

**SECTION 22 00 00
PLUMBING BASIC REQUIREMENTS**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Work included in 22 00 00, Plumbing Basic Requirements applies to Division 22, Plumbing work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of plumbing systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
 - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
 - 5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.02 RELATED SECTIONS

- A. Contents of Section applies to Division 22, Plumbing Contract Documents.
- B. Related Work:
 - 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
 - b. Drawings
 - c. Addenda
 - d. Owner/Architect Agreement
 - e. Owner/Contractor Agreement
 - f. Codes, Standards, Public Ordinances and Permits

1.03 REFERENCES AND STANDARDS

- A. References and Standards per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, individual Division 22, Plumbing Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 - 1. State of Oregon:
 - a. OAR - Oregon Administrative Rules
 - b. OESC - Oregon Electrical Specialty Code

- c. OFC - Oregon Fire Code
 - d. OMSC - Oregon Mechanical Specialty Code
 - e. OPSC - Oregon Plumbing Specialty Code
 - f. OSSC - Oregon Structural Specialty Code
 - g. OEESC - Oregon Energy Efficiency Specialty Code
 - h. Oregon Elevator Specialty Code
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
- 1. ABA - Architectural Barriers Act
 - 2. ADA - Americans with Disabilities Act
 - 3. AHRI - Air-Conditioning Heating & Refrigeration Institute
 - 4. ANSI - American National Standards Institute
 - 5. ASCE - American Society of Civil Engineers
 - 6. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
 - 7. ASHRAE Guideline 0, the Commissioning Process
 - 8. ASME - American Society of Mechanical Engineers
 - 9. ASPE - American Society of Plumbing Engineers
 - 10. ASSE - American Society of Sanitary Engineering
 - 11. ASTM - ASTM International
 - 12. AWWA - American Water Works Association
 - 13. CFR - Code of Federal Regulations
 - 14. CGA - Compressed Gas Association
 - 15. CISPI - Cast Iron Soil Pipe Institute
 - 16. ETL - Electrical Testing Laboratories
 - 17. EPA - Environmental Protection Agency
 - 18. FM - FM Global
 - 19. IAPMO - International Association of Plumbing and Mechanical Officials
 - 20. GAMA - Gas Appliance Manufacturers Association
 - 21. HI - Hydraulic Institute Standards
 - 22. ISO - International Organization for Standardization
 - 23. MSS - Manufacturers Standardization Society
 - 24. NEC - National Electric Code
 - 25. NEMA - National Electrical Manufacturers Association
 - 26. NFGC - National Fuel Gas Code
 - 27. NFPA - National Fire Protection Association
 - 28. NRCA - National Roofing Contractors Association
 - 29. NSF - National Sanitation Foundation
 - 30. OSHA - Occupational Safety and Health Administration
 - 31. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
 - 32. TEMA - Tubular Exchanger Manufacturers Association
 - 33. TIMA - Thermal Insulation Manufacturers Association
 - 34. UL - Underwriters Laboratories Inc.
- D. See Division 22, Plumbing individual Sections for additional references.

1.04 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 22, Plumbing Sections.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
 - 1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
 - 2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail or posted to ftp site. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. For paper format, provide one common binder per specification division, with tabbed dividers for each specification section. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Deviations will be returned without review.
 - 3. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 22, Plumbing Sections.
 - 4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
 - a. Label submittal to match numbering/references as shown in Contract Documents and schedules. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
 - b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference Division 22, Plumbing Sections for specific items required in product data submittal outside of these requirements.
 - c. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.
 - d. For vibration isolation of equipment, list make and model selected with operating load and deflection. Indicate frame type where required. Submit manufacturer's product data.
 - e. See Division 22, Plumbing Sections for additional submittal requirements outside of these requirements.
 - 5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.

6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.
7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 22, Plumbing Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
10. Substitutions and Variation from Basis of Design:
 - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
 - b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
11. Shop Drawings: Provide coordinated Shop Drawings which include physical characteristics of all systems, equipment and piping layout plans, and control wiring diagrams. Reference individual Division 22, Plumbing Sections for additional requirements for Shop Drawings outside of these requirements.
 - a. Provide Shop Drawings indicating sanitary and storm cleanout locations and type to Architect for approval prior to installation.
 - b. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
12. Samples: Provide samples when requested by individual Sections.
13. Resubmission Requirements:
 - a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.

- 1) Resubmit for review until review indicates no exception taken or "make corrections as noted".
 - 2) When submitting drawings for Engineers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.
14. Operation and Maintenance Manuals, Owner's Instructions:
- a. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
 - 1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
 - 2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
 - 3) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
 - 4) Include copy of startup and test reports specific to each piece of equipment.
 - 5) Include copy of final water systems balancing log along with pump operating data.
 - 6) Include commissioning reports.
 - 7) Include copy of pressure, flow, leakage and purity test data and water systems test data, as applicable. Include copy of third-party and state and local jurisdiction inspection reports.
 - 8) Include copy of valve charts/schedules.
 - 9) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
 - 10) Include product certificates of warranties and guarantees.
 - 11) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
 - b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 22 00 00, Plumbing Basic Requirements article titled "Demonstration".
 - c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special

guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15. Record Drawings:
 - a. Maintain at site at least one set of drawings for recording "As-constructed" conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
 - b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
 - c. At completion of project, input changes to original project on Revit Model and make one set of black-line drawings created from Revit Model in version/release equal to contract drawings. Submit Revit disk and drawings upon substantial completion.
 - d. At completion of project, show changes and deviations from the Drawings in red on one set of black-line drawings. Include written Addendums, RFIs, and change order items. Make changes to Drawings in a neat, clean, and legible manner.
 - e. Provide Invert elevations and dimensioned locations for water services, building waste, and storm drainage piping below grade extending to 5-feet outside building line.
 - f. See Division 22, Plumbing individual Sections for additional items to include in record drawings.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturers equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- F. Provide products that are UL listed.
- G. Piping Insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.
- H. All potable water system components, devices, material, or equipment containing a weighted average of greater than 0.25 percent lead are prohibited, and shall be certified

in accordance with current editions of the Safe Drinking Water Act (SDWA), NSF 61 & NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61.

- I. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.
- J. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

1.06 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty in Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.07 COORDINATION DOCUMENTS

- A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, cable trays, lights, and electrical services with architectural and structural requirements, and other trades (including ceiling suspension, and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
- B. Advise Architect in the event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
- C. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
- D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

1.08 WORK INCLUDED

- A. Furnish and install sleeves, inserts and anchorage required for the installation, which are embedded in work of other trades. Sleeve, wrap and seal piping in concrete.
- B. Electrical: For plumbing trim/devices/equipment, provide, from the line voltage connection by Division 26, the low voltage electrical connections and wiring as required for complete and operable system. Includes, but is not limited to: Low voltage electrical raceway, wiring and accessories, such as step-down transformers as necessary for function of sensors and automatic valve and faucet controls. Supply step-down transformers and size wiring as recommended by manufacturer of plumbing trim/faucets requiring electrical low voltage connection.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to fixtures, pumps, drains and equipment.

2.02 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed

catalog data and are to be UL approved or have adequate approval or be acceptable by State, County, and City authorities.

- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:
 - 1. Comply with local, State of Oregon, and Federal regulations relating to hazardous materials.
 - 2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
 - 3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

2.03 ACCESS PANELS

- A. See Division 01, General Requirements and Division 08, Openings for products and installation requirements.
- B. Confirm Access Panel requirements in Division 01, General Requirements, Division 08, Openings and individual Division 22, Plumbing Sections. In the absence of specific requirements, comply with the following:
 - 1. Provide flush mounting access panels for service of systems and individual components requiring maintenance or inspection. Where access panels are located in fire-rated assemblies of building, rate access panels accordingly.
 - a. Ceiling access panels to be minimum 24-inch by 24-inch required and approved size.
 - b. Wall access panels to be minimum of 12-inch by 12-inch required and approved size.
 - c. Provide screwdriver operated catch.
 - d. Manufacturers and Models:
 - 1) Drywall: Karp KDW.
 - 2) Plaster: Karp DSC-214PL.
 - 3) Masonry: Karp DSC-214M.
 - 4) 2 hour rated: Karp KPF-350FR.
 - 5) Milcor, Elmdor, Acudor, or approved equivalent.

PART 3 - EXECUTION

3.01 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Install equipment requiring access (i.e., drain pans, drains, control operators, valves, motors, cleanouts and water heaters) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect and Engineer prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

D. Earthwork:

1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
 - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with the provisions of related earthwork Sections/divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
 - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
 - a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:

1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.
2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums:

1. Provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

3.02 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 22 Plumbing Sections.

B. General:

1. Earthquake resistant designs for Plumbing (Division 22) equipment and distribution, i.e. motors, plumbing systems, piping, equipment, water heaters, boilers, etc. to conform to regulations of jurisdiction having authority.
2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to

withstand a force in direction equal to value defined by jurisdiction having authority.

3. Provide stamped Shop Drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for piping equipment and water heaters. Submit Shop Drawings along with equipment submittals.
4. Provide stamped Shop Drawings from licensed Structural Engineer of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details.

C. Piping:

1. Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA or local requirements.

D. Provide means to prohibit excessive motion of plumbing equipment during earthquake.

3.03 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Notify Architect or Engineer, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground piping installation prior to backfilling.
2. Prior to covering walls.
3. Prior to ceiling cover/installation.
4. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Bear responsibility and cost to make piping accessible, to expose concealed lines, or to demonstrate acceptability of the system. If Contractor fails to notify Architect at times prescribed above, costs incurred by removal of such work are the responsibility of the Contractor.

D. Final Punch:

1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Plumbing Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the plumbing systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.04 CONTINUITY OF SERVICE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new piping, and wiring to point of connection.
3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
 - a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
4. Organize work to minimize duration of power interruption.

3.05 CUTTING AND PATCHING

- A. Confirm Cutting and Patching requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
 2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
 3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
 4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing piping and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
 5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.06 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.07 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.
 2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
 3. Protect bright finished shafts, bearing housings and similar items until in service.

3.08 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division

01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.09 CLEANING

- A. Confirm cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

- A. Confirm installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
 - 1. Do not place equipment in sustained operation prior to initial balancing of plumbing systems.
 - 2. Provide pump impellers to obtain Basis of Design design capacities.
- D. Provide miscellaneous supports/metals required for installation of equipment and piping.

