to rough-in. Minimum branch pipe size for fixtures shall be 1/2".

### 3.11 PROTECTION

- A. Protect all work and materials against loss or damage. Close all pipe openings with caps or plugs. At final completion, thoroughly clean and deliver all work and equipment

in an unblemished new condition. Keep all motors and bearings in watertight and dustproof covers during entire course of installation.

- B. Protect floors, walls, framing and sheathing where pipe cutting and threading operations are conducted with plastic sheeting under plywood sheets. Extend plastic sheeting beyond the plywood. Clean-up metal cuttings, oil, etc., daily or as necessary to prevent debris from being tracked beyond the protected area. Damages, as determined by the [ **Architect** ], due to the pipe cutting/threading operation shall be repaired by the responsible trade.

### 3.12 CUTTING AND PATCHING

- A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of mechanical work. Do all necessary cutting and patching of existing building and yard surfaces required for completion of the mechanical work. Patch to match finish and color of adjacent surfaces. **Coordinate work in remodel and new areas to avoid cutting of new finished surfaces.**
- B. Precautions:
  - 1. In the event insulated piping or equipment and/or sprayed or trowelled-on fireproofing, sprayed acoustical material, and similar materials are uncovered during the cutting, patching or demolition operation, notify the Architect immediately to investigate the possibility that it is asbestos-laden material. Do not damage or attempt to remove any material suspected of containing asbestos.
  - 2. Do not proceed with the Work in such areas until so instructed by the Architect.

### 3.13 PIPE PENETRATION FIRE STOPPING

- A. Install as recommended by manufacturer and in accordance with the product's UL listing. Below are the minimum installation requirements.
  - 1. Install specified penetrating item(s) with required annular spacing in proper size wall or floor opening. Support penetrating item(s) adequately on both sides of construction.
  - 2. Clean all opening and penetrating item surfaces in penetration area to remove loose debris, dirt, oil, wax, grease, old caulking, etc.
  - 3. If needed or required for gypsum or concrete block walls, install specified galvanized steel wire mesh or sleeve recessed and centered inside wall around penetrating item(s) so that it is snug against perimeter of opening.
  - 4. When required, install specified type and depth of backing material in annular space, recessed to required fill depth of fire stopping caulking.
  - 5. Gun, trowel, and/or pump fire stopping sealant to specified depth in annular space around penetrating item(s). Trowel sealant surfaces flush with wall or floor surfaces to a smooth, defect-free finish. Where required, apply specified size caulking bead around penetrating item(s) at zero annular contact areas and tool smooth.

## 3.14 MECHANICAL PAINTING

- A. Minimum Requirements: All mechanical equipment, piping, insulation, etc., exposed in finished areas, storage rooms and other locations except mechanical equipment rooms will be painted under **Section 09900**.
- B. Painting Materials: Materials shall comply with **Section 099000, Painting** and shall be compatible with the material to be painted.
- C. Uninsulated Piping: Paint black or galvanized uninsulated piping located buried in ground, in concrete or masonry one (1) coat acid-resisting black paint. Paint black or galvanized uninsulated piping in moist equipment rooms, crawl spaces without vapor barriers, or] exposed to weather one (1) coat black asphaltum varnish.
- D. Iron Work: Paint hangers, rods, anchors, guides, threads of galvanized pipe, bases, supports, uncoated sheet metal and other iron work without factory finish, exposed to weather, located in moist concealed spaces and moist equipment rooms, one coat acid-resisting black paint. Apply one (1) coat Dixon's Aluminum Graphite No. 209 paint over the (1) coat primer as recommended by paint manufacturer to all hot metal surfaces.
- E. Piping in Mechanical Room: All insulated and uninsulated piping exposed in mechanical equipment rooms shall be painted. Painting is not required for cast iron, plastic, or glass waste piping, or for stainless steel piping, PEX tubing and soft copper tubing. Contractor shall submit proposed colors for approval. In lieu of painting, insulated piping may be covered with colored PVC insulation jacketing as specified in Section 22 0700, Plumbing Insulation.
- F. Insulated Piping and Other Insulated Surfaces: Paint insulated piping in half-round, split tile, or other inaccessible locations, one (1) coat asphalt emulsion.

## 3.15 PLUMBING WORK CLOSEOUT

- A. General: Refer to the Division 1 sections for general closeout requirements. Calibrate all equipment requiring same. Complete each system as shown or specified herein and place in operation except where only roughing-in or partial systems are called for. Each system shall be tested and left in proper operation free of leaks, obstructions, or contamination.
- B. Record Drawings: Submit record set of drawings as previously specified in this Section.
- C. Closeout Equipment/Systems Operations: Sequence operations properly so that work of project will not be damaged or endangered. Coordinate with seasonal requirements. Operate each item of equipment and each system in a test run of appropriate duration with the Owner present, and with the Owner's operating personnel present, to demonstrate sustained, satisfactory performance. Adjust and correct operations as

required for proper performance. Clean and lubricate each system, and replace dirty filters, excessively worn parts and similar expendable items of the work.

- D. Operating Instructions: Conduct a walk-through instruction seminar for the Owner's personnel who are to be involved in the continued operation and maintenance of plumbing equipment and systems. Provide written instructions outlining and explaining the identification system, operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety, efficiency and similar features of the systems.

END OF SECTION

SECTION 22 0700 – PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this section apply to the insulation of plumbing systems specified elsewhere in these specifications.
- B. The requirements of Section 22 0500, Common Plumbing Materials and Methods, also apply to this section.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
  - 1. Furnish services of installers who have successfully completed Armacell Qualified Installer Program (AQIP) manufacturer's installation training. Submit qualification data for manufacturer-trained mechanics.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products listed and labeled in accordance with UL 723, or in accordance with ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less and smoke-developed index of 150 or less.
- C. Minimum Insulation Thickness and Thermal Performance: Comply with the State of Oregon Energy Efficiency Code except where more stringent requirements are specified herein.
- D. Composite (Insulation, Jacket or Facing and Adhesives) Fire and Smoke Hazard Ratings: Not to exceed a flame spread of 25 or smoke development of 50 and containing less than 0.1% by weight deca-PDE fire retardant.
- E. Component Ratings of Accessories (Adhesives, Mastics, Cements, Tapes, Finishing Cloth for Fittings): Same as "B" requirements above and permanently treated. No water soluble treatments.

**1.3 SUBMITTALS**

- A. Submit catalog data and performance characteristics for each product specified.

**1.4 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. General: In addition to the requirements specified in Section 22 0500, the following apply:
  - 1. Deliver insulation, coverings, cements, adhesives and coatings to the site in factory-fabricated containers with the manufacturer's stamp or label affixed showing fire hazard ratings of the products. Store insulation in original wrappings and protect from weather and construction traffic.
  - 2. Protect insulation against dirt, water, chemical and mechanical damage. Do not install damaged insulation. Remove such insulation from project site.

**PART 2 - PRODUCTS****2.1 ACCEPTABLE MANUFACTURERS**

- A. Insulation Manufacturers: Johns Manville, Owens-Corning, Knauf, Certain Teed, Armacell, Pabco, Imcoa or Nomaco. Johns Manville products are listed unless indicated otherwise.
- B. Adhesive Manufacturers: Foster, 3M, Insul-Coustic, Borden, Kingco or Armacell.

