SECTION 22 05 00
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. Service and distribution piping including valves, supports, insulation, etc.
2. Complete plumbing systems, including fixtures, trim, equipment, etc.
3. Rough-in for all existing fixtures including stops. Final connection from the stops to the fixtures will be completed by the Owner.
4. Rough-in and final connection of plumbing equipment and fixtures included in 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 (EPAct)
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. 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 for review.
5. Submit as part of the required Project Closeout documents. Final submittal will be in the form of reproducible drawings.

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, 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.

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. 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 .

D. 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 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. Screwdriver latches on all access panels.

2.3 METERS AND GAUGES

A. General: Install meters and gauges where shown on the plans or specified elsewhere in these specifications.

B. 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.

C. 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.

2.4 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-585-70.
      b. Check: Bronze body, swing check, 200 psi WOG, T/S-413B (bronze disc) or T/S-413Y (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.
      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. Butterfly Valve Operators: Locking lever for shut-off service; "Memory Stop" for lever handle with 10 position throttling plate for throttling service; gear operator with babbitt sprocket rim for chain-operated valves and gear operators on all 8" or larger valves.

E. Butterfly Valve Style: Lug-type with cap screws for all valves utilized for equipment isolation for servicing. Lug and grooved style valves shall be capable for use as isolation valves and recommended by manufacturer for dead-end service at full system pressure.

F. Insulated Valves: Install extended-stem valves in all piping specified as insulated, and arrange in the proper manner to receive insulation.

G. Selection of Valve Ends (Pipe Connections): Select and install valves with ends matching the types of pipe/tube connections.

2.5 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. 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.

2.6 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.

2.7 PENETRATION FIRE STOPPING

A. Through-penetration fire stopping system tested and listed by Underwriters Laboratories. 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. 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.

D. 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 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 seven days 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.

3.3 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.

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

3.5 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.

C. 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. 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.

3.6 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.

3.7 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:

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

3. 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).
4. Install additional hangers or supports at concentrated loads such as pumps, valves, etc. to maintain alignment and prevent sagging.
5. Support Rod: Hanger support rods sized as follows:

Pipe and Tube Size		Rod Size	
Inches	mm	Inches	mm
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 (OSHPD). Acceptable Manufacturers: Amber/Booth, Mason Industries, Tolco, or approved.

3.8 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 and, where possible, extend the existing identification system. 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."

3.9 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.

3.10 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.

3.11 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.

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 Owner's Representative 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 Owner's Representative.

3.12 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.

3.13 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. Adjust and correct operations as required for proper performance.

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.

END OF SECTION 22 05 00

SECTION 22 07 00
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 05 00, Common Plumbing Materials and Methods, also apply to this section.

1.2 QUALITY ASSURANCE

A. Minimum Insulation Thickness and Thermal Performance: Comply with the State of Oregon Energy Efficiency Code except where more stringent requirements are specified herein.

B. 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.

C. 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 05 00, 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, Armstrong, Pabco, Imcoa or Nomaco. Johns Manville products are listed unless indicated otherwise.

B. Adhesive Manufacturers: Foster, 3M, Insul-Coustic, Borden, Kingco or Armstrong.

2.2 PIPING INSULATION

A. 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.

B. 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 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.
2. Protection Shields: MSS Type 40.
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.

PART 3 EXECUTION

3.1 PIPING INSULATION

A. General: Do not insulate underground piping.

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. Domestic Water Piping:
1. Insulate 1” and larger cold water piping with 1/2” thick glass fiber pipe covering.

2. Insulate hot water piping with glass fiber pipe covering, 1” thick for 1" and smaller hot water piping; 1-1/2" for 1-1/4" and larger hot water 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 1” thickness of glass fiber pipe covering with weather-proof metal jacket. Apply insulation after heat cable is installed.

D. Pipe Fittings: 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.

END OF SECTION 22 07 00

SECTION 22 10 00
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 05 00, 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.

B. Plastic Pipe:
1. Application:
   a. Domestic water, systems operating at less than 80 psi and 140 degrees F., 1" and smaller sizes.
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:
   a. Plumbing vent aboveground.
2. Pipe:
   a. Acrylonitrile-butadiene-styrene (ABS) (ASTM D3965) plastic drain, waste and vent piping (ASTM F628) and fittings (ASTM D2661) (DWV).
   b. Poly(vinyl chloride) (ASTM D1784) (PVC) 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 and vent
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. Light 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. Four bands on 1-1/2" thru 4" pipe and 6 bands on 5" thru 10" pipe.
5. Manufacturers: Cast iron pipe and fittings – AB&I, Charlotte Pipe, Tyler Pipe, or approved. All pipe shall be labeled by the manufacturer.

2.2 MISCELLANEOUS PIPING MATERIALS

A. 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.

2.3 PIPING SPECIALTIES

A. Cleanouts:
   1. Manufacturer: J.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.

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, adjustable top, and other options as indicated by model number listed on the drawings.

C. Shock Arrester: Precharged bellows or sealed piston type manufactured to meet PDI WH-201 and ASSE 1010 Standards. Size in accordance with PDI procedures. J. R. Smith, PPP, Sioux Chief, Wade, Zurn, Watts, Josam, or approved substitute.

D. 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 05 00. Use copper specified previously for all underground priming lines.

E. Traps: Except chrome plated fixture traps. Recessed drainage pattern for threaded pipe and same grade as pipe for cast iron and plastic pipe; with cleanout plugs in trap body in all above grade locations.