3.11 PAINTING

- A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
 - 1. Ferrous Metal: After completion of plumbing work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt for exterior or black enamel for interior, suitable for hot surfaces.
 - 2. In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
 - 3. See individual equipment Specifications for other painting.
 - 4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
 - 5. Piping: Clean, primer coat and paint exposed piping on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.
 - 6. Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

3.12 ACCESS PANELS

- A. Confirm Access Panel requirements in Division 01, General Requirements. In absence of specific requirements in Division 01, General Requirements, comply with individual Division 22, Plumbing Sections and the following:

1. Coordinate locations/sizes of access panels with Architect prior to work. Label access panels with engraved nameplates indicating function of panel.

3.13 DEMOLITION

- A. Confirm Demolition requirements in Division 01, General Requirements and Division 02, Existing Conditions. In absence of specific requirements, comply with individual Sections in Division 22, Plumbing and the following:
 1. Scope:
 - a. It is the intent of these documents to provide necessary information and adjustments to plumbing system required to meet code, and accommodate installation of new work.
 - b. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access or access to different areas.
 - c. Existing Conditions: Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to exactly locate and preserve underground utilities. Replace damaged items with new material to match existing. Promptly notify Owner if utilities are found which are not shown on Drawings.
 2. Equipment: Unless otherwise directed, equipment, fixtures, or fittings being removed as part of demolition process are Owner's property. Remove other items not scheduled to be reused or relocated from job site as directed by Owner.
 3. Unless specifically indicated on Drawings, remove exposed, unused piping to behind finished surfaces (floor, walls, ceilings, etc.). Cap piping and patch surfaces to match surrounding finish.
 4. Unless specifically indicated on Drawings, remove unused equipment, fixtures, fittings, rough-ins, and connectors. Removal is to be to a point behind finished surfaces (floors, walls, and ceilings).

3.14 ACCEPTANCE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Sections in Division 22, Plumbing and the following:
 1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 - a. Testing and Balancing Reports
 - b. Cleaning
 - c. Operation and Maintenance Manuals
 - d. Training of Operating Personnel
 - e. Record Drawings
 - f. Warranty and Guaranty Certificates
 - g. Start-up/Test Document and Commissioning Reports

3.15 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Tests:

1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.16 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that plumbing items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.17 ELECTRICAL INTERLOCKS

- A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize plumbing equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

END OF SECTION

**SECTION 22 05 19
PLUMBING DEVICES**

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Water Hammer Arrestors (Shock Absorbers)

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements apply to this Section.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Water Hammer Arrestors (Shock Absorbers):
 - 1. Bellows Type:
 - a. Amtrol
 - b. J.R. Smith
 - c. Wade
 - d. Zurn
 - 2. Piston Type:
 - a. PPP
 - b. Sioux Chief

2.02 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

- A. Bellows-type, stainless steel casing and bellows, pressure rated, tested and certified in accordance with PDI WH-201 or ASSE 1010.
- B. Piston-type, copper, brass or stainless steel with O-ring piston, pressure rated, tested and certified in accordance with PDI WH-201 or ASSE 1010.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. For plumbing devices requiring access from access panels (i.e. trap primers, water hammer arrestors and the like) submit location/size of all access panels to Architect for approval prior to purchase and installation of access panel. See Section 22 00 00, Plumbing Basic Requirements for additional requirements.
- B. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- C. Install per manufacturer recommendations.

3.02 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

- A. Install in upright position, in locations and of sizes in accordance with PDI WH-201 or ASSE 1010, and elsewhere as indicated.
- B. Locate shock absorbers in supply pipe in accordance with recommendations of Plumbing and Drainage Institute PDI-WH201 or ASSE 1010. Install ahead of solenoid operated valves. Determine size of absorber by fixture unit value of fixture supplied, using PDI symbols to designate sizes. Provide access panel for each shock absorber.
- C. Install per manufacturer recommendations.

END OF SECTION

**SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING**

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Valves, General
 - 2. Ball Valves
 - 3. Thermostatic Point-of-Use Mixing Valves (ASSE 1070 Rated)

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. NSF 61, Annex G and/or NSF/ANSI 372 for potable water services. Valves must be 3rd-party certified.
 - 2. ISO 9001 Certified.
 - 3. IAPMO Certified for Low Lead.
- C. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.
- D. Model numbers indicated as Basis-of-Design indicate valve characteristics. All valves are to meet code Low Lead/Lead Free Standards.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.
- B. Valves, General:
 - 1. Apollo
 - 2. Armstrong
 - 3. ASCO
 - 4. Cla-Val
 - 5. Conbraco
 - 6. Crane
 - 7. Clow
 - 8. Griswold
 - 9. Hammond
 - 10. Hays

11. Jenkins
 12. Josam
 13. Kennedy
 14. Milwaukee
 15. Mueller
 16. Nibco
 17. Red-White Valve
 18. Smith
 19. Wade
 20. Watts
 21. Wilkins
 22. Zurn
 23. Or approved equivalent.
- C. Ball Valves:
1. See Valves General above.
 2. NSF Valves:
 - a. Clow
 - b. Kennedy
 - c. Nibco
 - d. Or approved equivalent.
- D. Thermostatic Point-of-Use Mixing Valves (ASSE 1070 Rated):
1. Lawler
 2. Leonard
 3. Powers Hydroguard
 4. Or approved equivalent.

2.02 VALVES - GENERAL

- A. General:
1. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.
 2. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves 6-inches and smaller. Provide gear operators for quarter-turn valves 8-inches and larger and plug valves installed over 5-feet above finished floor.
 3. Valve Identification: Manufacturer's name (or trademark) and pressure rating clearly marked on valve body.
- B. Valves in Insulated Piping: With 2-inch stem extension and following features:
1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation on valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.
- C. Valve-End Connections:
1. Flanged: With flanges according to ASME B16.1 for iron valves.
 2. Solder Joint: With sockets according to ASME B16.18.
 3. Threaded: With thread according to ASME B1.20.1.
- D. Valve Bypass and Drain Connections: MSS SP-45.
- E. Building Service:

1. Shutoff and Isolation Valves:
 - a. Pipe Sizes 3-inches and Smaller: Ball Valve.
2. Drain Service: Ball Valves.
3. Strainer Blow-Off: Ball Valve.

2.03 BALL VALVES

- A. All ball valves on brazed piping are to be three-piece.
- B. 2-1/2 Inches and Smaller: MSS SP-110, 400-600 PSI, two-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 77CLF 100 Series two-piece.
- C. 3 Inches and Larger: MSS SP-110, 400-600 PSI, three-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 82-100/82A 140 Series three-piece.
- D. Full Port Ball Valve: 2- to 4-inch ductile iron, ASTM A536, micro finish steel chrome plated or stainless steel ball and stem. TFE seats, 600 PSI.

2.04 THERMOSTATIC POINT-OF-USE MIXING VALVES (ASSE 1070 RATED)

- A. Thermostatic type with bronze body construction, corrosion resistant materials, union end stops, check inlets with strainers, 0-200 degree F dial thermometer and discharge shut-off valve. Mixing valves to meet ASSE 1070.
- B. Maximum required delta temperature differential between hot water supply temperature and delivery temperature is 15 degrees F. Set valve outlet temperature per drawing requirements.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Prepare valves for shipping as follows:
 1. Protect internal parts against rust and corrosion.
 2. Protect threads, flange faces, grooves, and weld ends.
 3. Set ball valves open to minimize exposure of functional surfaces.
 4. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Inspect the shipping container before unpacking to look for damage that could have occurred during transport, and report it to the transportation company immediately. After visual inspection, remove the valve from the shipping container. Make sure the faces are free of any scratches and that there is not any obvious damage to the actuator assembly or valve body.
- D. Make sure to note the valve's model number during the unpacking process. The model number will need to be provided when purchasing replacement parts.
- E. Purge and clean all piping to be connected to valve.
- F. Install per manufacturer's recommendations.
- G. Determine that the valve and its plumbing piping is adequately supported when installed. If a valve is not adequately supported, this could prevent the valve from operating and sealing correctly. Be sure that all mating flanges are in line and parallel to minimize straining on joints and valve body.

- H. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- I. Do not attempt to repair defective valves; replace with new valves.
- J. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
- K. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose end adapter and cap on chain for each valve that must be installed with stem below horizontal plane. Ensure installation provides full stem movement.
- L. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.
- M. Mechanical Actuators: Install with chain operators where indicated. Extend chains to 5-feet above floor and hook to clips to clear aisle passage.
- N. Stem Selection: Outside screw and yoke stems, except provide inside screw, non-rising stem where space prevents full opening of OS&Y valves.
- O. Seats: Renewable seats, except where otherwise indicated.
- P. When soldering, use paste flux that are approved by the manufacturer for use with lead free alloys.
- Q. If valve applications are not indicated on Drawings, use the following:
 - 1. Shutoff Service: Ball valves.
- R. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- S. Valves, except wafer/butterfly types, with the following end connections:
 - 1. For Copper Tubing, 2-inches and Smaller. Threaded ends except where solder-joint valve-end.
 - 2. For Copper Tubing, 2-1/2-inches to NPS 4-inches. Flanged ends except where threaded valve-end.
 - 3. For Copper Tubing, 5-inches and Larger: Flanged ends.
 - 4. For Steel Piping, 2-inches and Smaller: Threaded ends.
 - 5. For Steel Piping, 2-1/2-inches to NPS 4-inches: Flanged ends except where threaded valve-end.
 - 6. For Steel Piping, 5-inches and Larger: Flanged ends.
- T. Valve Adjusting and Cleaning:
 - 1. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.
 - 2. Valve Identification. Tag valves per Section 22 05 53, Identification for Plumbing Piping and Equipment.

3.02 BALL VALVES

- A. See General Installation Requirements above.

3.03 THERMOSTATIC POINT-OF-USE MIXING VALVES (ASSE 1070 RATED)

- A. See General Installation Requirements above.
- B. Install mixing valve per manufacturer's instruction manual.

END OF SECTION

**SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Pipe Hangers and Supports for Plumbing Piping and Equipment
 - 2. Wall and Floor Sleeves
 - 3. Building Attachments
 - 4. Miscellaneous Metal and Materials

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. ASCE 7-10, Minimum Design Loads for Buildings and Other Structures.
 - 2. Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.
 - 3. Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".
 - 4. Install piping per SMACNA's requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.07 PERFORMANCE REQUIREMENTS

- A. General - Provide pipe and equipment hangers and supports in accordance with the following:
 - 1. When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for piping are not shown on the Drawings, the contractor is responsible for their design.
 - 2. Connections to structural framing are not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Engineered Support Systems:
 - 1. Support frames such as pipe racks or stanchions for piping and equipment which provide support from below.
 - 2. Equipment and piping support frame anchorage to supporting slab or structure.
- C. Provide channel support systems, for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.
- D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.
- E. Provide seismic restraint hangers and supports for piping and equipment.