**2.2 PIPING INSULATION**

- A. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials. Comply with UL 723 for flame spread/smoke developed ratings of 25/50.
- B. Interior and Exterior Piping Systems 32 to 180 Deg. F: Glass fiber preformed pipe insulation with a minimum K-value of 0.23 at 75 deg. F, a minimum density of 3.5 pounds per cubic foot within all-service vapor barrier jacket, vinyl or pre-sized finish and pressure sensitive seal containing less than 0.1% by weight deca-PDE fire retardant.
- C. Exterior Installations: Same as for interior installations except 0.016" aluminum finish jacket or, in coastal environments, 0.016" stainless steel.
- D. Pipe Temperatures Minus 30 to 180 Deg. F: Flexible, preformed, pre-slit, self-sealing elastomeric pipe insulation up to 2-1/8" ID, thermal conductivity of 0.27 BTU/hr. sq. ft./in. at 75 deg. F and vapor transmission rating of 0.2 perms/inch. Armstrong "Armaflex 2000" or, in concealed locations, Imcoa or Nomaco also approved.

**2.3 EQUIPMENT INSULATION**

- A. Equipment Temperatures Below 70 Deg. F: Flexible, closed cell, elastomeric sheet



insulation of 5.5 #/cubic feet density and 0.27 thermal conductivity at 75 deg. F. Armacell "AP Armaflex."

- B. Equipment Temperatures From 70 to 450 Deg. F: Glass fiber 3 pound density insulation with a 0.23 thermal conductivity at 75 deg. F. Johns Manville "814 Spin-Glas" with "FSK" jacket containing less than 0.1% by weight deca-PDE fire retardant or finished as recommended by manufacturer.
- C. Equipment Temperatures From 350 to 1200 Deg. F: Molded high temperature calcium silicate minimum 12.5 pound density and 0.4 thermal conductivity at 200 deg. F mean temperature. Glass cloth finish, Claremont Diplag or finished as recommended by insulation manufacturer.
- D. Exterior Tanks and Equipment Insulation Covering: Same as interior insulation with weatherproof metal or finished as recommended by insulation manufacturer.

#### 2.4 INSULATION ACCESSORIES

- A. Insulation Compounds and Materials: Provide rivets, staples, bands, tapes, adhesives, cements, coatings, sealers, welded studs, etc., as recommended by the manufacturer for the insulation and conditions specified. No staples allowed on cold water piping systems.
- B. PVC Protective Jacketing and Valve and Pipe Fitting Covers: Johns Manville Zeston 2000, Proto LoSmoke, Speedline Smoke Safe, or Ceel-Co Ceel-Tite 100 Series with precut fitting fiberglass insulation or approved.
- C. Jacket Lap Sealing Adhesives: Foster Drion 85-75 contact cement or approved substitute.
- D. Saddles and Shields: Install to prevent crushing of insulation at support points.
  - 1. Protection Saddles: MSS Type 39. Armacell Insuguard Multi
  - 2. Protection Shields: MSS Type 40. Armacell ArmaFix Ecolight
  - 3. Preinsulated Pipe Supports: Calcium silicate load bearing metal jacketed inserts. Pipe Shields Inc. or accepted substitute.
    - a. Pipe supported on rods - Models A1000, A2000, A3000, A4000.
    - b. Pipe supported on flat surfaces - Models A1000, A2000, A3000, A4000.
    - c. Pipe supported on pipe rolls - Models A3000, A4000, A5000.
    - d. Vertical riser clamp – Models E1000, E1100, E1200.
- E. Removable/Reusable Insulation Covers:
  - 1. Insulation Filler: Install 2-1/4# - 4#/cu. ft. glass fiber, 6# - 8#/ cu. ft. mineral wool or glass fiber/type E felted (9#/cu. ft.) flexible blankets and pads for large, irregular shaped equipment such as pump casings, bolting flanges, etc. For small common shapes such as valves, elbows, flanges, etc., install preformed flexible glass fiber

- pipe wrap, preformed glass fiber pipe covering or glass fiber/type E felted (9#/cu. ft.) insulation.
2. Hot Encasement: Glass fiber cloth plain or silicon coated on both sides, knitted stainless steel mesh, glass fiber cloth laminate with aluminum, or stainless steel foil or hex wire mesh.
  3. Cold Encasement: Glass fiber cloth silicon coated both sides, knitted stainless steel mesh, glass fiber cloth laminate with aluminum or stainless steel foil or glass fiber cloth with nickel wire insertion, silicon coated both sides.
  4. Stitching: Glass fiber thread/PVC coated, staples - galvanized or stainless steel, galvanized or stainless steel hog rings, 0.010" - 0.15" dia/dead soft stainless steel wire.
  5. Attachments and Securements:
    - a. Quilting: Stainless 2-hole washers, both sides with twisted 0.035" - 0.051" wire loops, 12 ga. stainless spindle/washer/ speed clip assembly or stainless 0.035" - 0.051" wire loops.
    - b. Lacing and Hooks: Stainless 2-hole 12 gage bent wire lacing hooks, stainless 2-hole dished washer assembly with twisted 0.035" - 0.051" wire loops, 12 gage stainless spindle washer with built-in hook and speed clip or stainless 1-hole dished and flat washer riveted through the cloth.
- F. Interior Tanks and Equipment Insulation Covering: Finished metal jacket or as recommended by the manufacturer for insulation material specified.

### PART 3 - EXECUTION

#### 3.1 PIPING INSULATION

- A. General: Insulate both metallic and non-metallic piping as subsequently specified. Insulation shall be continuous except where passing through structural members. Do not insulate underground piping except at joints and fittings on preinsulated piping unless indicated otherwise.
- B. At the contractor's option and in accordance with Part 2 of this section, elastomeric insulation may be installed on domestic water piping in thicknesses providing overall thermal resistance equivalent to the glass fiber insulation. Increased thickness is typically required. Installation shall comply with the manufacturer's recommendation with joints and seams completely sealed.
- C. Insulate Domestic Water Piping with glass fiber pipe covering:
  1. Cold Water piping: [1/2"][1"] thick for cold water piping.
  2. Hot Water Piping: 1/2" thick for 3/4" and smaller piping. 1" thick for 1" and 1-1/4" piping. 1-1/2" thick for 1-1/2" piping. [1-1/2"][ 2" ] thick for 2" and larger piping.
  3. Insulate hot water return piping same as hot water piping.
  4. Insulate all water piping exposed to outside weather and freezing temperatures with minimum 1" thickness of glass fiber pipe covering with weather-proof metal jacket. Apply insulation after heat cable is installed.

- D. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials. Comply with UL 723 for flame spread/smoke developed ratings of 25/50.
- E. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C1427, Type I, Grade 1, for tubular materials. Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.
- F. Interior Rain Drains:
1. Concealed: Insulate with 1" thick one pound density glass fiber blanket and continuous vapor barrier jacket.
  2. Exposed: Insulate with 3.5 pound density glass fiber insulation with continuous vapor barrier jacket.
  3. Cold climates: Insulate over heat tape where indicated.
- G. Waste Lines: Insulate all pipe exposed to outside temperatures with 3/4" thick glass fiber pipe insulation with a vapor barrier jacket.
- H. Pipe Fittings:
1. Insulate and finish all fittings including valve bodies, bonnets, unions, flanges and expansion joints with precut fiberglass insulation and preformed PVC covers sealed to adjacent insulation jacket for continuous vapor barrier covering over all fittings. Elastomeric insulation shall be cut and sealed at fittings.
  2. Use elastomeric insulation at flexible pipe connections.
  3. Provide removable/reusable insulation covers on 4" and larger valves, unions, flanges, pump casings, strainers and similar fittings or equipment requiring periodic service.
- I. Protective Covering: Install continuous protective PVC or metal covering on all piping and fittings in mechanical rooms, accessible tunnels, attic spaces, accessible ceilings, etc., where insulation may be subject to damage. Install with rivets or cement seams and joints.
- J. Piping Insulation Lap Seams and Butt Joints: Install insulation jacket in accordance with manufacturer's recommendation and without staples on cold water lines. Where jacket joint and lap seams have not adhered, remove affected section of insulation and reinstall or apply lap sealing adhesive in accordance with manufacturer's instructions.