F. Backflow Preventer: Where indicated on the Drawings, install a double check backflow preventer complete with shutoff valves, two separate check valves, and test cocks. USC Foundation for Cross Connection Control, State Health Officials, and serving utility approved. Bronze bodies on units 2" and smaller, and cast iron bodies with bronze trim on units 2-1/2" and larger.

G. Master Mixing Valve: All brass or bronze body with stainless steel parts, thermostatic wax-filled master control element to fail safe upon cold water or control element failure meeting ASSE 1017. Provide with external union angle check stops, strainers, volume control, shutoff valves, dial thermometer. Valve location, arrangement and capacity as shown on plans. Leonard, Lawler, Powers, Acorn, Bradley, Symmons, or approved substitute. See section 3 for factory start-up procedures.

H. 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.

2.4 PUMPS

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

2.5 BACKFILL MATERIALS

A. Subbase Materials: A graded mixture of gravel, sand, crushed stone or crushed slag.

B. Finely-Graded Subbase Material: Well graded sand, gravel, crushed stone or crushed slag, with 100% passing a 3/8" sieve.

C. Backfill Material: Soil material suitable for compacting to the required densities, and complying with AASHTO designation M145, Group A-1, A-2-4, A-2-5. or A-3.

PART 3 EXECUTION

3.1 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.

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.

3.2 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. Light Duty Couplings: All vent piping and all drainage and waste piping above grade.
2. Heavy Duty Couplings: All underground installations.

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.

3.3 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.

3.4 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. 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.

D. Trap Priming: Traps serving floor drains, floor sinks, catch basins, and similar fixtures shall be primed in accordance with Code requirements.

E. Domestic Hot Water Mixing Valves: Install in accordance with manufacturers installation instructions and piping diagrams.

3.5 EXCAVATING

A. General: Do not excavate for mechanical work until the work is ready to proceed without delay, to minimize the total time lapse from excavation to completion of backfilling. Comply with all applicable Federal and state safety regulations and local erosion control requirements.

B. Width: Excavate for piping with 6" to 9" clearance on both sides of pipe, except where otherwise shown or required for proper installation of pipe joints, fittings, valves and other work. Excavate for other work to provide minimum practical but adequate working clearances.

C. Depth for Direct Support: For work to be supported directly on undisturbed soil, do not excavate beyond indicated depths, and hand-excavate the bottom cut to accurate elevations. Support the following work on undisturbed soil at the bottom of the excavations:
1. Piping of 5" and less pipe/tube size.
2. Cast-in-place concrete.

D. Depth for Subbase Support: For large piping (6" pipe size and larger), tanks and where indicated for other mechanical work, excavate for installation of subbase material in the depth indicated, or, if not otherwise indicated, 6" below bottom of work to be supported.

3.6 BACKFILLING

A. Do not backfill until installed mechanical work has been tested and accepted wherever testing is indicated. Backfill with finely-graded subbase material to 6" above wrapped, coated and plastic. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to the required densities.

3.7 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.

3.8 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 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.

3.9 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. 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.

END OF SECTION 22 10 00

SECTION 22 40 00
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 05 00, 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 10 00.

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. J. 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 70 to psi to 20 psi. Leslie, Watts, Cash-Acme, Zurn-Wilkins, or approved substitute.

C. 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. Loose key quarter turn style, in wall, angle or straight through pattern to fit installation. Stops to be all brass with 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 where exposed. 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. 1.6 Gallon Flush Water Closet, 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.
      b. Electronic Flush Valve: Quiet acting, exposed chrome plated brass with line voltage powered recessed motion sensor and operating solenoid, manual flush pushbutton, screwdriver check/control stop with vandal resistant cap, cast wall flange, synthetic rubber diaphragm, and vacuum breaker, as recommended by closet manufacturer. Sloan
      c. Seat: Solid black 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. Floor Mounted, Top Spud: Kohler Wellcomme K-96053.
   3. Floor Mounted, Top Spud 18" High ADA: Kohler Highcliff K-96057.
   4. Wall Hung, Top Spud: Kohler Kingston K-4325-0.

E. Urinal, Flush Valve, Vitreous China, "UR-1":
   1. Install each listed urinal with the following: Quiet acting, exposed chrome plated brass with line voltage powered recessed motion sensor and operating solenoid, manual flush pushbutton, screwdriver check/control stop with vandal resistant cap, cast wall flange, synthetic rubber diaphragm, and vacuum breaker, as recommended by closet manufacturer. Sloan.
   2. Wall Hung, High Efficiency, Siphon jet, top spud: Install with plate-type chair carrier with bearing plate. Zurn, Jay R. Smith, Josam, Wade, Watts. Kohler Dexter K-5016.

F. Lavatory, Vitreous China, "LV-1":
   1. Faucet: Chrome plated brass body with handle for the handicapped, vandal resistant 0.5 gpm aerator, temperature limit stop, with grid strainer waste. Chicago 3400-ABCP.

3. Wall Hung, 20" x 18" Size "LV-": Provide with concealed arm hangers and wall backing plate (J.R. Smith, Josam, Wade, Watts, or Zurn). Kohler K-2005.

G. Service Faucet: 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.

I. Hose Bibs: Outside: Non-freeze type with vacuum breaker, bronze wall casing and wall clamp. Smith 5609-QT.

PART 3 EXECUTION

3.1 PIPING

A. Install in accordance with Section 22 10 00.

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 22 40 00