- F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Pipe Hangers and Supports for Plumbing Piping and Equipment:
1. Pipe Hangers/Supports:
 - a. B-Line Systems, Inc.
 - b. Anvil International
 - c. HOLDRITE
 - d. Erico Co., Inc.
 - e. Snappitz Thermal Pipe Shield Manufacturing
 - f. Rilco Manufacturing Co. Inc.
 - g. Nelson-Olson Inc.
 - h. Or approved equivalent.
 2. Channel Support Systems:
 - a. B-Line Systems, Inc.
 - b. Anvil International, Anvit-Strut
 - c. Erico Hanger Co., Inc.; O-Strut Div.
 - d. Unistrut Corp.
 - e. HOLDRITE EZ-Strut Systems
 - f. Or approved equivalent.
 3. Thermal-Hanger Shield Inserts:
 - a. Erico Hanger Co., Inc.
 - b. Pipe Shields, Inc.
 - c. Rilco Manufacturing Co., Inc.
 - d. HOLDRITE Insulation Couplings
 - e. Or approved equivalent.
 4. Freestanding Roof Supports:
 - a. Erico Hanger Co., Inc.
 - b. Nelson-Olsen Inc.
 - c. B-Line
 - d. M. Fab
 - e. Or approved equivalent.
 5. Pipe Alignment and Secondary Supports:
 - a. HOLDRITE
 - b. Starquick
 - c. Or approved equivalent.
- B. Wall and Floor Sleeves:
1. Below Grade and High Water Table Areas:
 - a. Modular Link Sealing System at Pipe Sleeves:
 - 1) Thunderline Corporation
 - 2) Or approved equivalent.
 2. Pre-Engineered Firestop Pipe Penetration Systems:
 - a. HOLDRITE HydroFlame
 - b. Proset

- c. Or approved equivalent.
- C. Building Attachments:
 - 1. Anchor-It
 - 2. Gunnebo Fastening Corp.
 - 3. ITW Ramset/Red Head
 - 4. Masterset Fastening Systems, Inc.
 - 5. Or approved equivalent.
- D. Miscellaneous Metal and Materials:
 - 1. See Miscellaneous Metal and Materials article below.
 - 2. Powder-Actuated Fastener Systems:
 - a. Gunnebo Fastening Corp.
 - b. Hilti, Inc.
 - c. ITW Ramset/Red Head.
 - d. Masterset Fastening Systems, Inc.
 - e. Or approved equivalent.

2.02 PIPE HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- A. Horizontal Piping Hangers and Supports - Horizontal and Vertical Piping, and Hanger Rod Attachments:
 - 1. Factory fabricated horizontal piping hangers and supports to suit piping systems in accordance manufacturer's published product information.
 - 2. Use only one type by one manufacturer for each piping service.
 - 3. Select size of hangers and supports to exactly fit pipe size for bare piping and to exactly fit around piping insulation with saddle or shield for insulated piping.
 - 4. Provide copper-plated hangers and supports for uninsulated copper piping systems.
 - 5. Provide padded pipe hangers, clamps and supports for thermoplastic piping system.
 - 6. Install no hub cast iron pipe and fittings per CISPI 301-09 Installation Procedures for Hubless Cast Iron Pipe and Fittings for Sanitary and Storm Drain Waste and Vent Piping Applications. Brace hubless cast iron pipe and fittings 5-inch and larger with HOLDRITE No Hub Pipe Restraints or approved equivalent.
- B. Pipe Hangers, Guides and Channel Systems:
 - 1. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.
 - 2. Hanger Rod Couplings: Malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.
 - 3. Pipe Rings for Hanger Rods: Pipe sizes 2-inch and smaller, MSS SP Type 6 or Type 10, or approved equivalent. Pipe sizes 2-1/2-inches and larger, clevis type hangers with adjustable nuts on rod. MSS SP Type 1. Pipe rings to have same finish as hanger rods.
 - 4. Pipe Slides: Type 35 reinforced Teflon slide material (3/32-inch minimum thickness) bonded to steel; highly finished steel or stainless steel contact surfaces to resists corrosion; 60-80 PSI maximum active contact surface loading; steel parts 3/16-inch minimum thickness; attachment to pipe and framing by welding.
 - 5. Pipe Guides:

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HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- a. Furnish and install pipe guides on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides securely to pipe and structure. Any contact with chilled water pipe is not to permit heat to be transferred in sufficient quantity to cause condensation on any surface.
 - b. Furnish and install guides approximately 4 pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Guides are not to be used as supports and are in addition to other pipe hangers and supports.
- C. Pipe Saddles and Shields:
 - 1. Factory fabricated saddles or shields under piping hangers and supports for insulated piping.
 - 2. Size saddles and shields for exact fit to mate with pipe insulation. 1/2 round, 18 gauge, minimum 12-inches in length (4-inch pipe and larger to be three times longer than pipe diameter).
- D. Thermal-Hanger Shield Inserts: 100-PSI (690-kPa) minimum compressive strength insulation, encased in sheet metal shield.
 - 1. Material for Cold Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier.
 - 2. Material for Hot Piping: Water-repellent-treated ASTM C533, Type 1 calcium silicate.
 - 3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
 - 4. For Clevis or Band Hanger: Insert and shield to cover lower 180 degrees of pipe.
 - 5. Insert Length: Extend 2-inches beyond sheet metal shield for piping operating below ambient air temperature.
 - 6. Thermal Hanger Shield Inserts should be provided at the hanger points and guide locations on pipes requiring insulation. The Inserts should consist of Polyisocyanurate (urethane or phenolic insulation) encircling the entire circumference of the pipe with a 360 degree PVC (1.524 mm thick) with a living hinge and J lock and installed during the installation of the piping system.
- E. Concrete Inserts:
 - 1. Malleable iron body, hot dipped galvanized finish. Lateral adjustment. MSS Type 18.
- F. Continuous Concrete Insert:
 - 1. Steel construction, minimum 12 gauge. Electrogalvanized finish. Pipe clamps and insert nuts to match.
- G. Beam Clamps:
 - 1. MSS Type 19 and 23, wide throat, with retaining clip.
 - 2. Universal Side Beam Clamp: MSS Type 20.
- H. Hangers for Pipe Size 2-inches and Smaller:
 - 1. Adjustable swivel ring hanger, UL listed, Type 6 or Type 10.
- I. Hangers for Pipe Size 2-1/2-inches and Larger:
 - 1. Adjustable clevis type, UL listed, Type 1.
- J. Plumbers Tape:
 - 1. Not permitted as pipe hangers or pipe straps.
- K. Pipe Alignment and Secondary Support Systems:
 - 1. Secondary Pipe supports for general applications (Non-Acoustical).

- a. Supports will be manufactured in compliance with IAPMO Product Standard PS 42-96. All products provided will be listed by IAPMO for secondary pipe support.
- b. Supports may be used when sound and/or vibration transfer is not a concern.
- 2. Secondary pipe supports for sound and vibration attenuation (Acoustical).
 - a. Supports will be manufactured in compliance with IAPMO Product Standard PS 42-96. All products provided will be listed by IAPMO for secondary pipe support.
 - b. Acoustical pipe supports will be manufactured and installed in compliance with International Organization for Standardization (ISO) 3822-1 with current amendments.
 - c. Supports will be used when sound and/or vibration transfer is a concern. Locations where acoustical supports will be provided and include but are not limited to partition walls between living units, tenant spaces, retail units, mechanical rooms and lobbies.
 - d. Support Products:
 - 1) Support to Wall Brace and Wall Stud Penetrations: HOLDRITE #261, #262, #263, and #264, or approved equivalent.
 - 2) Pipe Wrap for Pipe Clamps and Channel-Mounted Pipe Clamps: HOLDRITE #270, or approved equivalent.
 - 3) Pipe Wrap for Pipe Hangers: HOLDRITE #271, #272-2, and #272-4, or approved equivalent.
 - 4) Drop-Ear Fitting Support: HOLDRITE #265, or approved equivalent.
 - 5) Floor Riser Isolation Pads: HOLDRITE #275-T, or approved equivalent.
 - 6) Floor Isolation Pads (General Applications): HOLDRITE #274, #275, #276, and #278, or approved equivalent.

2.03 WALL AND FLOOR SLEEVES

- A. Below Grade and High Water Table Areas:
 - 1. Modular Link Sealing System at Pipe Sleeves: Neoprene gasket links bolted together around an interior sleeve forming a watertight seal. Use a modular link sealing system at sleeves to continuously fill the annular space between the pipe and the wall opening. Provide Link-seal Type C unless otherwise noted. OS with S-316 stainless construction for continuous water/tank walls.
 - 2. Sleeves through concrete foundation walls and floors. Ductile iron pipe. Class 50 or 51 pipe conforming to ANSI/AWWA C151/A21.51, cement lined. Pipe sleeve will extend a minimum of 6-inches beyond outside perimeter of foundation. Final placement of sleeve will be confirmed with project's structural engineer. In areas with a high water table, provide AWWA C900, Class 235 plastic pipe in lieu of ductile iron pipe.
- B. Pre-Engineered Firestop Pipe Penetration Systems: UL listed assemblies for maintaining fire rating of piping penetrations through fire-rated assemblies. Comply with ASTM E814.
- C. Insulating Caulking: Eagle or Pitcher Super 66 high temperature cement.
- D. Fabricated Accessories:
 - 1. Steel Pipe Sleeves: Fabricate from Schedule 40 black or galvanized steel pipe. Remove end burrs by grinding.
 - 2. Sheet Metal Pipe Sleeves: Fabricate from G-90 galvanized sheets closed with lock-seam joints. Provide following minimum gauges for sizes indicated:

- a. Sleeve Size 4-inches in Diameter and Smaller: 18 gauge.
- b. Sleeve Sizes 5-inches to 6-inches: 16 gauge.
- c. Sleeve Sizes 7-inches and Larger: 14 gauge.
- d. Fire-Rated Safing Material:
 - 1) Rockwool Insulation: Complying with FS-HH-I-558, Form A, Class IV, 6 lbs./cu.ft. density with melting point of 1985 degrees F and K value of 0.24 at 75 degrees F.
 - 2) Calcium Silicate Insulation: Noncombustible, complying with FS-HH-I-523, Type II, suitable for 100 degrees F to 1200 degrees F service with K value of 0.40 at 150 degrees F.