### 3.2 NON-JACKETED HOT WATER TANKS

- A. Materials: Insulation blanket and metal jacket as specified above.
- B. Manholes, Nameplates, Handholes, Cleanouts, Etc.: Do not insulate over manholes,

ASME Code stamps, manufacturer's nameplates, handholes, cleanouts, etc. Provide neatly beveled edges at interruptions of the insulation. When surfaces are to operate below ambient saturation temperatures, provide removable sections of insulation to cover the above with vapor sealed edges. Provide appropriate tagging.

END OF SECTION

**SECTION 22 1000 – PLUMBING PIPING AND PUMPS****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. Provide pipe, pipe fittings, piping specialties, pumps and related items required for complete piping system.
- B. Related Work: The requirements of Section 22 0500, Common Plumbing Materials and Methods, also apply to this section.

**1.2 QUALITY ASSURANCE**

- A. General: ASTM, and ANSI Standards are indicated. In addition, special standards are referenced where neither ASTM nor ANSI Standards are applicable.
- B. Labeling: All piping shall be continuously and legibly labeled on each length as required by codes and standards and including as a minimum, country of origin, manufacturer's identification marking, wall thickness designation, and applicable standards and approvals. Fittings shall be labeled as required by the referenced standard. Tubular fixture traps shall be stamped with manufacturer's mark and material thickness.
- C. Potable Water Valves: Potable water piping materials not limited to faucets, mixing valves, or pressure reducing valves. Valves shall meet NSF/ANSI Standard 61, Section 9, for drinking water faucets and shall be brass construction.
- D. Plastic Piping: All plastic piping systems including potable water and drain-waste-vent (DWV) shall meet NSF/ANSI Standard 14.
- E. Definitions: Where piping fluid is not indicated in the following paragraphs, provide similar piping materials for similar fluids (i.e., "make-up water" = "domestic water"; "wet stand pipe" = "fire sprinkler pipe"; "drainage piping" = "sanitary/storm sewer piping").
- F. Plumbing System Disinfection shall be performed by an experienced, qualified, chemical treatment agency. Mt. Hood Chemical, Chemcoa, Industrial Treatment of Water, or approved alternate.

**1.3 STORAGE AND HANDLING**

- A. Provide factory-applied end caps on each length of pipe and tube. Maintain end caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

1.4 SUBMITTALS

- A. Submit catalog data for each product specified.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Copper Pipe and Tube:

1. Application:
  - a. Domestic water
  - b. Priming lines
2. Pipe: ASTM B88.
  - a. Above Ground Domestic Water: Type L hard temper copper with soldered joints.
  - b. Underground Domestic Water and Priming Lines: Type L soft annealed with no joints or type K hard tempered copper with silver soldered joints.
3. Fittings: Wrought copper solder-joint fittings, ANSI B16.22.
4. Preinsulated Piping: Type K solder joint copper piping with 1" thick urethane insulation protected by 20 gauge PVC outer jacket. Rovanco "Insul/80," equivalent Rikwil or approved substitute.
5. Domestic Water, 2-1/2" and Larger: Rolled groove gasketed mechanical fittings with UPC approval. Tyco-Grinnell CTS or Victaulic CTS, NIBCO Press System or approved.
6. Domestic Water up to 4": UPC approved mechanically compressed copper or bronze fittings with EPDM O-ring seal. Viega ProPress, Mueller approved.

B. Plastic Pipe:

1. Application: Where approved by Code.
  - a. Domestic water, systems operating at less than 80 psi and 140 degrees F.
2. Pipe:
  - a. Cross-linked polyethylene (PEX-a) tubing for Water Service: ASTM F877; SDR 9. NSF-pw and NSF 61.
3. Fittings: Cold expansion (ASTM F1960) style fittings of the type indicated, matching piping manufacturer. Where not otherwise indicated, provide fittings produced and recommended by the piping manufacturer for the service indicated.

C. Plastic Pipe – Drain, Waste, Vent (DWV):

1. Application: Where allowed by Code only.
  - a. Sanitary waste
  - b. Plumbing vent
  - c. Rain drain
2. Pipe:
  - a. Poly(vinyl chloride) (ASTM D1784) (PVC) solid core plastic drain, waste and

- vent pipe (ASTM D2665 and D1785) and fittings (ASTM D2665) (DWV).
3. Fittings: Provide fittings of the type indicated, matching piping manufacture. Where not otherwise indicated, provide socket style, solvent weld fittings produced and recommended for the service indicated by the piping manufacturer.
- D. Cast Iron DWV Pipe:
1. Application: 1-1/2" and larger.
    - a. Sanitary waste
    - b. Plumbing vent
    - c. Rain drain
  2. Pipe: Hubless cast iron soil pipe, CISPI 301-05/ASTM A 888-05.
  3. Fittings: Hubless cast iron fittings: CISPI 301-05/ASTM A 888-05.
  4. Couplings:
    - a. Standard Duty: Standard couplings meeting CISPI 310/ASTM A 1277.
    - b. Heavy Duty: No-hub couplings meeting ASTM C 1540, and FM 1680. ASTM C 564 neoprene gasket, type 304 SS corrugated shield and type 304 SS clamping bands.
    - d. Couplings to Dissimilar Pipe in Concealed Locations: Fernco "LowFlex" or approved substitute.
  5. Manufacturers: Cast iron pipe and fittings – AB&I, Charlotte Pipe, Tyler Pipe, or approved. All pipe shall be labeled by the manufacturer.
- E. Plastic Pipe:
1. Application: Where approved by Code.
    - a. Cooling coil condensate drain
  2. Pipe:
    - a. Polyvinyl Chloride and Chlorinated Polyvinyl Chloride Plastic Pipe for Water Service: SDR-PR pipe, ASTM D2241; Schedules 40, 80 and 120, ASTM D1785.
  3. Fittings: Provide fittings of the type indicated, matching piping manufacturer. Where not otherwise indicated, provide socket style, solvent weld fittings produced and recommended by the piping manufacturer for the service indicated.

## 2.2 MISCELLANEOUS PIPING MATERIALS

- A. Insulating (Dielectric) Fittings: Provide standard products recommended by the manufacturer for use in the service indicated, and which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and reduce corrosion. Victaulic "Clear Flow."
- B. Soldering and Brazing Materials: Provide soldering materials as determined by the installer to comply with installation requirements.
1. Tin-Antimony Solder: ASTM B32, Grade 95TA.
  2. Lead-Free Solder: ASTM B32, Grade HB. Harris "Bridgit" approved.

3. Silver Solder: ASTM B32, Grade 96.5TS.
  4. Flux: Water soluble paste flux.
  5. Brazing filler rod: BCuP rod to suit conditions.
- C. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges. Pressure and temperature rating required for the service indicated.
- D. Pipe Sleeves: For installation in cast in place concrete floor systems. UL 1479 listed with ratings for fire, smoke, and water intrusion. Cast in place pipe sleeve with external waterstop collar and interior pipe seal and intumescent collar. Holdrite "Hydroflame".
- E. Sleeve Seal: Rubber-link pipe wall and casing closure. Thunderline Link-Seal. For fire rated wall, floor or ceiling penetrations, 3-M "CP-25" caulk, "No. 303" putty and/or "PSS 7904" sealing system.
- F. Strainers: "Y-pattern," Class 125 [epoxy coated iron body] [bronze body] with tapped blow-off connection and removable 20 mesh stainless steel screen. NIBCO or equal.
- G. Tracer Wire: 14 gauge, single strand, copper wire with blue insulation for water, green for sanitary and storm sewers, and yellow for gas. 3M "DBY" direct bury splice kit required at all splices.