2.04 BUILDING ATTACHMENTS

- A. General: Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project Structural Engineer. Provide anchor bolts suitable for cracked concrete.
- B. Anchor Bolts:
 - 1. Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.
 - 2. Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.
 - 3. Anchor (Adhesive) Bolts: Consisting of two-part adhesive cartridge and zinc-plated Type A307 steel anchor bolt rod assembly with ASTM A194 nut.
- C. Beam Clamps:
 - 1. MSS Type 19 and 23, wide throat, with retaining clip.
 - 2. Universal Side Beam Clamp: MSS Type 20.
- D. Powder-Actuated Drive Pin Fasteners:
 - 1. Powder-Actuated Drive-Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- E. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- F. Grout: ASTM C1107, Grade B, factory mixed and packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
 - 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 - 2. Properties: Nonstaining, noncorrosive, and non-gaseous.
 - 3. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

2.05 MISCELLANEOUS METAL AND MATERIALS

- A. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings, that are necessary for completion of the project. The Contractor is responsible for their design.
 - 1. Fabricate miscellaneous units to size, shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

- B. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.
- C. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.
- D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.
- E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.
- F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods and equipment required for fabrication.
- G. Provide hot dipped galvanized components for items exposed to weather.
- H. Use straps, threshold rods and wire with sizes required by SMACNA to support piping.
- I. Grout: ASTM C1107, Grade B, factory mixed and packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
 - 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 - 2. Properties: Nonstaining, noncorrosive, and non gaseous.
 - 3. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Examination:
 - 1. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.
- B. Preparation:
 - 1. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall," "2-Hour Fire/Smoke Barrier," and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.
- C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate with project structural engineer proper placement of inserts, anchors and other building structural attachments.

3.02 PIPE HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- A. Hangers and Supports:
 - 1. Comply with MSS SP-58. Pipe Hanger and Support Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For horizontally hung grooved-end piping, provide a minimum of 2 hangers per pipe section.
 - 2. Pipe Ring Diameters:
 - a. Uninsulated and Insulated Pipe, except where oversized pipe rings are specified: Ring inner diameter to suit pipe outer diameter.
 - b. Insulated Piping Where Oversized Pipe Rings are Specified and Vibration Isolating Sleeves: Ring inner diameter to suit outer diameter of insulation or sleeve.
 - 3. Oversize Pipe Rings: Provide oversize pipe rings of 2-inch and larger size.

4. Pipe Support Brackets: Support pipe with pipe slides.
5. Steel Backing in Walls: Provide steel backing in walls to support fixtures and piping hung from steel stud walls.
6. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
 - a. Field assemble and install according to manufacturer's written instructions.
7. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers.
8. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe.
9. Do not support piping from other piping.
10. Fire protection piping will be supported independently of other piping.
11. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.
12. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.
13. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchor, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units.
14. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
15. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping" is not exceeded.
16. Insulated Piping: (comply with the following)
 - a. Attach clamps and spacers to piping.
 - 1) Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - 2) Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - 3) Do not exceed pipe stress limits according to ASME B31.9.
 - b. Install MSS SP-58, Type 40 protective shields on cold piping having a vapor barrier. Shields to span arc of 180 degrees.
 - 1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
 - c. Shield Dimensions for Pipe, not less than the following:
 - 1) NPS 1/4 to NPS 3-1/2 (DN8 to DN 90): 12-inches long and 0.048-inch thick.
 - 2) NPS 4 (DN100): 12-inches long and 0.06-inch thick.
 - d. Insert Material: Length at least as long as protective shield.
 - e. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
17. Equipment Clearances: Do not route equipment or piping through electrical rooms, transformer vaults, elevator equipment rooms, or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-feet lateral clearance from all sides of electric

switchgear panels. Do not route piping or equipment above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact equipment or pipe routing to provide proper clearance with such items.

18. Pipe supports and hanger spacing (pipe supported from structure or floor-supported) to meet the requirements of References and Standards Article in Part 1 above.
- B. Vertical Piping:
1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
 2. Riser clamps to be directly under fitting or welded to pipe. Provide neoprene pads for all systems except natural gas.
 3. Riser to be supported at each floor penetration.
 4. Provide structural steel supports at the base of pipe risers. Size supports to carry forces exerted by piping system when in operation.
- C. Adjusting and Painting:
1. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping and equipment to proper level and elevations.
 2. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.

3.03 WALL AND FLOOR SLEEVES

- A. "Link-Seal" Pipe Sleeves: Install at slab on grade floor/below grade piping penetrations. Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations (except for DWV piping at slab on grade). Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations.
- B. Fabricated Pipe Sleeves:
1. Provide either steel or sheet metal pipe sleeves accurately centered around pipe routes. Size such that piping and insulation, if any, will have free movement within the sleeve, including allowance for thermal expansion. Sleeve diameter to be determined by local seismic clearance requirement, and by waterproofing requirements.
 2. Length: Equal to thickness of construction penetrated, except extend floor sleeves 1-inch above floor finish.
 3. Provide temporary support of sleeves during placement in concrete and other work around sleeves. Provide temporary end closures to prevent concrete and other materials from entering pipe sleeves.
 4. Seal each end airtight with a resilient nonhardening sealer, UL listed and fire rated per ASTM 814.

3.04 BUILDING ATTACHMENTS

- A. Install within concrete slabs or attach to structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints and at changes in direction of piping.
- B. Attachment to Wood Structure: Provide MSS Type 34 for attachment to wooden beam or approved attachment for a wood structure.
- C. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install concrete inserts before concrete is placed; fasten insert secure to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.

- E. Install powder-actuated drive pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Test powder-actuated insert attachments with a minimum load of 100 pounds.
- F. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.
- G. Anchor Bolts:
 - 1. Install anchor bolts for mechanical equipment and piping as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment and piping are hung.
 - 2. Anchor Bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.
- H. Pipe Anchors: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.
- I. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor wall, and through equipment room walls and floors.
- J. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
 - 1. Install fabricated pipe sleeve.
 - 2. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification with specified material.
 - 3. Seal each end airtight with a resilient nonhardening UL listed fire resistant ASTM 814 sealant.
- K. Piping Penetrations Through Fire-rated (1 to 3 hour) Assemblies:
 - 1. Select and install pre-engineered pipe penetration system in accordance with the UL listing and manufacturer's recommendation.
 - 2. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814. Use HOLDRITE HydroFlame or approved equivalent.
- L. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

3.05 MISCELLANEOUS METAL AND MATERIALS

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.
- C. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.

Provide temporary bracing or anchors in formwork for items which are to be built into concrete masonry or similar construction.

- D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
- E. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
 - 1. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- F. Fabrication:
 - 1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates and similar devices. Hot dip galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
 - 2. Finishes:
 - a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with 1 coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas with primer of same material before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
 - b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials:
 - 1) Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
 - c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.
- G. Metal Fabrication:
 - 1. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

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HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

2. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
3. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of weld and methods used in correcting welding work, and with the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.
4. Provide hot dipped galvanized components for items exposed to weather.

END OF SECTION

**SECTION 22 07 00
PLUMBING INSULATION**

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Type 1, Glass Wool Pipe Insulation
 - 2. Type 2, Flexible Elastomeric Insulation
 - 3. Type 7, ADA Accessible Lavatory/Sink Insulation Kit
 - 4. Accessories
 - 5. Pipe Fitting Insulation Covers

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Piping insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Installer qualifications.
 - 2. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
 - 3. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
 - 4. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.
 - 5. Submit manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements apply to this Section.
- B. In addition, meet the following:
 - 1. Formaldehyde Free: Should be third-party certified with UL Environment Validation.
 - 2. Recycled Content: A minimum of 40 percent post-consumer recycled glass content certified and UL validated.
 - 3. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.
 - 4. Installer to have minimum 5 years' experience in the business of installing insulation.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.07 FIRE HAZARD CLASSIFICATION

- A. Maximum fire hazard classification of the composite insulation construction as installed to be not more than a Flame Spread Index (FSI) of 25 and Smoke Developed Index (SDI) of 50 as tested by current edition of ASTM E84 (NFPA 255) method.
- B. Test pipe insulation in accordance with requirements of current edition of UL "Pipe and Equipment Coverings".

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Type 1, Glass Wool Pipe Insulation:
 - 1. Owens-Corning
 - 2. Johns Manville
 - 3. Or approved equivalent.
- B. Type 2, Flexible Elastomeric Insulation:
 - 1. Insulation:
 - a. Armacell LLC Armaflex
 - b. K-Flex
 - c. Or approved equivalent.
 - 2. Glue:
 - a. Armacell LLC Armaflex Low VOC Adhesive
 - b. K-Flex
 - c. Or approved equivalent.
 - 3. Paint:
 - a. Armacell LLC Armaflex
 - b. K-Flex
 - c. Or approved equivalent.
- C. Type 7, ADA Accessible Lavatory/Sink Insulation Kit:
 - 1. IPS/Truebro
 - 2. McGuire/Pro-Wrap
 - 3. Plumberex/Pro-Extreme
 - 4. Brocar Trap Wrap
 - 5. Or approved equivalent.
- D. Accessories:
 - 1. ITW Insulation Systems
 - 2. Or approved equivalent.
- E. Pipe Fitting Insulation Covers:
 - 1. Zeston Johns Manville
 - 2. ITW Insulation Systems
 - 3. Or approved equivalent.

2.02 TYPE 1, GLASS WOOL PIPE INSULATION

- A. Glass Fiber: ASTM C547 Type I and IV; rigid molded, noncombustible.
 - 1. Thermal Conductivity Value: 0.27 BTU*in/(hr*sf°F) at 75 degrees F.
 - 2. Maximum Service Temperature: 850 degrees F to 1000 degrees F.

3. Vapor Retarder Jacket: White Kraft paper reinforced with glass fiber and bonded to aluminum foil, with self-sealing longitudinal laps and butt strips or vapor barrier mastic.

2.03 TYPE 2, FLEXIBLE ELASTOMERIC INSULATION

- A. Elastomeric Foam: ASTM C534; flexible, cellular elastomeric, molded or sheet.
 1. Thermal Conductivity Value: 0.25 BTU*in/(hr*sf°F) at 75 degrees F.
 2. Maximum Service Temperature of 220 degrees F.
 3. Maximum Flame Spread: 25.
 4. Maximum Smoke Developed: 50 (3/4-inch thick and below).
 5. Connection: Waterproof vapor retarder adhesive as needed.
 6. UV Protection: UV outdoor protective coating per manufacturer's requirements.
- B. Glue: Contact adhesive specifically manufactured for cementing flexible elastomeric foam.
- C. Paint: Nonhardening high elasticity type, specifically manufactured as a protective covering of flexible elastomeric foam insulation for prevention of degradation due to exposure to sunlight and weather.

2.04 TYPE 7, ADA ACCESSIBLE LAVATORY/SINK INSULATION KIT

- A. P-traps, trap arms, tail pieces, hot water and cold water insulating guards meeting ASTM C1822. Molded closed cell insulation with vinyl cover and nylon fasteners, paintable. Thermal conductivity; K = 1.17 (BTU*in/(hr*sf°F) at 75 degrees F mean temperature. Provide accessories as required for complete installation covering all exposed waste piping, water piping, stops and supplies. Color white.

2.05 ACCESSORIES

- A. Equipment Insulation Compounds: Provide adhesives, cement, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
- B. Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers as recommended by insulation manufacturer for applications indicated. Accessories, i.e., adhesives, mastics, cements and tape to have same flame and smoke component ratings as insulation materials with which they are used. Shipping cartons to bear a label indicating that flame and smoke ratings do not exceed those listed above. Provide permanent treatment of jackets or facings to impart flame and smoke safety. Provide non-water soluble treatments. Provide UV protection recommended by manufacturer for outdoor installation.

2.06 PIPE FITTING INSULATION COVERS

- A. PVC Plastic Fitting Covers: Schuller Zeston 2000, Knauf Proto Fitting or approved equivalent. One-piece molded type fitting covers and jacketing material, gloss white. Connections: Tacks; pressure sensitive color matching vinyl tape.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION INFORMATION

- A. Verification of Conditions:
 1. Do not apply insulation until pressure testing and inspection of piping has been completed.
 2. Examine areas and conditions under which insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Preparation: Clean and dry surfaces to be insulated.
- C. Installation:
 1. Insulation: Continuous through walls, floors and partitions except where noted otherwise.
 2. Piping and Equipment:

- a. Install insulation over clean, dry surfaces with adjoining sections firmly butted together and covering surfaces. Fill voids and holes. Seal raw edges. Install insulation in a manner such that insulation may be split, removed, and reinstalled with vapor barrier tape on strainer caps and unions. Do not install insulation until piping has been leak tested and has passed such tests. Do not insulate manholes, equipment manufacturer's nameplates, handholes, and ASME stamps. Provide beveled edge at such insulation interruptions. Repair voids or tears.
- D. Provide accessories as required. See Part 2 Article "Accessories" above.
- E. Protection and Replacement: Protect installed insulation during construction. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- F. Labeling and Marking: Provide labels, arrows and color coding on piping. Attach labels and flow direction arrows to jacketing per Section 22 05 53, Identification for Plumbing Piping and Equipment.
- G. Insulation Shields: Provide hangers and shields (18 gauge minimum) outside of insulation for cold piping (<60 degrees F). Hot water piping hangers may penetrate insulation to contact pipe directly. Provide 18-inch long, noncompressible insulation section at insulation shields for lines 1-1/2-inches and larger (hot and cold piping).
- H. Piping Surfaces to be Insulated:

Item to be Insulated	System Insulation Type	Pipe Size	Insulation Thickness
Cold Water Piping Above Grade	1	=<1-1/2-inch	1/2-inch
		>1-1/2-inch	1-inch
Hot Water Piping Below Grade	2	=<1-1/2-inch	1-inch
		>1-1/2-inch	1-1/2-inch
Hot Water Circulation Piping Below Grade	2	=<1-1/2-inch	1-inch
		>1-1/2-inch	1-1/2-inch
ADA Accessible Lavatory/Sink	7	All	As Listed
Condensate Drain Piping	1, 2	All	1/2-inch
Aboveground Refrigerated Water Systems	1, 2	All	1-inch

3.02 TYPE 1, GLASS WOOL PIPE INSULATION

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions for below grade installation.
- C. Lap seal insulation with waterproof adhesive. Do not use staples or other methods of attachment which would penetrate vapor barrier. Apply fitting covers with seated tacks and vapor barrier tape.
- D. Apply insulation to pipe and seal with self-sealing lap. Use self-sealing butt strips to seal butt joints. Insulate fittings, valves and unions with single or multiple layers of insulation and cover to match pipe or use preformed PVC molded insulation covers.

3.03 TYPE 2, FLEXIBLE ELASTOMERIC INSULATION

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions for below grade installation.

- C. Slip insulation on pipe prior to connection. Butt joints sealed with manufacturer's adhesive. Insulate fitting with miter-cut pieces. Cover insulation exposed to weather and undergrade with two coats of finish as recommended by manufacturer.
- D. Flexible Elastomeric Tubing: Slip insulation over piping or if piping is already installed, it should be slit and snapped over piping. Joints and butt ends must be adhered with 520 adhesive.

3.04 TYPE 7, ADA ACCESSIBLE LAVATORY/SINK INSULATION KIT

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions.
- C. Provide lavatory/sink insulation kit. Install on waste fittings, hot and cold water stops and supplies.

3.05 ACCESSORIES

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions.
- C. Provide and install accessories for all insulation types listed in this Section.

3.06 PIPE FITTING INSULATION COVERS

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions.

END OF SECTION

**SECTION 22 10 00
PLUMBING PIPING**

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Sanitary, Drainage DWV Piping, Buried Within 5-feet of Building
 - 2. Sanitary, Drainage DWV Piping, Above Grade
 - 3. Water Piping, Buried Within 5-feet of Building
 - 4. Hot and Cold Domestic Water Above Grade
 - 5. Condensate Piping
 - 6. Primer Piping
 - 7. Cleanouts

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. NSF 61, Annex G.
 - 2. Steel pipe to conform to ASTM and ANSI Standards as specified in this Section.
 - 3. Copper piping to conform to ASTM B88, B306 and B208 and the standards of Copper Development Association (CDA), and American Welding Society, (AWS).
 - 4. Cast Iron Piping to conform to standards of ASTM A-74, CISPI 301 and FM 1680.
 - 5. Manufacturer's Standards Society (MSS) for valving and support reference standard.
 - 6. American Water Works Association (AWWA) for Valving Assembly Standards.
 - 7. American Society of Sanitation Engineers (ASSE) for Valving Standards.
 - 8. American National Standards Institute (ANSI) for Piping Standards.
 - 9. NFPA Standard 51B - "Fire Prevention in Use of Cutting and Welding Processes".
 - 10. Crosslinked polyethylene (PEX) pipe conforming to ASTM F876, F877 and CSA B1375, or DIN 16892 and 16893.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. See component manufacturers listed in individual articles below.
- B. Uponor

- C. Cerro
- D. Tyler
- E. ADS
- F. Charlotte
- G. Elkhart
- H. Enfield
- I. Fusesseal
- J. Gruvlok
- K. Spears
- L. Nibco
- M. Orion
- N. American-USA
- O. Sioux Chief
- P. Viega
- Q. Mueller
- R. Or approved equivalent.
- S. Cleanouts:
 - 1. J.R. Smith
 - 2. Zurn
 - 3. Wade
 - 4. Watts
 - 5. Sioux Chief
 - 6. Or approved equivalent.
- T. Firestopping Penetrations in Fire Rated Wall Floor Assemblies:
 - 1. Hilti
 - 2. Proset
 - 3. Or approved equivalent.

2.02 GENERAL

- A. Provide pipe, tube and fittings of the same type, fitting requirements, grade, class and the size and weight indicated or required for each service, as indicated in other Division 22, Plumbing Specifications. Where type, grade, or class is not indicated, provide proper selection as determined by installer for installation requirements, and comply with governing regulations and industry standards.
- B. Manufactured materials delivered, new to the project site and stored in their original containers.
- C. Product Marking: Furnish each item with legible markings indicating name brand and manufacturer, manufacturing process, heat number and markings as required per ASTM and UL/FM Standards.

2.03 SANITARY, DRAINAGE DWV PIPING, BURIED WITHIN 5-FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A888/CISPI 301 hubless.
 - 1. Fittings: Cast iron.
 - 2. Coupling Assembly:
 - a. Heavy Duty: ASTM C1540, Clamp-All Hi-Torq 125, Husky SD 4000, Mission HeavyWeight couplings.
- B. Copper Tube: ASTM B 306, DWV
 - 1. Fittings: ASME B16.29, wrought copper.

2. Joints: ASTM B32, ASTM B-828 and alloy Sn50 solder.
3. Flux: ASTM B813-91, water soluble.
- C. PVC Pipe: ASTM D 2665 IPS Schedule 40, **SOLID WALL** piping for drainage/waste and vent (DWV).
 1. Fittings: PVC DWV ASTM D2665.
 2. Joints: Solvent welded, with ASTM D2564 solvent cement, 2-step glue (primer and glue) is required.

2.04 SANITARY, DRAINAGE DWV PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A888/CISPI 301 hubless.
 1. Fittings: Cast iron.
 2. Coupling Assembly:
 - a. Standard Duty: ASTM C1277 or CISPI 310.
- B. PVC Pipe: ASTM D 2665 IPS Schedule 40, **SOLID WALL** piping for drainage/waste and vent (DWV).
 1. Fittings: PVC DWV ASTM D2665.
 2. Joints: Solvent welded, with ASTM D2564 solvent cement, 2-step glue (clear primer and glue) is required.

2.05 WATER PIPING, BURIED WITHIN 5-FEET OF BUILDING

- A. Copper Pipe: ASTM B88, hard drawn, Type K (A).
 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
 2. Joints: Brazed - BCuP2.
- B. Ductile Iron Pipe: AWWA C151/A21.51.
 1. Fittings: Ductile or gray iron, standard thickness.
 2. Joints: AWWA C111/A21.11, rubber gasket with 3/4-inch diameter rods, mega lug type.