## 2.3 PIPING SPECIALTIES

- A. Cleanouts:
1. Manufacturer: Jay R. Smith, Zurn, Wade, Watts, Josam, Mifab, Sioux Chief, or approved substitute.
  2. Types:
    - a. Tile Floor Cleanouts: Smith 4053-U with square heavy-duty nickel bronze top, bronze plug, and vandalproof screws. Adjustable top where cast into floor slab.
    - b. Carpeted Floor Cleanout: Smith 4023-U-X with round heavy-duty nickel bronze top, bronze plug, carpet clamping device, and vandalproof screws. Adjustable top where cast into floor slab.
    - c. Concrete Floor Cleanout: Smith 4023 with round heavy-duty nickel bronze top. Adjustable top where cast into floor slab.
    - d. Wall Cleanouts: Smith 4472-U, bronze ferrule with raised head bronze plug, stainless steel shallow cover and vandalproof screws.
    - e. Outside Area Walks and Drives: Smith 4253-U-G with galvanized cast iron body, top secured with vandalproof screws, and bronze plug. Install in 18" x 18" x 6" deep concrete pad flush with grade.
    - f. Plastic Body Cleanouts: At Contractor's option, where ABS-DWV or PVC-DWV piping is approved, compatible plastic body cleanouts may be substituted. Cleanouts shall have finished tops of style and material as specified above.



- B. Drains:
1. Manufacturers: Zurn, Jay R. Smith, Josam, Watts, Wade, Froet Industries, Mifab, Sioux Chief, or approved substitute. Where numbers are scheduled on the drawings they represent minimum the acceptable standard for locations involved.
  2. Cast iron construction with acid resistant coating, anchor flange, and other options as indicated by model number listed on the drawings. PVC drains where specifically noted. Cast iron dome strainers on roof drains.
  3. Install sheet flashing, extending not less than 10" from and clamped to all drains not completely cast-in-place in a homogeneous material.
- C. Trench Drain: Polyester concrete material, cast channels with 0.6% sloped bottom and with cast iron grate. Length as indicated on the Drawings. ACO Drain Incorporated "Channel Slope" NW-100 with No. 603 catch basins where indicated or approved substitute.
- D. Trench Drain: UV and chemical resistant HDPE interlocking 4", channel sections in flat and presloped styles with bottom or end outlets as shown. Provide with grate anchors and construction covers. Coordinate grate choice with Owner. Sioux Chief, Zurn or Mifab.
- E. Hydromechanical Grease Interceptor: The interceptor vessel shall be formed of seamless chemical resistant thermoplastic suitable for underground installation with up to 72" of cover and 160 deg. F influent. Interceptor shall incorporate an internal flow control device and inlet diffusion baffle and operate with a balanced air environment. Average unit efficiency shall be not less than 95%. Vessel shall include 3 optional outlet locations and shall provide for a discharge sampling point. Service access to be provided via H-20 traffic rated access rings and secured covers. When required by the installation, unit shall include cut-to-length riser extensions with watertight connections. Schier, Endura, Mifab or approved substitute.
- F. Flashing: Minimum 4# sheet lead; to extend horizontally 10" from edge of vent penetrations or rain drain body and vertically 12" minimum up from roof turned over and down into hub of vent or finished with bronze cap providing counterflashing for screwed pipe.
- G. Shock Arrester: Precharged bellows or sealed piston type manufactured to meet PDI WH-201 and ASSE 1010 Standards. Size in accordance with PDI procedures. Jay R. Smith, PPP, Sioux Chief, Wade, Zurn, Watts, Josam, Mifab WHB or approved substitute.
- H. Priming Valves: Smith 2699, Josam 88250, Wade W8800T, Zurn Z1022, Watts MS810 or equivalent Precision Plumbing, Mifab. Locate in closets, under counters or in walls behind access panels as specified in Section 22 0500. Use copper specified previously for all underground priming lines.
- I. Traps: Except chrome plated fixture traps. Recessed drainage pattern for threaded

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pipe and same grade as pipe for cast iron and plastic pipe; with cleanout plugs in trap body in all above grade locations.

- J. Pressure Reducing Valve: Single seat type with in-line renewable stainless steel seat diaphragm, and valve. Size and capacity as shown on Drawings. Bronze bodies with screwed connections on valves 2-1/2" and smaller and flanged steel bodies on valves 3" and larger. Install each PRV with strainer on inlet or internal strainer. Select for 15 psi fall-off at indicated flow. Leslie, Watts, Apollo, Cash-Acme, Zurn-Wilkins, or approved substitute.
- K. Backflow Preventer: Where indicated on the Drawings, install a reduced pressure backflow preventer complete with strainer on inlet, shutoff valves, two separate check valves, differential relief valve with drain funnel, and test cocks. USC Foundation for Cross Connection Control, State Health Officials, and serving utility approved. Bronze bodies on units 2" and smaller, cast iron bodies with bronze trim on units 2-1/2" and larger, and stainless steel construction for carbonated beverage service.
- L. Master Mixing Valve Station:
1. Mixing valve station shall be fully factory assembled and tested incorporating type L copper tube with solder fittings, isolation ball valves on all inlet and outlet connections, check valves on inlet lines, recirculating pump with aquastat and timeclock wired to a junction box for single point power connection, circulating line balancing valve, check valve, [strainer,]and thermometer, all mounted [in a hinged door, stainless steel cabinet for] [to an assembled mounting frame for floor or] wall mounting. Provide pressure reducing valves on multiple mixing valve stations. All piping connections shall be labeled.
  2. Master Mixing Valve(s) of all brass or bronze body with stainless steel parts, electronic thermostatic master control element to fail safe upon cold water or control element failure meeting ASSE 1017. Provide with strainers on inlets, and dial thermometer(s) on [inlets and] outlet. Valve location, arrangement and capacity as shown on plans.
  3. Manufacturers: Leonard, Bradley, Powers, Acorn, Symmons, or approved substitute.
- M. Domestic Water Balancing Valve: Balancing fitting with differential pressure taps, brass or bronze body and trim. B&G "Circuit Setter" or equivalent Taco, Armstrong, Thrush, Wheatley, Flow Design or approved substitute. At Contractor's option, balancing valves 3" and larger may be butterfly style, Jenkins No. 222 EL or approved substitute as specified in Section 15100.
- N. Thermostatically Controlled Balancing Valve: Thermal Balancing Valve for domestic hot water recirculation circuits. Internal thermostatic balancing cartridge automatically modulates flow to ensure constant temperature which is adjustable from 95 degrees F to 140 degrees F. Sizes 1/2" and 3/4" with NPT female connections. Provided with DZR low-lead brass valve, stainless steel and copper adjustable thermostatic cartridge, peroxide-cured EPDM hydraulic seals, 300 Series stainless steel springs, adjustment knob with

temperature adjustment scale and tamper-proof adjustment locking screw. Provide with optional check valve and pre-formed insulation shell. Provide with optional (model dependent) outlet temperature gauge, 30 degrees F to 180 degrees F scale.

1. Maximum working pressure: 230 psi.
2. Maximum differential pressure: 15 psi.
3. Maximum inlet temperature: 195 degrees F.
4. Meets requirements of ANSI/NSF 372-2011. Certified to low-lead laws and listed by ICC-ES, file PMG-1360, for use in accordance with U.S. and Canadian plumbing codes.
5. Certified to NSF/ANSI 61 (180 degrees F/82 degrees C Commercial Hot), Drinking Water System Component- Health Effects, by ICC-ES, file PMG-1512.
6. Caleffi 1164 Series or approved.

- O. Domestic Hot Water Demand Circulation Controller: Hot water circulation pump controller with flow switch, temperature sensor, timer, and pump relay. Controller to start circulation pump upon demand sensed by flow switch and stop pump when circulation loop return reaches setpoint (adjustable). 120 volt power cord and receptacle for circulation pump. Flow switch to activate at 0.3 gpm or less. Constant on override switch for troubleshooting. Enovative.

#### 2.4 PUMPS

- A. Domestic Hot Water Circulator: Bronze body, bronze fitted, in-line circulator with sleeve bearing. Bell & Gossett 1" HV or equivalent Grundfos, Thrush, Wilo, Taco, or Armstrong. Provide with 7-day programmable electronic time clock and aquastat to start and stop the pump.

### PART 3 - EXECUTION

#### 3.1 UTILITY SERVICE

- A. Plumbing Utility Connections: Complete installation. Contact local serving utilities to determine conditions involved and make or arrange to have connection made at proper time and pay all costs involved.
- B. Sanitary and Storm Sewers: Connect to or arrange for connection to existing/ public sanitary and storm sewers as shown on the Drawings and as required by the serving utility. Verify depth, size and location prior to installation of the new sewer systems.
- C. Water Service: Connect to or arrange for connection to public water service. Verify serving utility requirements prior to beginning any installation. Verify water main size, depth, pressure and location prior to starting work.
- D. Fire Service: Connect to or arrange for connection to existing public water main. Contact local serving utilities to determine conditions involved and make or arrange to have connection made at proper time and pay all costs involved.

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Provide vault and install backflow preventer provided under the fire sprinkler work specified in Section 21 1300. Coordinate vault size and piping arrangement. Installation of meters and vault by the serving utility.

### 3.2 PIPE INSTALLATION

- A. General: Install pipe, tube and fittings in accordance with recognized industry practices, manufacturer's instructions, and plumbing code standards. Install each run accurately aligned with a minimum of joints and couplings, but with adequate and accessible unions and flanges for disassembly, maintenance and/or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings.
- B. Piping Runs: Route piping close to and parallel with walls, overhead construction, columns and other structural and permanent-enclosure elements of the building. Install piping plumb and level except where pitched for drainage. If not otherwise indicated, run piping in the shortest route which does not obstruct usable space or block access for servicing the building or equipment and avoid diagonal runs. Wherever possible in finished and occupied spaces, conceal piping from view. Do not encase horizontal runs in solid (concrete or CMU) partitions. Do not locate piping within dedicated electrical spaces (six feet above switchgear and panelboards). Provide drip pans below piping routed above dedicated electrical space.
- C. Changes in Direction: Use fittings for all changes in direction. Run lines parallel with building surfaces.
- D. Line Grades:
  - 1. Drainage Lines: Run at maximum possible grade and in no case less than 1/4" per foot within building.
  - 2. Vents: Pitch for drainage 1/4" per 10'.
  - 3. Water: Pitch to low points and install hose bib drains. 3' minimum depth of ground cover for all lines outside building unless otherwise noted.
- E. Unions and Flanges: At all equipment to permit dismantling and elsewhere as consistent with good installation practice.
- F. Expansion: Provide loops, swing joints, anchors, runouts and spring pieces to prevent damage to piping or equipment.
- G. Insulating (Dielectric) Fittings: Comply with manufacturer's instructions for installing unions or fittings. Install in a manner which will prevent galvanic action and stop corrosion where the "joining of ferrous and non-ferrous piping" is indicated.
- H. Tracer Wire: Install tracer wire as close to underground non-metallic water, sanitary and storm sewers and gas pipe in the trench as possible. Tracer wire shall be accessible at grade via all services, valve and meter boxes, curb cocks, cleanouts at the building, manholes (inside the cover near the top), etc. Locate all points on the record as-installed drawings. Splice into utility tracer system where available. Comply with code

requirements.

- I. Piping: Install for services as specified in Part 2. The following are special requirements:
  1. Underground Drainage Pipe: Install cast iron soil pipe for the following conditions. When specified in Part 2 of this Section and where allowed by Code, plastic piping may be installed in lieu of cast iron piping.
    - a. Under the building to 5' outside the building structure.
    - b. 5' each way from a potable water line crossing.
    - c. First section (minimum 5') from any connection to underground structures such as catch basins, manholes, disposal well or tank, etc.
    - d. Through all fill areas where pipe cannot be rested on undisturbed earth.
    - e. Where the top of the pipe is less than 12 inches below finish grade.
    - f. At Contractor's option in lieu of concrete or clay sewer pipe.

### 3.3 PIPING JOINTS

- A. General: Provide joints of the type indicated in each piping system, and where piping and joint as manufactured form a system, utilize only that manufacturer's material.
- B. Cast Iron "No-Hub": All joints in accordance with the Cast Iron Soil Pipe Institute (CISPI) Designation No. 310-97 "Installation Procedures for Hubless Cast Iron Soil Pipe and Fittings For Sanitary and Storm Drain, Waste and Vent Piping Applications." Horizontal runs of 5" and greater shall be braced as indicated in Figure 4 for "rodding" restraints. Application of couplings as follows:
  1. Standard Duty Couplings: All vent piping and all drainage and waste piping above grade.
  2. Heavy Duty Couplings:
    - a. All underground installations.
    - b. All rain drain leader joints located more than 20 feet below the roof drain.
- C. Solder Copper Tube and Fitting Joints: In accordance ANSI B 828 with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in a manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens. "T-Drill" field formed tees may be utilized where the main is at least two pipe sizes larger than the branch.
- D. Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards:
  1. Heat Joining of Thermoplastic Pipe: ASTM D-2657.
  2. Making Solvent-Cemented Joints: ASTM D-2865 and ASTM F-402.

- E. Braze Copper Tube and Fitting Joints: Where indicated. Pass a slow stream of dry nitrogen gas through the tubing at all times while brazing to eliminate formation of copper oxide.
- F. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gasket.
- G. Ferrous Threaded Piping: Thread pipe in accordance with ASME B1.20.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave no more than three threads exposed.
- H. Grooved Pipe Joints: Comply with fitting manufacturer's instructions for making grooves in pipe ends. Remove burrs and ream pipe ends. Assemble joints in accordance with manufacturer's instructions. Visually inspect the assembled joint to ensure proper gasket seating.

### 3.4 CLEANOUTS

- A. Where required by code, at each change of sewer direction 45 degrees or greater and more than 10' long, at end of each branch or main and spaced not greater than 100' apart, as required by code and/or as shown on Drawings. Provide cleanouts beneath all sinks.