2.06 HOT AND COLD DOMESTIC WATER ABOVE GRADE

- A. Copper Tube: 3-inches and above. ASTM B88 (ASTM BA88m), Type L (B), Drawn.
 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 2. Joints: Brazed BCuP2.
- B. Copper Tube: 2-1/2-inches and smaller. ASTM B88 (ASTM B88M), Type L (B), Drawn.
 1. Fittings: ASME B16.18 copper.
 2. Joints: ASTM B32, alloy Sn95 solder.
- C. Copper Tube: Water pressures up to 250 PSI gauge. ASTM B 88 (ASTM BA 88m), Type K (A), Drawn.
 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 2. Joints: Brazed BCuP2.
- D. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), Drawn.
 1. Fittings: ASME B16.22, wrought copper.
 2. Joints: Roll grooved mechanical coupling. ASTM A536.
- E. Cross-Linked Polyethylene Tubing, Fittings and Accessories (except exposed locations).
 1. Tubing:
 - a. Cross-linked polyethylene (PEX) tubing complies with requirements of ASTM F876 and F877, and cross-linking method must be Type A (hot)method.

- b. PEX tubing to have minimum working pressure of not less than 160 PSI for water at 73.4 degrees F, 100 PSI for water at 180 degrees F and 80 PSI for water at 200 degrees F determined in accordance with Plastic Pipe Institute Technical Report TR-3/92, and listed in Plastic Pipe Institute Technical Report TR-4/95.
- 2. Fittings:
 - a. Fittings: Engineered Plastic Fittings for above grade applications. Engineered plastic fittings for below grade applications. Serrated type with reinforcement rings.
 - b. Reinforcement Rings: Manufactured using "Engel Method" to ensure that viscoelastic stress regenerative properties are sufficient to produce pressure tight seal.
 - c. Fitting Insert: Of such dimension in that tubing must be expanded in order to facilitate insertion of fitting into tube.
 - d. Accomplish expansion of tubing and ring by an expansion tool designed expressly for that purpose.
 - e. Fittings complies with requirements of ASTM F877.
- 3. Manifolds: Provide premanufactured copper manifolds of same manufacturer as piping.
- 4. Stub-out Ells and Stub-out Brackets: Provide premanufactured Type L copper stub-out ells and copper stub-out brackets.

2.07 CONDENSATE PIPING

- A. Copper Tube: ASTM B 88 (ASTM B898M), Type K (A).
 - 1. Fittings: ASME B16.29, wrought copper.
 - 2. Joints: ASTM B32, alloy Sn50 solder.
- B. Use chemical resistant piping for drainage of condensate from combustion fuel sources (such as condensing boilers and water heaters), as noted in this Section for area of application.
- C. CPVC (Chlorinated Poly Vinyl Chloride) Pipe and Fittings:
 - 1. Pipe and Fittings: Schedule 40, NSF-14, ASTM 439, IAPMO IS20-96, socket fittings, solvent weld.

2.08 PRIMER PIPING

- A. Above Ground: Type L hard-drawn copper tubing with wrought sweat fittings and soldered joints.
- B. Belowground: Type L soft annealed copper tubing with wrought sweat fittings and brazed joints.
- C. Belowground: Cross-linked polyethylene (PEX) and engineered plastic fittings.

2.09 CLEANOUTS

- A. Locate cleanouts as shown on Drawings and as required by local code. Cleanouts same size as pipe except that greater than 4-inches will not be required. Plastic components not allowed, except unless specifically noted.
- B. Types:
 - 1. Tile Floor Cleanouts: J. R. Smith 4020 with round heavy-duty nickel bronze top, taper thread, ABS plug and vandalproof screws.
 - 2. Carpeted Floor Cleanout: J. R. Smith 4023-Y with carpet cleanout marker, round heavy-duty nickel bronze top, taper thread, ABS plug, carpet clamping device and vandalproof screws.
 - 3. Concrete Floor Cleanout (General): J. R. Smith 4020 with round heavy-duty nickel bronze top, taper thread and ABS plug with vandalproof screws.

4. Parking, Drives and Concrete Floor Cleanouts (Heavy Load): J. R. Smith 4100 with round heavy-duty nickel bronze top, taper thread and ABS plug with vandalproof screws.
5. Wall Cleanout: J. R. Smith 4472-U, countersunk bronze taper thread plug, stainless steel shallow cover and vandalproof screws.
6. Outside Area Walks: J. R. Smith 4020-U with round heavy-duty nickel bronze top, taper thread, ABS plug and top secured with vandalproof screws. Install in 18- by 18- by 6-inch deep concrete pad flush with grade.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Underground Piping Systems:
 1. Examination: Verify that excavations are to required grade, dry, and not over-excavated.
 2. Perform necessary excavation and backfill required for installation of plumbing work. Repair piping or other work at no expense to Owner.
 3. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Owner.
 4. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of testing laboratory.
 5. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (muck, peat), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material. Adequate width of trench for proper installation of piping or conduit.
 6. Support Foundations:
 - a. Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to depth which is determined by Architect as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Specification Sections or Drawings.
 - b. Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Owner.
 - c. Foundation Material: Where native material has been removed, place and compact necessary foundation material to form base for replacement of required thickness of bedding material.

	Class A		Class B	
Material Passing	Min.	Max.	Min.	Max.
3/4-inch Square Opening	27	47	0	1

- d. Bedding Material: Full bed piping on sand, pea gravel, or 3/4-inch minus crushed rock. Place minimum 4-inch deep layer of sand, pea gravel, or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of

pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide firm foundation.

7. Backfilling:
 - a. Following installation and successful completion of required tests, backfill piping in lifts.
 - 1) In "Pipe Zone" place backfill material and compact in lifts not to exceed 6-inches in depth to height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.
 - 2) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.
 - b. Backfill Material:
 - 1) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.
 - 2) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."
8. Compaction of Trench Backfill:
 - a. Where compaction of trench backfill material is required, use one of following methods or combination thereof:
 - 1) Mechanical tamper,
 - 2) Vibratory compactor, or
 - 3) Other approved methods appropriate to conditions encountered.
 - b. Architect to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.
- B. General Installation:
 1. Work performed by experienced journeyman plumbers. No exceptions.
 2. Provide access panels for concealed valves, shock arrestors, trap primers and the like.
 3. Install pipes and pipe fittings in accordance with recognized industry practices and manufacturer's recommendations.
 4. Align piping accurately at connections, within 3/32-inch misalignment tolerance. Comply with ANSI B31 Code for Pressure Piping.
 5. Locate piping runs, as indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details, and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2-inch where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1-inch clearance outside insulation. Whenever possible in finished and occupied spaces, conceal piping from view by locating it in column enclosures, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as indicated.

- a. Do not run piping through transformer vaults, telephone, elevator, electrical or electronic equipment spaces or enclosures unless indicated on Drawings.
- b. Concealed Piping Above Suspended Ceiling: Plan and coordinate to avoid interferences; install to maintain suspended ceiling heights shown on Architectural Drawings. Allow sufficient space above removable ceiling panels for panel removal. Locate piping so that valves are visible and accessible within 24-inches horizontally and vertically from point of access to the ceiling space. Provide plenum rated materials for ceiling spaces which are being used as plenums.
- c. Exposed Work: Run pipes parallel to the closest wall unless otherwise shown on Drawings; maintain maximum headroom; avoid light fixtures.
- d. Insulation Space Allowance: In piping work, allow space for pipe insulation and jackets. If interferences occur, move the piping to accommodate insulation thickness specified.
- e. Pipe Lengths: Do not use short lengths or nipples at locations where a full length of pipe will fit.
- f. Alignment Prior to Supporting and Anchoring: Place piping in proper alignment and position prior to connection to anchors, expansion loops, and equipment. Furnish jacking devices, temporary steel structural members, and assembled structures as necessary. Remove temporary equipment and structures supplied by contractor at completion; such items to remain Contractor property.
- g. Valve and Equipment Connections: Piping not to place undue stress on flanged valves and equipment connections. Install mating flange faces true and parallel to each other and not requiring springing of piping for assembly. Pipe hangers and supports to carry the full weight of the pipe and fluid.
- h. Piping Leaks: Correct immediately; use new materials; leak-sealing compounds or peening not permitted.
- i. Pressure Ratings of Fittings, Valves, and Devices in Piping Systems: Pressure rating to be equal to, or greater than, the maximum working pressure of the system.
- j. Equipment Vents and Drains: Provide for coils and vessels which contain water. Provide isolation valves and outlet valves at piping high and low points to permit venting and draining of the vessel without venting and draining connected piping. Provide hose connections and caps on drain lines.
- k. Escutcheon Plates: Where exposed insulated and uninsulated piping passes through walls, floors or ceilings; provide spring clip type. Provide plates on both sides of wall or floor.

C. Testing:

1. General:

- a. Provide temporary equipment for testing, including pumps, compressors, tanks, and gauges, as required. Test piping systems before insulation (if any) is installed and remove or disengage control devices before testing. Where necessary, test sections of each piping system independently, but do not use piping valves to isolate sections where test pressures exceed local valve operating pressure rating. Fill each section with water, compressed air, or nitrogen and pressurize for the indicated pressure and time.
- b. Notify Architect and local Plumbing Inspector 2 days before tests.

- c. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.
 - d. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
 - e. Send test results to Architect for review and approval and include in Operation and Maintenance Manual.
- 2. Testing of Pressurized Systems:
 - a. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.
 - b. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.
- 3. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at hydrostatic pressure of 125 PSIG.
- D. Corrosive Soil Conditions:
 - 1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's recommendations.
 - 2. Provide epoxy coated cast iron pipe and fittings for drainage systems.
 - 3. Obtain and review project soils report for verification of requirements concerning corrosive soils.
- E. Protection:
 - 1. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping, ductwork, fixtures, equipment and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore to its original condition or replace fixtures, equipment or apparatus damaged prior to final acceptance of work.
- F. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
 - 1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.
- G. Cut piping squarely, free of rough edges and reamed to full bore. Insert piping fully into fittings.
- H. Provide joints of type indicated in each piping system.
- I. Thread pipe in accordance with ANSI/ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Remove excess cutting oil from piping prior to assembly. 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 not more than 3 threads exposed.
- J. Sleeves:
 - 1. Pipe Sleeves:
 - a. Layout work in advance of pouring concrete, furnish, and set sleeves necessary to complete work.