### 3.5 MISCELLANEOUS PIPING EQUIPMENT

- A. Floor, Wall and Ceiling Plates: Chrome plated pressed steel or brass screw locked split plates on all pipe penetrations in finished spaces.
- B. Strainers: Install in a manner to permit access for cleaning and screen removal and with blow-off valve.
- C. Sleeves: At all penetrations of masonry or cast in place concrete construction. PVC, 24 gauge galvanized steel tube or Schedule 40 galvanized steel pipe. Use steel pipe sleeves through beams, footings, girders or columns and for all penetrations of walls or floors below grade. Where floor finish is ceramic tile, terrazzo, or similar material extend standard steel pipe sleeves 1-1/2" above finished floor. Fabricate sleeves 1" diameter larger than pipe or insulation. PVC and sheet metal sleeves at non-structural penetrations only. Use specified sleeve system for all above grade concrete floor applications.
- D. Sleeve Caulking: Caulk below grade pipe with rubber link seal. Grout above grade pipe with cement mortar or approved waterproof mastic. All caulking or grouting shall extend full depth of sleeve. Utilize rubber sealing links in lieu of caulking. Install UL sealing caulk, putty and/or system at all penetrations of fire rated walls, floors and ceiling.

- E. Shock Arrestors: Install at end of mains, in a battery of three or more flush valve-operated fixtures water header, ahead of quick closing and solenoid operated valves. Size per PDI recommendations where size is not indicated. Provide access panels.
- F. Trap Priming: Traps serving floor drains, floor sinks, catch basins, and similar fixtures shall be primed in accordance with Code requirements.
- G. Domestic Hot Water Mixing Valves: Install in accordance with manufacturers installation instructions and piping diagrams.

### 3.6 BASE PREPARATION

- A. Subbase Installation: Where indicated, install subbase material to receive mechanical work, and compact by tamping to form a firm base for the work. For 4" and larger piping, horizontal cylindrical tanks and similar work, shape the subbase to fit the bottom 90 degrees of the cylinder, for uniform continuous support. Provide finely-graded subbase material for wrapped, coated and plastic pipe and tank. Shape subbases and bottoms of excavation with recesses to receive pipe bells, flanged connections, valves and similar enlargements in the piping systems and set bottom of trench at proper pitch and correct elevations with subbase material.
- B. Concrete Encasement: Where piping under roadways is less than 2'-6" below surface of roadway, provide 4" base slab of concrete to support piping. After piping is installed and tested, provide 4" thick encasement (sides and top) of concrete before backfilling. Provide Class 2500 concrete for encasement and slab.
- C. Previous Excavations: Where piping crosses over an area more than 5' wide which has been previously excavated to a greater depth than required for the piping installation, provide suitable subsidence-proof support for the piping. Comply with the details shown, or where not otherwise shown, provide the following support system:
  - 1. Excavate to undisturbed soil, in a width equal to the pipe diameter plus 2'. Install 8" courses of subbase material, each compacted to 95% of maximum density, as required to fill excavation and support piping.

### 3.7 BACKFILLING

- A. General: Bedding and backfilling of plastic DWV piping shall comply with ASTM D2321, Standard practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
- B. Do not backfill until installed mechanical work has been tested and accepted wherever testing is indicated. Install drainage fill where indicated, and tamp to a uniform firm density. Backfill with finely-graded subbase material to 6" above wrapped, coated and plastic piping and tanks, and to center line of other tanks (where recommended by tank manufacturer, use "pea gravel" backfill). Condition backfill material by either drying or

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adding water uniformly, to whatever extent may be necessary to facilitate compaction to the required densities. Do not backfill with frozen materials.

### 3.8 CLEANING

A. General: Clean all dirt and construction dust and debris from all mechanical piping systems and leave in a new condition. Touch up paint where necessary.

B Disinfection of Domestic Water Piping System:

1. Prior to starting work, verify system is complete and clean.
2. Open all drains and fixtures valves in the building starting with the valve nearest the water service line and permit the water to run clear for 10 minutes to eliminate grease, cuttings, flux, and foreign matter.
3. Disinfect piping system in accordance with ANSI/AWWA C651-92 standard.
4. Take samples from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C601. If any sample fails the analysis, repeat the procedure.
5. Include a copy of the bacteriological analysis in the Operating and Maintenance manuals.

C. Sanitary and Storm Drainage System:

1. Remove construction debris from cleanouts, drains, strainers, baskets, traps, etc., and leave same accessible and operable. Place plugs in the end of uncompleted piping at the end of the day or whenever work stops.
2. Before final acceptance of completed sewer system, flush and clean the entire system with water. Trap and remove solid material obtained from flushing and cleaning from the new system. Do not allow debris to enter the existing sewer system.

D. Deionized Water Piping: Remove all foreign material from piping and flush with clean water. Sanitize and clean in accordance with procedure recommended by deionized water equipment manufacturer. After system is ready to be operated, test water purity and certify that water quality is within allowable limits.

### 3.9 TEST

A. General:

1. Minimum duration of two hours or longer, as directed for all tests. Furnish report of test observation signed by qualified inspector. Make all tests before applying insulation, backfilling, or otherwise concealing piping or connecting fixtures or equipment. Where part of the system must be tested to avoid concealment before the entire system is complete, test that portion separately, same as for entire system.
2. Provide all necessary temporary equipment for testing, including pump and



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- gauges. Remove control devices before testing and do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for the indicated pressure and time.
3. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.
- B. Repair:
1. Repair piping system sections which fail the required piping test by disassembly and re-installation, using new materials to the extent required to overcome leakage. Do not use chemical stop-leak compounds, solder, mastics, or other temporary repair methods.
  2. Drain test water from piping systems after testing and repair work has been completed.
- C. Sewer: Furnish all facilities and personnel for conducting the test. Test in accordance with the requirements of the State Plumbing Inspector and local authorities.
- D. Plumbing Waste and Vent Piping: Hydrostatic test by filling to highest point, but not less than 10' water column on major horizontal portion.
- E. Water Piping: Hydrostatic pressure of 100 psig without loss for four hours.
- F. Tanks and Equipment: Hydrostatic pressure to 1.5 times operating pressure but do not exceed maximum rated pressure.
- 3.10 SUPERVISION AND START-UP
- A. Adjust flush valves, pressure reducing valves, mixing valves, water heater thermostats, domestic hot water circulating system balancing valves, and similar equipment.
  - B. Domestic hot water system balancing: Adjust domestic hot water recirculating balancing valves to equalize return temperatures from each branch line.
  - C. The installation, start-up, and adjustment of Master mixing valve shall be supervised by an authorized agent of the manufacturer. The manufacturer's agent shall check out and approve the installation and shall also approve and be responsible for adjusting the operating and control system and instructing the Owner's representatives on the system operation.
  - D. Master mixing valve start-up procedure: Provide a factory authorized representative to review the installation of the mixing valve and verify that the adjustment has been completed by an authorized agent of the manufacture. Provide documentation in the O&M documents showing adjustment has been completed per manufacture instructions. Record supply and return temperatures. Work shall be completed prior to substantial completion.

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**PLUMBING PIPING AND PUMPS**

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END OF SECTION

**SECTION 22 3000 – PLUMBING EQUIPMENT****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. The requirements of this section apply to the plumbing equipment.
- B. Provide plumbing equipment specified and shown on the Drawings.
- C. Related Work: The requirements of Section 22 0500, Common Plumbing Materials and Methods, also apply to this section.

**1.2 QUALITY ASSURANCE**

- A. Code: Comply with requirements of the Oregon State Plumbing Specialty Code.
- B. All equipment and component parts shall conform to governing codes. Gas-fired equipment shall be design certified by AGA.
- C. Labeling: All equipment shall have permanent labels affixed by the manufacturer listing model number, capacity, efficiency, approvals, and similar characteristics of the product.

**PART 2 - PRODUCTS****2.1 PIPING**

- A. Piping, fittings, pumps, and related items are specified in Section 22 1000.