- b. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with non-shrinking grout or approved caulking compound (Except DWV Piping penetrating a concrete slab set on finish grade), provide "Link-Seal" sleeve sealing system for concrete/slab penetrations which are below grade. Caulk/seal piping passing through fire rated building assembly with UL rated assemblies. Provide fire-rated assemblies per local AHJ requirements
 - c. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with non-shrinking caulking compound. Provide modular link sealing system for concrete penetrations which are below grade. Caulk/seal piping passing through fire-rated assemblies per local AHJ requirements.
 - d. Beam Sleeves: Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Indicate penetrations on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations. Plumbing Drawings are diagrammatic. Offset piping as required to meet these limitations. Pipe sleeve locations must be indicated on reinforced concrete and steel beam shop drawings. Field cutting of beams not allowed without written approval of structural engineer. No extra costs allowed for failure to coordinate beam penetrations prior to reinforced concrete and steel beam shop drawing submittal.
- 2. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
 - a. Install fabricated pipe sleeve.
 - b. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification.
 - c. Seal each end airtight with a resilient nonhardening seal per code.
 - 3. Piping penetrations through fire-rated (1 to 3 hour) assemblies:
 - a. Select and install pre-engineered pipe penetration system in accordance with UL listing and manufacturer's recommendation.
 - b. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E84.

3.02 SANITARY, DRAINAGE DWV PIPING, BURIED WITHIN 5-FEET OF BUILDING

- A. Excavation and Backfill:
 - 1. See 3.01,A. above.
- B. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.
- C. Corrosive Soil Conditions:
 - 1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's requirements.
 - 2. Provide epoxy coated cast iron pipe and fittings for drainage systems.

- D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.
- E. Sanitary and Storm Drainage:
 - 1. Grade piping at a uniform pitch of 2 percent unless otherwise noted on Drawings.
 - 2. Indirect Waste or Drain Piping: Extend piping to discharge as shown on Drawings. Maintain minimum air gap. Provide traps on indirect waste or drain piping exceeding 60-inches.
 - 3. Fixture Carriers: Concealed fixture carriers for wall hung plumbing fixtures are specified in Section 22 40 00, Plumbing Fixtures.
 - 4. Drains:
 - a. Install drains to suit finished floor or roof surface. Install drains and components per manufacturer's instructions. Slope flooring to floor drain or sink a minimum of 1/2-inch below finished floor elevation.
 - b. Install P-traps for hub drains, floor drains and floor sinks. P-traps to be of the same materials as soil and waste piping. Provide trap primer assembly for each drain or floor sink.
 - 5. Wall Access Panel: Secure to wall framing and install so that flange forms a close fitting joint with the finished wall surface.
 - 6. Heat trace and insulate P-traps exposed to freezing conditions. Provide heat trace and electronic components to Division 26 for installation.
 - 7. Insulate horizontal branch lines from floor sinks, receptors and drains receiving cold discharge from equipment and appliances.
- F. Epoxy Coated Cast Iron Pipe and Fittings: Coat the piping terminus of any cut piping with an applied epoxy per manufacturer's instructions. Denso Protal 7200 fast-cure epoxy repair coating.

3.03 SANITARY, DRAINAGE DWV PIPING, ABOVE GRADE

- A. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.
- B. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
 - 1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.
- C. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM Std. B-32, in accordance with IAPMO Is 3-93, ASTM B-828 and Copper Development Association recommended procedures. Clean joints by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes to be water soluble for copper and brass potable water applications, and meeting CDA standard test method 1.0 and ASTM B813-91. Apply solder until a full fillet is present around the joint. Do not apply solder and flux in such excessive quantities as to run down interior of pipe. Lead solder or corrosion flux not to be present at the jobsite.
- D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.
- E. Sanitary Drainage:
 - 1. Grade piping at a uniform pitch of 2 percent unless otherwise noted on Drawings.

2. Indirect Waste or Drain Piping: Extend piping to discharge as shown on Drawings. Maintain minimum air gap. Provide traps on indirect waste or drain piping exceeding 60-inches.
3. Fixture Carriers: Concealed fixture carriers for wall hung plumbing fixtures are specified in Section 22 40 00, Plumbing Fixtures.
4. Drains:
 - a. Install drains to suit finished floor. Install drains and components per manufacturer's instructions. Slope flooring to floor drain or sink a minimum of 1/2-inch below finished floor elevation.
 - b. Install P-traps for hub drains, floor drains and floor sinks. P-traps to be of the same materials as soil and waste piping. Provide trap primer assembly for each drain or floor sink.
5. Wall Access Panel: Secure to wall framing and install so that flange forms a close fitting joint with the finished wall surface.
6. Heat trace and insulate P-traps exposed to freezing conditions. Provide heat trace and electronic components to Division 26 for installation.
7. Insulate horizontal branch lines from floor sinks, receptors and drains receiving cold discharge from equipment and appliances.

3.04 WATER PIPING, BURIED WITHIN 5-FEET OF BUILDING

- A. Excavation and Backfill:
 1. See 3.01,A. above.
- B. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
- C. Domestic Water:
 1. "Piping" to include pipes, fittings, nipples, valves and accessories connected thereto.
 2. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts, flues, conduits and work of other trades, and as close to ceiling or other construction as practical, free of unnecessary traps or bends.
 3. Grade water supply piping for complete drainage of the system. Install hose bibbs at low points.
 4. Use unions for piping connections to equipment.
 5. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.
 6. Use reducers or increasers. Use no bushings.
 7. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageways.
 8. Cover, cap or otherwise protect open ends of piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect and sterilize water supply piping as specified. Furnish written report on final water quality results.
 9. Install exposed connections to equipment with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping permitted.
 10. Make ferrous to non-ferrous connections with dielectric fittings.
 11. Use extra heavy pipe for nipples, where unthreaded portion is less than 1-1/2-inches. Use no close nipples. Use only shoulder-type nipples.
 12. Through-Wall Pipes: Type 'L' copper tubing for through-wall pipes which connect to exposed stops at wall surface. Anchor the pipes in the wall; attach pipe with U-

bolts to steel back-up plates or steel angles anchored in the wall. Provide wrought copper elbow which securely anchors ears in wall at through-wall pipes.

13. Provide drain valves at base of risers and at low points on the system.

D. Sterilization of Domestic Water System:

1. General: Upon completion of tests and necessary replacements, thoroughly flush and disinfect domestic water piping.
2. Method: After thoroughly flushing system with water to remove sediment, fill system with a solution containing 50 parts per million of chlorine for not less than 24 hours or 200 parts per million of chlorine for not less than 3 hours. After retention, drain, reflush and return system to service.
3. Certification: Provide copy of domestic water chlorination certificate in each operations and maintenance manual.
4. Provide water line disinfections performed by a licensed contractor with training in potable water line disinfections.

E. Buried Pre-Insulated Pipe Installation:

1. Installation and Testing: Install and test products in accordance with manufacturer's installation instructions.
2. Manufacturer's installation instructions are to describe the following:
 - a. Storage and handling of pipes.
 - b. Trench preparation.
 - c. Installing pipe.
 - d. Installing accessories.
 - e. Installing fittings.
 - f. Building penetrations.
 - g. Field insulation kits.
 - h. Testing.

3.05 HOT AND COLD DOMESTIC WATER ABOVE GRADE

- A. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
- B. Testing of Pressurized Systems:
 1. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.
 2. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.
- C. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at hydrostatic pressure of 125 PSIG.
- D. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
 1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.
- E. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM Std. B-32, in accordance with IAPMO Is 3-93, ASTM B-828 and Copper Development Association recommended procedures. Clean joints by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes to be water soluble for copper and brass potable water applications, and meeting CDA standard test method 1.0 and ASTM B813-91. Apply solder until a full fillet is present around the joint. Do not apply solder and flux in such excessive quantities as to run down interior of pipe. Lead solder or corrosion flux not to be present at the jobsite.

- F. Braze copper tube and fitting socket with BCuP series filler metal without flux. Use listed brazing flux for joining of copper tube to brass or bronze fittings, meeting AWS FB3A or FB3C. "Shock" cooling is prohibited. A continuous fillet is to be visible around the completed joint. After cooling, thoroughly remove flux residue with warm water and a brush prior to testing. Do not use BCuP filler on copper alloys containing over 10 percent nickel. Cap or plug piping during construction to prevent entry of foreign material.
- G. Domestic Water:
1. "Piping" to include pipes, fittings, nipples, valves and accessories connected thereto.
 2. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts, flues, conduits and work of other trades, and as close to ceiling or other construction as practical, free of unnecessary traps or bends.
 3. Grade water supply piping for complete drainage of the system. Install hose bibbs at low points.
 4. Use unions for piping connections to equipment.
 5. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.
 6. Use reducers or increasers. Use no bushings.
 7. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageways.
 8. Cover, cap or otherwise protect open ends of piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect and sterilize water supply piping as specified. Furnish written report on final water quality results.
 9. Install exposed connections to equipment with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping permitted.
 10. Make ferrous to non-ferrous connections with dielectric fittings.
 11. Use extra heavy pipe for nipples, where unthreaded portion is less than 1-1/2-inches. Use no close nipples. Use only shoulder-type nipples.
 12. Through-Wall Pipes: Type 'L' copper tubing for through-wall pipes which connect to exposed stops at wall surface. Anchor the pipes in the wall; attach pipe with U-bolts to steel back-up plates or steel angles anchored in the wall. Provide wrought copper elbow which securely anchors ends in wall at through-wall pipes.
 13. Provide drain valves at base of risers and at low points on the system.
 14. Backflow Preventers: Pipe relief to nearest drain. Slope at 2 percent.
- H. Sterilization of Domestic Water System:
1. General: Upon completion of tests and necessary replacements, thoroughly flush and disinfect domestic water piping.
 2. Method: After thoroughly flushing system with water to remove sediment, fill system with a solution containing 50 parts per million of chlorine for not less than 24 hours or 200 parts per million of chlorine for not less than 3 hours. After retention, drain, reflush and return system to service.
 3. Certification: Provide copy of domestic water chlorination certificate in each operations and maintenance manual.
 4. Provide water line disinfections performed by a licensed contractor with training in potable water line disinfections.