**2.2 GAS STORAGE WATER HEATERS**

- A. Commercial High Efficiency Gas-fired Storage Water Heater:
  - 1. CSA, UL, and serving utility approved commercial gas-fired modulating condensing heater complying with the state energy code and ASHRAE 90.1 requirements and of size and capacity shown on Drawings. Minimum water heater efficiency of 95%. Fan powered combustion system suitable for venting with plastic vent pipe. Glass-lined steel tank and heat exchanger and equipped with electronic anode and heat traps. 1-1/2" minimum of non-organic insulation, cold rolled enameled steel jacket. Electronic controller with scheduling, diagnostics and color LED fault display, hot surface or spark igniter, automatic gas pressure regulator and modulating gas control valve, all brass hose bib drain, and hand hole cleanout. ASME code pressure-temperature relief valve. Minimum 3 year tank warranty. Provide with condensate trap and neutralizer.
  - 2. A.O. Smith, Rheem, Bradford White, Raypack, Bock, or approved substitute.

2.3 WATER HEATER ACCESSORIES

- A. Water Heater and Tank Seismic Restraints: For water heaters and tanks, Watts "Spacemaker", Holdrite "Quickstrap," or approved.
- B. Water Heater mounting bracket: Wall or ceiling mounted water heater support and drain pan assembly with seismic restraints. Watts "Spacemaker", Holdrite, or approved.
- C. Domestic Hot Water Expansion Tank: NSF/ANSI 61 compliant lined steel tank for potable water with epoxy exterior finish, anti-microbial lining, air charging valve and corrosion resistant system piping connection. Butyl rubber bladder/diaphragm. Base mounting ring on sizes over 5 gallons. ASME construction on sizes over 10 gallons. Provide with relief valve where working pressure rating is less than 150 psi.
- D. Expansion tank wall mounting bracket: Provide for expansion tanks 5 gallons or less. Holdrite QS.

PART 3 - EXECUTION

3.1 UTILITY SERVICE

- A. Plumbing Utility Connections: Complete installation. Verify rough in dimensions of equipment prior to installing piping.

3.2 EQUIPMENT INSTALLATION AND CONNECTION

- A. All equipment shall be installed plumb and level unless otherwise recommended by the manufacturer.
- B. Arrange piping connections to equipment to allow removal and replacement of the equipment without disassembly of connecting piping. Provide valves, unions, flanges, etc. at connection points.
- C. Arrange equipment for adequate service access as recommended by the manufacturer and as required by code.
- D. Anchor equipment to resist displacement due to seismic events as detailed on the drawings, recommended by the manufacturer, and as required by code and as specified in other sections of these specifications. Provide seismic straps as specified above for tank type water heaters.
- E. Install drain pans under all water heaters with piping to approved point of disposal.

3.3 EQUIPMENT CLEANING

- A. Remove construction and shipping protection and thoroughly clean all plumbing equipment just prior to building acceptance.

3.4 SUPERVISION AND START-UP

- A. Do not place equipment onto operation until required work of other trades is complete, e.g. venting systems, combustion air ducts, etc.
- B. Follow manufacturer's instructions for start-up and adjustment of equipment.
- C. The installation, start-up, and adjustment of the gas water heater shall be performed by an authorized agent of the manufacturer. The manufacturer's agent shall check out and approve the installation and shall also approve and be responsible for adjusting the operating and control system and instructing the Owner's representatives on the system operation.

END OF SECTION

**SECTION 22 4000 – PLUMBING FIXTURES****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. The requirements of this section apply to the plumbing fixtures and trim.
- B. Provide fixtures as shown on the Drawings and specified herein. Provide all required fixture trim and accessories for a complete, finished installation.
- C. Related Work: The requirements of Section 22 0500, Common Plumbing Materials and Methods, also apply to this section.

**1.2 QUALITY ASSURANCE**

- A. Code: Comply with requirements of the Oregon State Plumbing Specialty Code.
- B. Fixture color: White unless indicated otherwise.
- C. Potable Water Valves: Potable water valves not limited to faucets, mixing valves, or pressure reducing valves. Valves shall meet NSF Standard 61, Section 9, for drinking water faucets and shall be brass construction. Brass components which contact water within the faucet shall be from brass which contains no more than 0.25 percent lead by dry weight.

**PART 2 - PRODUCTS****2.1 PIPING**

- A. Piping, fittings, and related items as specified in related Sections 22 1000.

**2.2 INTERIOR PLUMBING MATERIALS**

- A. Shock Arrester: Precharged bellows or sealed piston type manufactured to meet PDI WH-201 and ASSE 1010 Standards. Size in accordance with PDI procedures. Jay R. Smith, PPP, Sioux Chief, Wade, Zurn, Watts, Josam, or approved substitute.
- B. Dishwasher and Cooking Equipment Pressure Reducing Valve: For installation with dishwasher booster heater and other kitchen equipment, all brass, single seat type for dead end service, with renewable stainless steel seat and valve. Designed for service on hot water to reduce pressure from 50 to psi to 20 psi. Leslie, Watts, Cash-Acme, Zurn-Wilkins, or approved substitute.
- C. Handsink Tempering Valve: The lavatory tempering valve shall be IAPMO lab certified per ASSE 1070 at 0.25 gpm (1.0 lpm) and CSA standards and shall have a solid brass

body with corrosion resistant internal components. It shall include integral checks with screens to prevent backflow and to filter debris from entering the valve. Temperature adjustment shall be made using an Allen wrench and a locknut on the bonnet to prevent unauthorized or accidental temperature adjustment. Valve shall provide 4.0 gpm (15 lpm) with 3/8" compression connection and 4.5 gpm (17 lpm) capacity with the 1/2" NPT connection at 45 psi (310 kpa) differential. Temperature range shall be 85-115° F (29-46° C). Valve shall be Acorn model ST70.

- D. Secondary piping supports: Install manufactured secondary piping supports for support and positioning of fixture rough-in piping from framing members. Hubbard, Sioux-Chief, or approved substitute.

### 2.3 PLUMBING FIXTURES AND TRIM

- A. Stops: Furnish stop valves for all fixtures. ¼ turn ball valve style, in wall, angle or straight through pattern to fit installation. Stops to be all brass with full turn brass stem and replaceable washer, no plastic. Compression nuts to be high copper content brass. Finish to be copper nickel chrome plate. Product to carry manufacturer's name. Risers to be chrome plated copper. Provide chrome plated shallow escutcheons. McGuire, Chicago, Brasskraft, Keeney, Zurn, or approved substitute.
- B. Fixture Traps: Exposed fixture tailpieces, traps, and wastes shall be chrome plated 17 gauge seamless brass tube with cast brass nuts and deep or box style escutcheons as required to conceal rough piping. Products to be stamped with manufacturer's name and material gauge. McGuire, Keeney, Zurn, or approved.
- C. Provide insulating covers on all exposed accessible lavatory and sink fixture traps and water supplies. Covers to be ASTM C1822 compliant.
- D. See Separate PDF for Fixture cut sheets and kitchen equipment specifications provided by Architect.
- E. WC-1/WC-2, Water Closet: 1.6 Gallon Flush Valve, Vitreous China: Elongated water closet bowl shall be designed for 1.6 gallon siphon jet flushing action.
  - 1. Install each listed water closet with the following:
    - a. Manual Flush Valve: Quiet acting, exposed chrome plated brass with ADA metal oscillating non-hold-open handle, screwdriver check/control stop with vandal resistant cap, cast wall flange, synthetic rubber diaphragm, and vacuum breaker, as recommended by closet manufacturer. Sloan, Zurn.
    - b. Seat: Solid white heavy weight molded plastic seat, with molded in bumpers; open front less cover for elongated bowl with check and self-sustaining hinge. Hinge and hardware to be 300 Series stainless steel. Church 295-SSC, Beneke 523-SS/CH-B, or Bemis 1955 SS/C, Zurn Z5956SS-EL-STS.

2. WC-1: Floor Mounted, Top Spud water closet: American Standard 2234.015, Kohler K-4350, or Eljer 111-2125. Toto CT 705.
  3. WC-2 ADA: Floor Mounted, Top Spud 18" High: American Standard 3043.102, Kohler K-4368, Eljer 111-2145.
- F. LV-1/LV-2, Lavatory, Vitreous China:
1. Faucet: Chrome plated brass body with handle for the handicapped, vandal resistant 0.5 gpm aerator, temperature limit stop, with grid strainer waste. Symmons "S-60-G-H" metering faucet,
  2. Counter Mounted, Self-rimming, 19" Diameter Round "LV-1": American Standard 0491.019, Kohler K-2202, or Eljer 051-0174.
  3. Counter Mounted, Self-rimming, Oval "LV-2": American Standard 0476.028, Kohler K-2196, or Eljer 051-3514.
- G. MB-1, Service Sump (Mop Basin):
1. Faucet exposed, brass body, rough plated, long spout, top brace, hose end spout with bucket hook, vacuum breaker and integral stops in shanks. Chicago 897, T & S B-0665-BSTP, or equal Zurn, Delta Commercial, mounted 24" above rim. Install with 18 gauge type 302, No. 4 finish stainless steel splash on the two walls.
  2. Molded stone 24" x 36" x 10" deep with vinyl bumper guard and 3" brass body strainer outlet. Fiat, Mustee, Swan or approved substitute.
- H. BF-1, Water Bottle Filler/ Cooler:
1. Free standing, walk-in style, stainless steel, vandal resistant, hands-free operation.
  2. High efficiency, filtered, refrigerated, stainless steel.
  3. 8.0 gph ELKAY LZWSGRNM8PK or equal.
- I. PW-1, Pet Washer:
1. Free standing, walk-in, stainless steel.
  2. Wall/Deck mount faucet with garden hose thread.
  3. High flow hand sprayer with coiled hose.
  4. Side access solids interceptor. STRIEM SIDEKICK or equal.
- J. S-1, Stainless Steel Sink:
1. Type 302 or 304, 18 gauge, self-rimming stainless steel sink, fully undercoated, drawn bowl with satin finish. Elkay numbers are listed; or approved substitute. Install with stainless steel crumb cup strainer outlet, flange tail piece, and 1-1/2" trap; Elkay, Keeney, or approved. For faucets, Chicago and T&S numbers are listed; equal Zurn, Delta Commercial approved
  2. Single Compartment 19" x 19" x 6.5": Install with Chicago 1201 or T & S B-2955 Delta 100-WFELHHDF faucet with 2.5 gpm aerator. Elkay LRAD191955.



- K. DW-1, Automatic Dishwasher: Front opening, under counter, free standing, fully automatic dishwasher with top and side panels. Hobart UMP-4-D.
- L. CW-1, Recessed Clothes Washer Fitting: Hot and cold water valve washing machine waste outlet with quarter turn ball valves and water hammer arresters. Sioux Chief Ox Box. Fire rated where required. Provide with indirect waste funnel where used for condensate disposal.
- M. IM-1, Recessed Single Water (Ice Maker) Fitting: Cold water connection with water hammer arrester and quarter turn ball valve. Sioux Chief Ox Box. Fire rated where required.
- N. RC-1, Recessed Single Water (Refrigerator) Fitting: Cold water connection with water hammer arrester and quarter turn ball valve. Sioux Chief Ox Box. Fire rated where required
- O. SH-1, Single Stall Shower:
1. Install with concealed piping and 2.5 gpm head. Pressure equalizing mixing valve with combination strainer/check stops and temperature limit stop. Delta, Moen, Symmons approved. Powers, Leonard, Lawler, Symmons approved.
  2. Low threshold, shower pan. Durable acrylic, with tile flange. Provide grid strainer outlet. . Bestbath P6036.V2 or equal. See architectural for shower stall details
- P. SH-2 ADA, Single Stall Shower:
1. Install with concealed piping and 2.5 gpm head. handheld shower head with flex hose, vacuum breaker, and wall slide bar for ADA. Pressure equalizing mixing valve with combination strainer/check stops and temperature limit stop. Delta, Moen, Symmons approved. Powers, Leonard, Lawler, Symmons approved.
  2. Low threshold, shower pan. Durable acrylic, with tile flange. Provide grid strainer outlet and grab bar. Bestbath P6036B75B or equal. See architectural for shower stall details.
    - a. SV16 (SV16-LVR, with lever handle) – Temperature/Pressure balancing mixing valve for individual showers. Flows down to 1-1/4 gpm.
    - b. Sv16 Shower valve shall meet performance requirements of ASSE 1016-2011, Type T/P, compensating for  $\pm 50\%$  fluctuation in supply line pressure and compensate for increases in hot water supply temperature. Valve shall operate with a non-rising stem and have ceramic shutoffs for long term drip-free reliability. Cartridge shall be self-contained, designed for easy maintenance and repair. Valve shall be a cast brass body with a capacity of 4 gpm (15 lpm) at 45 psi (310 kpa) differential. Valve shall include a field adjustable limit stop, factory set at 110° F (43° C) and capable of supplying mixed water temperature within 5° F (2.8° C) of hot water supply temperature. Valve shall always open through cold water to maximize the

safety of the bather. Valve shall be Acorn model SV16.

- Q. TD-1, Trench drain: Stainless steel, linear shower drain. Sioux Chief 823 Series. Coordinate strainer pattern with Architect.
- R. TD-2, Trough drain: Stainless steel, linear floor trough with grate. 12" x 24", 14 ga stainless steel. 3" drain.
- S. Hose Bibs:
  - 1. HB-1, Outside: Non-freeze type with vacuum breaker, bronze wall casing and wall clamp. Zurn Z-1310-6, Wade W-8620, Woodford 67 Series, Smith 5609-PB, or Watts HY420.
  - 2. HB-2, Indoor Wall Hydrant: 3/4" inlet, vacuum breaker, brass construction. Woodford 24 Series.
- T. Fixtures Furnished by Owner (and/or Under Another Section): Some fixtures will be furnished by the Owner (and/or under another specification section). Include under this section the required rough-ins, 3/8" chrome plated supplies with stops, 1-1/2" chrome plated cast brass "P" trap (or, on kitchen sinks, 2" cast iron "P" traps) for each sink compartment, and make final connection. Verify all rough-ins and connection requirements before commencing work.

### PART 3 - EXECUTION

#### 3.1 PIPING

- A. Install in accordance with Section 22 1000.
- B. Install secondary pipe supports at rough-ins for all plumbing fixtures.

#### 3.2 FIXTURE INSTALLATION AND CONNECTION

- A. All exposed fixture hardware and piping shall be plated with polished chrome unless otherwise directed in these specifications.
- B. All fixtures in contact with finished walls and floors shall be caulked with waterproof, white, non-hardening sealant which will not crack, shrink or change color with age.
- C. All fixtures and component parts shall conform to governing codes.
- D. All fixtures shall be securely mounted level and plumb or as recommended by the manufacturer. Mount fixtures intended to be accessible to the handicapped at the dimensions required by code.

#### 3.3 STARTUP

- A. Adjust flush valves, pressure reducing valves, mixing valves, water heater thermostats, hot water circulating system balancing valves, and similar equipment.
- B. Remove construction protection, tags and labels and thoroughly clean all plumbing equipment and trim. Scour all fixtures just prior to building acceptance.

END OF SECTION