3.06 CONDENSATE PIPING

- A. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:

1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

3.07 PRIMER PIPING

- A. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

3.08 CLEANOUTS

- A. Install in aboveground piping and building drain piping as indicated, as required by code; at each change in direction of piping greater than 135 degrees; at minimum intervals of 100-feet; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping. Select type to match adjacent building finish. Provide shop drawings to Architect to coordinate locations and types of cleanouts with Architect prior to installation.
- B. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.
- C. Corrosive Soil Conditions:
 1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's requirements.
 2. Provide epoxy coated cast iron pipe and fittings for drainage systems.
- D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

END OF SECTION

**SECTION 22 40 00
PLUMBING FIXTURES**

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. General Plumbing Fixtures:
 - a. China Fixtures, White Only
 - b. Faucet Fittings
 - c. Molded Resin or Stone Fixtures
 - d. Stainless Steel Fixtures
 - e. Thermostatic Mixing Valves
 - 2. Carriers
 - 3. Drinking Fountains
 - 4. Electric Water Coolers
 - 5. Fixture Trim
 - 6. Flushometers - Water Closet/Urinal
 - 7. Water Closet Seats
 - 8. Stainless Steel Drainage Fittings

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Comply with lead free (less than or equal to 0.25 percent) products in drinking water systems.
 - 2. NSF 61, Annex G, Drinking Water System Components, Compliant.
 - 3. ISO 9001, Quality Management Standard Certified.
 - 4. IAPMO Low Lead Certification.
 - 5. Provide fixtures, faucets and accessories to meet barrier free requirements of the governing code with respect to plumbing fixtures provided for the physically handicapped.
 - 6. Items approved for use by State of Oregon.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. "Or approved equivalent" as defined in 22 00 00, Plumbing Basic Requirements. Substitution process requirements apply to approved equivalent products.

B. General Plumbing Fixtures: See Schedule on Drawings for type.

1. China Fixtures - White Only:
 - a. American Standard
 - b. Briggs
 - c. Kohler
 - d. Or approved equivalent.
2. Faucet Fittings:
 - a. Private:
 - 1) Chicago
 - 2) Delta Commercial
 - 3) Moen
 - 4) Speakman
 - 5) Symmons
 - 6) T&S Brass
 - 7) Or approved equivalent.
 - b. Public:
 - 1) American Standard
 - 2) Chicago
 - 3) Delta Commercial
 - 4) Moen Commercial
 - 5) Sloan
 - 6) Symmons
 - 7) T & S Brass
 - 8) Or approved equivalent.
3. Molded Resin or Stone Fixtures:
 - a. Fiat
 - b. Mustee
 - c. Stern Williams
 - d. Or approved equivalent.
4. Stainless Steel Fixtures:
 - a. Elkay
 - b. Haws
 - c. Just
 - d. Or approved equivalent.
5. Thermostatic Mixing Valves:
 - a. Bradley
 - b. Powers
 - c. Symmons
 - d. Holby
 - e. Or approved equivalent.

C. Carriers:

1. JR Smith
2. Zurn
3. Or approved equivalent.

D. Drinking Fountain:

1. Elkay
 2. Halsey-Taylor
 3. Haws
 4. Oasis
 5. Sunroc
 6. Or approved equivalent.
- E. Electric Water Coolers:
1. Elkay
 2. Halsey-Taylor
 3. Haws
 4. Oasis
 5. Sunroc
 6. Or approved equivalent.
- F. Fixture Trim:
1. McGuire
 2. Dearborn Brass
 3. Oatey
 4. Or approved equivalent.
- G. Flushometers - Water Closet/Urinal:
1. Delaney
 2. Sloan
 3. Zurn
 4. Or approved equivalent.
- H. Water Closet Seats:
1. Bemis
 2. Or approved equivalent.
- I. Stainless Steel Drainage Fittings:
1. Blucher
 2. Josam
 3. JR Smith
 4. Kusel
 5. Zurn
 6. Or approved equivalent.

2.02 GENERAL PLUMBING FIXTURES

- A. Review substitution request requirements in Division 01, General Requirements and 22 00 00, Plumbing General Requirements.
- B. Reference Architectural Details for mounting height and location of fixtures.
- C. Provide factory fabricated fixtures of type, style and material indicated on the plumbing fixture connection schedule shown on the Drawings. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by manufacturer, or required for complete installation. Where more than one type is indicated, selection is installer's option; but, fixtures of same type must be furnished by a single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.
- D. Provide fixtures complete with fittings, supports, fastening devices, bolt caps, faucets, valves, traps, stops and appurtenances.

- E. Plumbing Fixture Thermostatic Mixing Valves:
1. Lavatories provide ASSE 1070 compliant mixing valves or multiple lavatories served by a single ASSE 1070 compliant mixing valve.
 2. Sinks serviced with a single ASSE 1070 mixing valve or multiple sinks served by a single ASSE 1070 mixing valve.
 3. Commercial kitchen handsinks provide ASSE 1070 mixing valves.
 4. Janitor sinks or process/maintenance type sinks do not require ASSE 1070 mixing valves if operated by trained personnel. Provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.
 5. Hot water hose bibbs do not require ASSE 1070 mixing valves if operated by trained personnel. Provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.

2.03 CARRIERS

- A. Wall Hung Water Closets:
1. Vertical: Zurn Z-1204-N4-XH-50 or Z-1204-ND4-XH-50 (JR Smith 230y-MS4-M12/230DY-M54-M12). Adjustable vertical load siphon jet with 300 lb. capacity.
 2. Horizontal: Zurn ZE-1203-N4-XH-50 or ZE-1203-ND4-XH-50 (JR Smith 220 R/L-Y-M54-M12/220DY-M5-M12). Adjustable horizontal siphon jet with 300 lb. load capacity.
- B. Wall Hung Urinal: Zurn Z-1218-WS. (JR Smith 637). Coupling type or plate type with bearing plate 200 lb. capacity.
- C. Wall Hung Lavatory: Zurn Z-1231 (D). (JR Smith 700). Concealed arm, 250 lb. capacity.
- D. Wall Hung Service Sink: Zurn Z-1218. (JR Smith 913/914). Coupling type. 300 lb. capacity.
- E. Wall Hung Drinking Fountain: Zurn Z-1225-BL (JR Smith 834-97-98). Plate type. 300 lb. capacity.
- F. 750 lb. Carrier for Water Closet:
1. Adjustable vertical type.
 2. Adjustable horizontal type.

2.04 DRINKING FOUNTAINS

- A. See Schedule on Drawings for type.

2.05 ELECTRIC WATER COOLERS

- A. See Schedule on Drawings for Type.

2.06 FIXTURE TRIM

- A. Traps: Provide heavy duty commercial grade traps on fixtures except fixtures with integral traps. Exposed traps will be chromium plated cast brass or 17 gauge chromium plated brass tubing.
1. Sink: McGuire 8912-C-DF.
 2. Lavatory: McGuire 8902-C-DF.
- B. Supplies and Stops: Lead free heavy duty commercial grade, chrome plated with brass stems. Stops: Loose Key type.
1. Lavatory: McGuire LFH 2165 CK
 2. Sink: McGuire LFH 2167 LK
 3. Water Closets: McGuire
- C. Lavatory Grid Strainer: McGuire 155A.
- D. Sink Grid Strainer: McGuire 152N.
- E. Shower Grid Strainer: McGuire 1266.
- F. Sink Basket Strainer: McGuire 151.

- G. Trim barrier-free wrap for P-traps and supplies by McGuire, Pro-Wrap, Plumberex or True-bro.
- H. Escutcheons: McGuire wrought brass deep bell.
- I. Wax Rings and Toilet Bolts: WM Harvey No Seep No. 1 053065-N.

2.07 FLUSHOMETERS - WATER CLOSET/URINAL

- A. See Schedule on Drawings for types.

2.08 WATER CLOSET SEATS

- A. See Schedule on Drawings for type.

2.09 STAINLESS STEEL DRAINAGE FITTINGS

- A. Austenitic Stainless Steel of Material type (304/316) & gauge as listed in the plumbing fixture schedule.

PART 3 - EXECUTION

3.01 GENERAL PLUMBING FIXTURE INSTALLATION INFORMATION

- A. Verification of Conditions:
 - 1. Examine rough-in work of water supply and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures.
 - 2. Examine walls, floors and cabinets for suitable conditions where fixtures are to be installed.
 - 3. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings and pertinent codes and regulations, design and referenced standards.
 - 4. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.
 - 5. Install a stop valve in a readily accessible location in water connection to each fixture.
 - 6. Install escutcheons at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
 - 7. Seal fixtures to walls and floors using silicone sealant Dow Corning No. 780 or approved equivalent. Match sealant color to fixture color.
 - 8. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.
 - 9. Inspect each unit for damage prior to installation. Replace damaged fixtures.
 - 10. Replace washers or cartridges of leaking or dripping faucets and stops.
 - 11. Clean fixtures, trim and strainers using manufacturer's recommended cleaning methods and materials.
 - 12. During construction, cover installed fixtures, drains, sinks and water coolers with cardboard and wrap with sheet plastic.
 - 13. Provide trap primers for floor drains, floor sinks, trench drains and hub drains.
 - 14. Install roof and overflow roof drains per architectural details. Cover drains during roof construction to protect drain. Provide offsets or expansion joints at each roof/overflow drain.
 - 15. Do not use lead flashing.
- B. Owner Furnished Equipment:
 - 1. Rough-in and make final connections to Owner furnished equipment. Provide necessary items to complete installation.

2. Comply with requirements of this Section and Drawings for installation procedures.
- C. Adjusting and Cleaning: Clean plumbing fixtures, trim, and strainers of dirt and debris upon completion of installation. Adjust water pressure at drinking fountains, faucets, shower valves and flush valves to provide proper flow stream and specified GPM. Repair leaks at faucets and stops.
- D. Extra Stock: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner.
- E. Field Quality Control: Upon completion of installation of plumbing fixtures, test fixtures to demonstrate capability and compliance with Specifications. Correct or replace malfunctioning units at site, then retest to demonstrate compliance.
- F. Protection: Protect fixtures and equipment from damage. Cover finished fixtures with cardboard and sheet plastic. Fixtures are not to be used during construction. Replace damaged items with new.
- G. Signage: For fixtures that do not have ASSE 1070 mixing valve protection for hot water temperature, provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.

3.02 CARRIERS INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.
- C. Coordinate wall thickness so carrier has adequate depth to be concealed.

3.03 DRINKING FOUNTAIN INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

3.04 ELECTRIC WATER COOLER INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

3.05 FIXTURE TRIM INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

3.06 FLUSHOMETERS - WATER CLOSET/URINAL INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

3.07 WATER CLOSET SEAT INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

3.08 STAINLESS STEEL DRAINAGE FITTINGS

- A. Install components in accordance with manufacturers instructions and approved product data submittals.
- B. Set plumb, level and flush to surrounding surfaces unless specifically noted otherwise.
- C. As applicable install clamping devices-flanges to receive surface finish products (flooring, membranes etc.).

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES