

DIVISION 22**PLUMBING**

22 00 00	Plumbing Basic Requirements
22 05 13	Common Motor Requirements for Plumbing Equipment
22 05 16	Expansion Fittings and Loops for Plumbing Piping
22 05 19	Plumbing Devices
22 05 23	General-Duty Valves for Plumbing Piping
22 05 29	Hangers and Supports for Plumbing Piping and Equipment
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SECTION 22 00 00
PLUMBING BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 DESIGN-BUILD SUMMARY OF WORK

- A. Work included in 22 00 00 applies to Division 22, Plumbing work to provide materials, labor, tools, permits and incidentals to make plumbing systems ready for Owner's use for proposed project.

1.02 DESIGN-BUILD INSTRUCTIONS

- A. This document is issued to give Bidders a basis for preparing a proposal to design and install a complete plumbing system for this project.
- B. Alternates to this Document may be offered as a separate proposal.
- C. Bidder to submit the following information with the Proposal:
 - 1. Preliminary drawings indicating areas of work and general scope within areas referenced.
 - 2. Description of systems, manufacturer and method of control.
 - 3. List of materials proposed for systems which are applicable to this project.
 - 4. Any other information which the bidder considers pertinent in evaluating the proposal.

1.03 DESIGN-BUILD DESIGN APPROACH

- A. Use this Specification as a guide for design/engineering requirements, workmanship and materials or construction. Utilize design-build concept throughout construction phase of project.
- B. Investigate and be apprised of applicable codes, rules, and regulations as enforced by Authority Having Jurisdiction (AHJ).
- C. Visit the Site of the proposed construction. Verify and inspect the existing site to determine conditions that affect this work.

1.04 DESIGN-BUILD DESIGN CRITERIA/CALCULATIONS

- A. Related Work Specified Elsewhere:
 - 1. Contents of Section apply to Division 22 Specifications.
 - 2. Requirements of Section are a minimum for Division 22 Sections, unless otherwise stated in each Section, in which case that Section's requirements take precedence.
- B. Facility Fuel Systems Criteria:
 - 1. Refer to Section 23 11 23, Facility Fuel - Natural Gas Piping and Systems.
- C. Design Criteria:
 - 1. Size waste, water and vent piping in accordance with State Plumbing code and local jurisdiction requirements.
 - 2. Waste piping to be routed at 1/4-inch per foot unless specifically noted otherwise. Obtain approval from local authorities for piping, with slope less than 1/4 per foot.
 - 3. Size domestic water piping with a maximum pressure drop of 2 PSI per 100 feet and a maximum velocity of 6 feet per second for hot and cold water. For hot water return calculate maximum velocity no greater than 4 ft/second.
 - 4. Provide rough-in and connections for waste, water and vents for fixtures. Coordinate actual location of rough-in with Contractor and Architect.
 - 5. Connect storm drain piping from roof drains or gutters to site storm piping. See Architectural and Civil Drawings for locations. Coordinate exact location of site piping.
 - 6. Provide cold water valved tap as required. Minimum 3/4-inch service. Provide ball valve in branch piping. Connect fixtures shown to main waste, water and vent systems.
- D. Calculations:
 - 1. Submit the following Plumbing Calculations:
 - a. Water Sizing Calculations
 - b. Sanitary Drainage Calculations
 - c. Structural Calculations for Seismic Bracing of Plumbing Equipment and Piping

- d. Structural calculations to be signed by a registered Engineer in the State of Oregon.
- E. Existing systems testing:
 - 1. Test and confirm all existing equipment, devices and fixtures operate correctly. Assess repair or replacement values/costs and present findings for Owner review and direction.

1.05 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 representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.06 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

1.07 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. CISPI - Cast Iron Soil Pipe Institute
 - 15. ETL - Electrical Testing Laboratories
 - 16. EPA - Environmental Protection Agency
 - 17. FM - FM Global
 - 18. IAPMO - International Association of Plumbing and Mechanical Officials
 - 19. GAMA - Gas Appliance Manufacturers Association
 - 20. HI - Hydraulic Institute Standards
 - 21. ISO - International Organization for Standardization
 - 22. MSS - Manufacturers Standardization Society
 - 23. NEC - National Electric Code
 - 24. NEMA - National Electrical Manufacturers Association
 - 25. NFGC - National Fuel Gas Code
 - 26. NFPA - National Fire Protection Association
 - 27. NRCA - National Roofing Contractors Association
 - 28. NSF - National Sanitation Foundation
 - 29. OSHA - Occupational Safety and Health Administration
 - 30. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
 - 31. TEMA - Tubular Exchanger Manufacturers Association
 - 32. TIMA - Thermal Insulation Manufacturers Association
 - 33. UL - Underwriters Laboratories Inc.
- D. See Division 22, Plumbing individual Sections for additional references.
- E. 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.
- F. 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.
- 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.

1.08 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. For electronic format, provide one zip file per specification division containing a separate file 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 Section 22 05 48, Vibration and Seismic Controls for Plumbing Piping and Equipment. 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, Owners Instructions:
 - a. Submit, at one time, electronic files (PDF format) on CD/DVD 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 air 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 CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.
 - d. Provide Invert elevations and dimensioned locations for water services, building waste, and storm drainage piping below grade extending to 5-feet outside building line.
 - e. See Division 22, Plumbing individual Sections for additional items to include in record drawings.

1.09 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State, Federal and other applicable laws and regulations.
- B. 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.

- C. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- D. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- E. Provide products that are UL listed.
- F. 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.
- G. 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.

1.10 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.

1.11 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.

1.12 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. Provide like items from one manufacturer, including but not limited to fixtures, pumps, drains and equipment.

2.02 MATERIALS

- 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. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.
- C. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- D. 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 two keys for each set of keyed cylinder type locks.
 - 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 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, 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.

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 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 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).

3.13 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

3.14 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.

3.15 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.

3.16 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 13**COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT****PART 1 - GENERAL****1.01 SUMMARY**

- A. Work Included:
 - 1. General Motor Construction and Requirements

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. NEMA Premium Efficiency
 - 2. Energy Policy Act (EPACT), latest applicable version(s) for minimum motor efficiencies.

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. General Motor Construction and Requirements:
 - 1. Lincoln Motors
 - 2. Century Electric Motors (formerly A.O. Smith Electrical Products)
 - 3. Baldor Electric (Reliance Electric)
 - 4. General Electric
 - 5. Toshiba
 - 6. Exceptions: Motors integral to equipment efficiency listing (EER, COP, etc.) per listing agency.
 - 7. Or approved equivalent.

2.02 GENERAL

- A. Electrical components and materials to be UL to ETL listed/labeled as suitable for location and use.
- B. Wiring installed in conduit.

2.03 GENERAL MOTOR CONSTRUCTION AND REQUIREMENTS

- A. Electrical Service: Power wiring from source to motor termination under Division 26, Electrical. Coordinate location of disconnect and starter or motor controller. Combination starter/disconnects may be used in lieu of separate items.
- B. Electrical Service - Unless otherwise noted in the Contract Documents, the following voltage and phase characteristics apply to motors:
 - 1. Motors 1/2 HP and Under: 120 volt, 1 phase.
 - 2. Motors 3/4 HP and Over: 208 volt, 3 phase.
 - 3. Motors 3/4 HP and Over: 480 volt, 3 phase

- C. Construction:
 - 1. Open drip-proof type except where specifically noted otherwise.
 - 2. Design for continuous operation in 104 Degrees F environment.
 - 3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
 - 4. Built-in thermal overload protection or externally protected with separate over-load with low-voltage release or lock-out. Quick trip device on hermetically sealed motors.
 - 5. Service Factor: 1.15 for poly-phase motors. 1.25 for motors associated with shaft pressurization system fans. 1.35 for single phase motors.
 - 6. Noise Rating: Quiet.
 - 7. Efficiency: Provide premium efficiency motors.
 - 8. Motors used in Conjunction with Variable Speed Drives: Variable torque type matched for the full operating range of the variable frequency drive. As a minimum, motors to have Class F insulation, winding insulation rated for 1000 volts and insulated bearings to prevent high frequency ground path. Loads not-to-exceed 80 percent of nameplate rating
- D. Explosion-Proof Motors: UL approved and labelled for hazard classification with over temperature protection.
- E. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
- F. Wiring Terminations:
 - 1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Coordinate conductor sizes with Division 26, Electrical. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
 - 2. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.
- G. Unless otherwise indicated, motors 1-HP and larger to meet/exceed NEMA Premium Efficiency and latest EPACT.
- H. Vertical in-line pump motors per NEMA MG1, Motors and Generators.

PART 3 - EXECUTION

3.01 GENERAL

- A. Electrical Requirements:
 - 1. Contractor to Provide the Following:
 - a. Motors
 - b. Starters and disconnects that are integral parts of plumbing equipment as shown on the equipment schedules. Reference Drawings and subsequent Sections. Provide a working system. Coordinate with Division 26, Electrical.
 - c. Low Voltage and Electronic Control Devices
 - d. Low Voltage Transformers
 - e. Low Voltage Conduit and Wire and Connecting Devices
 - f. Conduit and wire for electronic devices, except for line voltage wiring.
 - 2. Electrical work listed above performed by a licensed electrical contractor or by the control manufacturer, but provided for and coordinated under Division 22, Plumbing work. In addition, controls work supervised and subsequently approved in writing by the control manufacturer.
 - 3. Contractor to furnish the following to the Electrical Contractor where applicable: Line voltage control equipment, including switches (except disconnects), time switches, transformers, relays, etc. (except those part of MCC).
 - 4. Include the Following Items under Division 26, Electrical Work:
 - a. Line voltage wire and conduit system.
 - b. Disconnects not provided with equipment.

- c. Installation of line voltage control equipment furnished under Paragraph 3.01.C.above.
- B. Electrical Interlocks: Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize mechanical equipment wiring diagrams to coordinate with the electrical systems so that proper wiring of the equipment involved is affected.
- C. Coordinate location of disconnect and starter or motor controller. Combination starter/disconnects may be used in lieu of separate items.
- D. Explosion-Proof Motors: UL approved and labeled for hazard classification, with over temperature protection.
- E. Unless otherwise indicated, motors 1-HP and larger to meet/exceed NEMA Premium Efficiency and latest EPACT.
- F. Check line voltage and phase and ensure agreement with nameplate.
- G. Verify motor rotation.
- H. Field Quality Control:
 - 1. Prepare for Acceptance Tests as Follows:
 - a. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
 - b. Test interlocks and control features for proper operation.
 - c. Verify that current in each phase is within nameplate rating.
 - 2. Testing: Perform the Following Field Quality-Control Testing:
 - a. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.
 - b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
 - a. Inspect field-assembled components, equipment installation, and piping and electrical connections for compliance with requirements.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - c. Verify bearing lubrication.
 - d. Verify proper motor rotation.
 - e. Test Reports:
 - 1) Prepare a written report to record the following test procedures used:
 - (a) Test results that comply with requirements.
 - (b) Test results that do not comply with requirements and corrective action taken to achieve compliance.
- I. Adjusting: Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.
- J. Cleaning:
 - 1. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
 - 2. Clean motors, on completion of installation, according to manufacturer's written instructions.

3.02 GENERAL MOTOR CONSTRUCTION AND REQUIREMENTS

- A. Motor Installation: Install in accordance with manufacturer's instructions. Coordinate with starter or variable speed controller with control sequence to provide necessary starter accessories.

END OF SECTION

SECTION 22 05 16**EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Work Included:
 - 1. Flexible Pipe Connectors, Copper Piping
 - 2. Flexible Expansion Loop (for Thermal and Seismic Applications), Copper Piping
 - 3. Expansion Joints, Two-Ply Bellows Type Copper Pipe

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. Include items listed below.

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. Flexible Pipe Connectors, Copper Piping:
 - 1. Mercer Rubber Company
 - 2. Metraflex Company
 - 3. Mason
 - 4. Hyspan
 - 5. Or approved equivalent.
- B. Flexible Expansion Loop (for Thermal and Seismic Applications), Copper Piping:
 - 1. Mercer Rubber Company
 - 2. Metraflex Company
 - 3. Mason
 - 4. Hyspan
 - 5. Or approved equivalent.
- C. Expansion Joints, Two-Ply Bellows Type Copper Pipe:
 - 1. Mercer Rubber Company
 - 2. Metraflex Company
 - 3. Mason
 - 4. Hyspan
 - 5. Or approved equivalent.

2.02 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

- A. Inner Hose: Bronze, close pitch, annular corrugated hose.
- B. Exterior Sleeve: Braided bronze (piping over 2-inches to be 3 pound braided stainless steel).
- C. Pressure Rating: 125 PSI at 70 degrees F with a 4 to 1 safety factor.
- D. Joint: Sweat ends.

- E. Size: Use pipe sized units.
- F. Maximum offset: 3/8-inch on each side of installed center line.
- G. Basis of Design: Metraflex Model BBS.

2.03 FLEXIBLE EXPANSION LOOP (FOR THERMAL AND SEISMIC APPLICATIONS) - COPPER PIPING

- A. Construction: Two flexible Sections of hose and braid, two 90 degree elbows and a 180 degree return designed so piping does not change direction, but maintains course along a single axis. Use Vee Loop where space is limited. System to import no thrust loads to system support anchors or building structure.
- B. Inner Hose: Bronze, close pitch, annular corrugated hose.
- C. Exterior Sleeve: Braided bronze.
- D. Pressure Rating: 125 PSI at 70 degrees F with a 4 to 1 safety factor.
- E. Joint: Sweat ends.
- F. Size: Use pipe sized units.
- G. Support: Center support at bottom of 180 degree return.
- H. Basis of Design: Metraflex Metraloop. Vee configuration Mason-Mercer VCPSB.

2.04 EXPANSION JOINTS - TWO PLY BELLOWS TYPE COPPER PIPE

- A. Construction: Laminated bellows ASTM A240 Type 321 stainless steel, copper tube ASTM B88, ASTM A240 Type 321 stainless steel housing and guide, anti torque device, limit stops, internal guides
- B. Working Pressure: 200 PSI.
- C. Maximum Temperatures: 500 degrees F.
- D. Maximum Compression: 2-inches.
- E. Maximum Extension: 1/2-inch.
- F. Joint: Sweat ends. ASME B16.22.
- G. Size: Use pipe sized units. Maximum 4-inch pipe.
- H. Basis of Design: Hyspan Model 8509, 8510.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Expansion/Contraction Fitting Installation:
 - 1. Install expansion/contraction fittings according to manufacturer's written instructions.
 - 2. Install expansion/contraction fittings in sizes matching pipe size in which they are installed.
 - 3. Align expansion/contraction fittings to avoid end-loading and torsional stress.
 - 4. Install in accordance with EJMA (Expansion Joint Manufacturer's Association) Standards.
 - 5. Wood structures: install expansion/contraction fittings and guides at every floor.
 - 6. Concrete structures: install expansion/contraction fittings and guides at interval spacing recommended by the manufacturers.
- B. Pipe Bend and Loop Installation:
 - 1. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
 - 2. Attach pipe bends and loops to anchors.
 - a. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code Section IX, "Welding and Brazing Qualifications."
 - b. Concrete Anchors: Attach by fasteners. Follow fastener manufacturer's written instructions.
- C. Swing Connections:

1. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
 2. Connect mains, risers and branch connections to equipment with at least four pipe fittings, including tee in riser.
- D. Guide Installation:
1. Install guides on piping adjoining expansion fittings and loops.
 2. Attach guides to pipe and secure to building structure.
- E. Anchor Installation:
1. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
 2. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.
 3. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.
 4. Install pipe anchors according to expansion fitting manufacturer's written instructions if expansion fittings are indicated.
 5. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.
- F. Painting:
1. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
 2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

3.02 FLEXIBLE PIPE CONNECTORS, COPPER PIPING

- A. See General Installation Requirements above.
- B. Install per manufacturers written recommendations and requirements.

3.03 FLEXIBLE EXPANSION LOOP (FOR THERMAL AND SEISMIC APPLICATIONS), COPPER PIPING

- A. See General Installation Requirements above.
- B. Install per manufacturers written recommendations and requirements.

3.04 EXPANSION JOINTS, TWO-PLY BELLOWS TYPE COPPER PIPE

- A. See General Installation Requirements above.
- B. Install per manufacturers written recommendations and requirements.

END OF SECTION

**SECTION 22 05 19
PLUMBING DEVICES**

PART 1 - GENERAL**1.01 SUMMARY**

- A. Work Included:
 - 1. Pressure Gauges
 - 2. Thermometers
 - 3. Water Hammer Arrestors (Shock Absorbers)
 - 4. Trap Primers

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. Pressure Gauges:
 - 1. Dwyer Instruments, Inc.
 - 2. Moeller Instrument Co., Inc.
 - 3. Omega Engineering, Inc.
 - 4. Terice
 - 5. Or approved equivalent.
- B. Thermometers:
 - 1. Ashcroft
 - 2. Terice
 - 3. Weiss
 - 4. Marshalltown
 - 5. Weksler
 - 6. Or approved equivalent.
- C. Water Hammer Arrestors (Shock Absorbers):
 - 1. Bellows Type:
 - a. Amtrol
 - b. J.R. Smith
 - c. Wade
 - d. Zurn
 - e. Or approved equivalent.
 - 2. Piston Type:
 - a. PPP
 - b. Sioux Chief

c. Or approved equivalent.

D. Trap Primers:

1. Wade
2. Zurn
3. J.R. Smith
4. PPP
5. Or approved equivalent.

2.02 PRESSURE GAUGES

A. Pressure Gauges: ASME B40.100, phosphor-bronze bourdon type, dry type.

1. Case: Cast aluminum, stem-mounted, flange less.
2. Size: 4-1/2-inch diameter.
3. Window: Clear glass.
4. Connector: Brass.
5. Scale: White aluminum with black graduation and markings.
6. Pointer: Black, adjustable.
7. Mid-Scale Accuracy: One percent.
8. Scale: PSI and KPa.
9. Basis of Design: Trerice Model 600CB.

2.03 THERMOMETERS

A. Thermometers - Adjustable Angle: Red or blue appearing organic liquid in glass, ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 9-inch scale.
2. Window: Acrylic.
3. Scale: Aluminum, white background, black graduations and markings.
4. Stem: 3/4-inch NPT brass (aluminum for installation in air ducts).
5. Accuracy: 2 percent, per ASTM E 77.
6. Calibration: 0-160 with 2 Degrees F graduations.
7. Basis of Design: Trerice BX9.

2.04 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

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

2.05 TRAP PRIMERS

- A. Trap automatic primer valve with integral anti siphon protection. Code approval required.
- B. Flush valve tail-piece trap primer. PPP FVP-1VB.
- C. Electronic trap seal automatic primer valve with integral anti siphon protection and timer. Coordinate quantity, locations and voltage characteristics for control points.
- D. Trap seal primer valve (low lead) with integral automatic anti-siphon protection. The priming valve to discharge on both pressure drop and pressure spike. PPP CPO 500.

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, General Plumbing Requirements for additional requirements.
- B. Temperature Gauges:

1. Install in vertical upright position, tilted so as to be easily read at floor.
 2. Thermometer Wells: Install in piping in vertical upright position. Fill well with oil or graphite, secure cup.
- C. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- D. Install per manufacturer recommendations.

3.02 PRESSURE GAUGES

- A. Install pressure gauge where exposure to heat and vibration are minimal and where the dial can be easily read. It is also important to install the gauge in a location with undisturbed and continuous flow of the pressure medium.
- B. Provide a needle valve or gauge cock, installed between the process and the pressure gauges.
- C. General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position, visible from floor.
- D. Locations: Install in the following locations, and elsewhere as indicated.
1. At each pump inlet and outlet.
 2. At inlet and discharge of each pressure reducing valve.
 3. At make-up water service outlets.
- E. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- F. Pressure Gauge Range/Graduations:

System	Pressure (PSI)	Graduations (PSI)
Cold Water	0-100	1
Hot Water	0-100	1
Compressed Air	0-160	1

- G. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- H. Install per manufacturer recommendations.

3.03 THERMOMETERS

- A. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2-inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- B. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- C. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- D. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- E. Thermometer Range/Graduations:

System	Temperature (Degrees F)	Graduations (Degrees F)
Cold Water	25-125	1
Hot Water	30-240	2

- F. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- G. Install per manufacturer recommendations.

3.04 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

- A. Water Hammer Arrestors: Install in upright position, in locations and of sizes in accordance with PDI WH-201, and elsewhere as indicated.
- B. Locate shock absorbers in supply pipe in accordance with recommendations of Plumbing and Drainage Institute PDI-WH201. 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.

3.05 TRAP PRIMERS

- A. Flush supply line prior to installation.
- B. Install valve plumb using caution to not over tighten. Tightening to more than 55 ft. lbs. can damage valve and void the warranty. Do not wrench on hex.
- C. Effective operating range 20 to 80 PSIG (138 to 552 kPa).
- D. Do not subject trap primer valve to pressure in excess of 125 PSI.

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. Balancing Valves
 - 3. Ball Valves
 - 4. Swing Check Valves
 - 5. Backflow Prevention Assemblies
 - 6. Pressure Regulating Valve-Domestic Water
 - 7. Thermostatic Master Mixing Valves (ASSE 1017 Rated)
 - 8. 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.
- 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. Stockham
 20. Tour Anderson
 21. Wade
 22. Watts
 23. Wilkins
 24. Zurn
 25. Or approved equivalent.
- C. Balancing Valves:
1. Caleffi
 2. Griswold
 3. Hays
 4. Armstrong CBV
 5. Tour Anderson
 6. Or approved equivalent.
- D. Ball Valves:
1. See Valves General above.
 2. NSF Valves:
 - a. Clow
 - b. Kennedy
 - c. Nibco
 - d. Or approved equivalent.
- E. Swing Check Valves:
1. See Valves General above.
- F. Backflow Prevention Assemblies:
1. Backflow Preventers:
 - a. Apollo
 - b. Cla-Val
 - c. Conbraco
 - d. Watts
 - e. Or approved equivalent.
 2. Backflow Prevention Assemblies - Reduced Pressure Zone Backflow Preventer (RPBP) for High Hazard Applications - 2-inches and Smaller:
 - a. Febco 860-with 650A.
 - b. Conbraco 40-210-AGD.
 - c. Wilkins 375-XL-SAG.
 - d. Watts 919-QT-S valve with 919AGC or 919AGF.
 - e. Or approved equivalent.
 3. Backflow Prevention Assemblies - Reduced Pressure Zone Backflow Preventer (RPBP) for High Hazard Applications - 2-1/2-inches and Larger:
 - a. Febco 860 with 758A.
 - b. Conbraco Apollo 40-700 with 758A.
 - c. Watts 909-S-NFA-NRS with AGC.
 - d. Wilkins 375-FSC.
 - e. Or approved equivalent.

4. Backflow Prevention Assemblies - Double Check Valve Assembly (DCVA) for Low Hazard Applications - 2-inches and smaller:
 - a. Febco 850-650A
 - b. Conbraco Apollo 40-110-T2
 - c. Watts 007-QT-FDA-S
 - d. Wilkins 350-S-XL
 - e. Or approved equivalent.
5. Backflow Prevention Assemblies - Double Check Valve Assembly (DCVA) for Low Hazard Applications - 2-1/2-inches and larger:
 - a. Conbraco Apollo 45-11-1
 - b. Watts 709-DCDA with 77F-01-FDA-12
 - c. Or approved equivalent.
6. Spill Resistant Pressure Vacuum Breaker:
 - a. Febco
 - b. Conbraco
 - c. Watts
 - d. Wilkins
 - e. Or approved equivalent.
7. Atmospheric Vacuum Breakers:
 - a. Febco
 - b. Conbraco
 - c. Watts
 - d. Wilkins
 - e. Or approved equivalent.
- G. Pressure Regulating Valve-Domestic Water:
 1. Cash Acme
 2. Cla-Val
 3. Watts
 4. Wilkins
 5. Or approved equivalent.
- H. Thermostatic Master Mixing Valves (ASSE 1017 Rated):
 1. Holby Tempering Valve
 2. Lawler Series 66
 3. Leonard Type TM
 4. Powers LFMM430 (Lead Free)
 5. Symmons Temp Control Series 5
 6. Or approved equivalent.
- I. 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.
 4. Check Valves: Swing.

2.03 BALANCING VALVES

- A. Maximum 125 PSIG System Working Water Pressure.
- B. Manual Set Balancing Valves:
 1. Valves are to be of the "Y" pattern, equal percentage globe-style and provide three functions:
 - a. Precise flow measurement.
 - b. Precision flow balancing.
 - c. Positive drip-tight shut-off.
 2. Valve to provide multi-turn, 360 degree adjustment with micrometer type indicators located on the valve handwheel. Valves have a minimum of five full 360 degree handwheel turns. 90 degree circuit-setter style ball valves are not acceptable. Valve handle to have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valves to be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi to have two 1/4-inch threaded brass metering ports with check valves and gasketed caps located on the inlet side of the valve. Valves to be furnished with flow smoothing fins downstream of the valve seat and integral to the forged valve body to make the flow more laminar. The valve body, stem and plug to be brass. The handwheel to be high-strength resin.
 3. 2-1/2-inch and Larger: Valves are to be of the "Y" pattern, equal percentage globe-style and provide three functions:
 - a. Precise flow measurement.
 - b. Precision flow balancing.
 - c. Positive drip-tight shut off. Valve to provide multi-turn, 360 degree adjustment with micrometer type indicators location on the valve handwheel. Valves to have a minimum of five full 360 degree handwheel turns. 90 degree circuit-setter style ball valves are not acceptable. Valve handle to have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valve body to be either cast iron with integrated cast iron flanges (2-1/2-inch to 12-inch) or ductile iron with industrial standard grooved ends (2-1/2-inch to 12-inch). Valve stem and plug disc to be bronze with handwheel that permits multi-turn adjustments. Sizes 2-1/2-inch and 3-inch - five turns, sizes 4-inch to 6-inch - 6 turns, sizes 8-inch to 10-inch - 12 turns and size 12-inch - 14 turns. Flange adapters to be provided to prevent rotation.

2.04 BALL VALVES

- A. All ball valves on brazed piping are to be three-piece.
- B. 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, brass or

stainless steel ball, Teflon seat, brass stem, extended steel handle. Apollo 82-100/82A 140 Series three-piece.

- C. 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, brass or stainless steel ball, Teflon seat, brass stem, extended steel handle. Apollo 77 CLF 100 Series two-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.

2.05 SWING CHECK VALVES

- A. 2-inches and Smaller: Class 125, bronze body, horizontal swing, regrinding type, Y-pattern, renewable disc. Nibco 413. MSS SP-80.
- B. 2-1/2-inches and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends. Nibco F918. MSS SP-71.
- C. Rubber Flapper Check Valve: Horizontal or vertical upward flow installation. Working pressure to 175 PSI. Ductile iron or cast iron body. Steel reinforced Buna-N rubber flapper epoxy coating on wetted parts. MSS SP-80.

2.06 BACKFLOW PREVENTION ASSEMBLIES

- A. General: Assemblies model numbers listed below are for general comparison. Project specific model numbers to be verified contractor as approved by jurisdiction where project is located.
- B. Reduced Pressure Zone Backflow Preventer (RPBP) for High Hazard Applications:
 - 1. 2-inches and Smaller: Assembly consists of shutoff ball valves in inlet and outlet, and strainer on inlet. Assemblies include test cocks and pressure-differential relief valve located between two positive seating check valves and comply with requirements of ASSE Standard 1013 and AWWA C511. Bronze construction, threaded ends, stainless steel internal parts, FDA strainer, and air gap fitting. Route pipe from air gap fitting to approved waste receptor.
 - 2. 2-1/2-inches and Larger: Assembly consists of shutoff OS&Y gate valves in inlet and outlet, and strainer on inlet. Assemblies include test cocks and pressure-differential relief valve located between two positive seating check valves and comply with requirements of ASSE Standard 1015 and AWWA C511. Epoxy coated cast iron body construction, flanged ends, stainless steel internal parts, bronze seats, and FDA strainer.
- C. Double Check Valve Assembly (DCVA) for Low Hazard Applications:
 - 1. 2-inches and Smaller: Assembly consists of shutoff ball valves in inlet and outlet, and FDS strainer on inlet. Assemblies include test cocks and two positive seating check valves and comply with requirements of ASSE Standard 1015 and AWWA C510. Bronze construction, threaded ends, and stainless steel internal parts.
 - 2. 2-1/2-inches and Larger: Assembly consists of shutoff OS&Y gate valves in inlet and outlet, and strainer on inlet. Assemblies include test cocks and two positive seating check valves and comply with requirements of ASSE Standard 1015 and AWWA C510. Epoxy coat cast iron body construction, strainer flanged ends, and stainless steel internal parts.
- D. Spill Resistant Pressure Vacuum Breaker: Watts Model 800MCQT with 777S "Y" strainer.
- E. Atmospheric Vacuum Breaker: Assembly consists of a bronze vacuum breaker body with silicone disc, and full size orifice. Device to be IAPMO listed, meet ASSE standard 1001, and ANSI standard A113.1.1 rough chrome plate finish.

2.07 PRESSURE REGULATING VALVE-DOMESTIC WATER

- A. Water: Bronze body, diaphragm or piston type, spring actuated, with separate or integral stainless steel strainer, pressure range to suit conditions, approved for potable water use, low lead. Provide shutoff valves, pressure relief valves, unions, drain valve and bypass.
- B. Water: Automatic control pressure regulating valve, stainless steel seat, stem and spring, diaphragm actuated with brass body, hydraulic control pilots with effluent operating temperature range 32 degrees F to 180 degrees F, FDA and AWWA approved.

- C. Water: Bronze body construction, stainless steel strainer screen, thermal expansion bypass with renewable stainless steel seat and high temperature resisting diaphragm.

2.08 THERMOSTATIC MASTER MIXING VALVES (ASSE 1017 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 1017.
- 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.
- C. Flow from the tempered water circulating pump to be split to mixing valve and building hot water heating system.

2.09 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 BALANCING VALVES

- A. See General Installation Requirements above.
- B. Install with flow in the direction of the arrow on the valve body and installed at least five pipe diameters downstream from any fitting, and at least ten pipe diameters downstream from any pump. Two pipe diameters downstream from the balancing valve should be free of any fittings. When installed, easy and unobstructed access to the valve handwheel and metering ports for adjustment and measurement are to be provided. Mounting of valve in piping must prevent sediment build-up in metering ports.

3.03 BALL VALVES

- A. See General Installation Requirements above.

3.04 SWING CHECK VALVES

- A. See General Installation Requirements above.
- B. Swing Check Valve Installation: Install in horizontal position with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow. Only install where there are 10 pipe diameters of straight pipe upstream of valve.
- C. Ejector and Sump Pump-Discharge Check Valves:
 - 1. 2-inches and Smaller: Bronze swing or spring-loaded lift check valves with bronze disc.
 - 2. 2-1/2-inches and Larger: Rubber flapper swing check valves with lever and weight.
- D. Domestic Water and Circulation Pump Discharge Check Valves:
 - 1. 2-inches and Smaller: Bronze body, spring loaded, lead free, lift check.
 - 2. 2-1/2-inches and Larger: Wafer style, silent lift check valve, lead free.

3.05 BACKFLOW PREVENTION ASSEMBLIES

- A. See General Installation Requirements above.
- B. Install where indicated, and where required by code. Where practical, locate in same room as equipment being protected.
- C. Submit product cut sheets to local AHJ for approval prior to purchase and installation.
- D. Install as close to wall as possible with clearances for access and maintenance as required by AHJ.
- E. Coordinate exact location of installation and type of backflow device serving a particular piece of equipment with AHJ and Architect prior to purchase and installation.
- F. Provide wall/floor brackets that are of fully welded, hot dipped galvanized construction, fabricated to meet field conditions. Mount backflow preventer to brackets using cadmium plated "U" type bolts and nuts.
- G. Contact local water district/backflow specialist and request backflow installation requirements. Install backflow devices per UPC and local water district/backflow specialist requirements.
- H. Route waste piping from air gap waste fitting concealed within walls to point of air gap termination at indirect waste receptor.
- I. Follow local codes for installation requirements. Pipe lines should be thoroughly flushed to remove foreign material before installing the unit. Provide a strainer ahead of backflow preventer to prevent disc from unnecessary fouling. Install valve inline with arrow on valve body pointing in the direction of flow. It is important that the valve be easily accessible to facilitate testing and servicing. Do not install in a concealed location.

3.06 PRESSURE REGULATING VALVE-DOMESTIC WATER

- A. See General Installation Requirements above.
- B. Install valve in the line with arrow on valve body pointing in the direction of flow. This valve should be installed where it is accessible with sufficient clearance for cleaning, service or adjustment. Install the reducing valve when possible before a sill cockline if possible. Before installing the reducing valve hose bibb, flush out the line to remove loose dirt and scale which might damage valve disc and seat.
- C. Horizontal installation is recommended. However, valve can be installed in a vertical position. Regulator must be installed in an accessible location to facilitate servicing the regulator.
- D. To readjust reduced pressures, loosen adjusting screw nut and turn adjusting screw clockwise to raise reduced pressure and counterclockwise to lower reduced pressure.
- E. When reducing valve is used, it makes a closed system; therefore, pressure relief protection must be provided on the downstream side of the reducing valve to protect equipment.
- F. Provide pressure relief valve and terminate discharge to indirect waste receiver.
- G. Anytime a reducing valve is adjusted, the use of a pressure gauge is recommended to verify correct pressure setting. Do not bottom out adjusting screw or spring cage.
- H. Provide inlet and outlet ball valves, and globe valve bypass. Provide pressure gauge on valve outlet.
- I. Provide pressure relief valve piped full size to indirect waste receiver or floor drain.
- J. Provide factory startup on automatic control valves.

3.07 THERMOSTATIC MASTER MIXING VALVES (ASSE 1017 RATED)

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

3.08 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. Flashing
 - 5. 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.

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. See Section 22 05 48.
- F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment. See Section 22 05 48.

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. Flashing:
 - 1. Fastenal
 - 2. Or approved equivalent.
- E. 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:
 - 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.
 - 6. Channel Type Pipe Hanging System: Framing members No. 12 gauge formed steel channels, 1-5/8-inch square, conforming to ASTM A570 GR33; one side of channel to have a continuous slot with in-turned lips; framing nut with grooves and spring 1/2-inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A307; fittings conforming to ASTM A575; parts enamel painted or electro-galvanized.
- 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. Riser Clamps:
1. Steel, UL listed. MSS Type 8.
- K. Plumbers Tape:
1. Not permitted as pipe hangers or pipe straps.
- L. 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.

M. Freestanding Roof Pipe Supports:

1. Polyethylene high-density U.V. resistant quick "pipe" block with foam pad.
2. Recommended installation is for pipe blocks to be freestanding.
3. Piping 3-inches and larger mounted on block type supports.

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 FLASHING

- A. Steel Flashing: 26 gauge galvanized steel.
- B. Safes: 8 mil thick neoprene.
- C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.
- D. Provide hot dipped galvanized components for items exposed to weather.

2.06 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. Pipe Guides:
 - a. Install on continuous runs where pipe alignment must be maintained. Provide a minimum of two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides to pipe structure. Any contact with chilled water pipe should not permit heat to be transferred in sufficient quantity to cause condensation on any surface.
 - b. Install approximately 4 pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Do not use as supports. Provide in addition to other required pipe hangers and supports.
 - 8. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field -fabricated, heavy-duty trapezes.
 - a. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - b. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1
 - 9. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers.
 - 10. 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.
 - 11. Do not support piping from other piping.
 - 12. Fire protection piping will be supported independently of other piping.

13. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.
 14. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.
 15. 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.
 16. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
 17. 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.
 18. 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 39 protection saddles, if insulation without a vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 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. 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.
 - d. 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.
 - 3) NPS 5 and NPS 6 (DN125 and DN150): 18-inches long and 0.06-inch thick.
 - 4) NPS 8 to NPS 14 (DN200 to DN350): 24-inches long and 0.075-inch thick.
 - 5) NPS 16 to NPS 24 (DN400 to DN600): 24-inches long and 0.105-inch thick.
 - e. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
 - f. Insert Material: Length at least as long as protective shield.
 - g. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
 19. Equipment Clearances: Do not route equipment or piping through electrical rooms, transformer vaults, elevator equipment rooms, IT rooms, MPOE 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.
 20. 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. Pipe Curb Assemblies:
1. Provide prefabricated units for roof membrane and insulation penetrations related to equipment. Coordinate with roofing system. Set supports on the structural deck. Do not set supports on insulation or roofing. Provide level supports by prefabricated pitch built into the curb.
 2. Pipe Curb Assemblies: Provide for piping and electrical conduit which penetrates the structural roof deck to service equipment above the roof level (i.e., piping, electrical power and control wiring). Meet requirements of roof warranty.

3. Piping above roof to be supported with freestanding roof pipe supports unless detailed otherwise. At roofing applications, the adhesion mastic is to be specifically submitted to and approved by the roofing system manufacturer/installer to maintain the integrity of all warranties.
 4. At concrete floors, install a polyurethane mastic to the support block and adhere in place.
- C. 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. Provide structural steel supports at the base of pipe risers. Size supports to carry forces exerted by piping system when in operation.
- D. 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. Anchor Bolts:
1. General: 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.
- B. Pipe Anchors:
1. General: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.
- C. Building Attachments:
1. Install within concrete or on structural steel or wood. Attachment to Wood Structure: Provide MSS Type 34 for attachment to wooden beam or approved attachment for a wood structure.

2. 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.
 3. 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.
- D. Bolting:
1. General: 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.
- E. 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.
- F. 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.
- G. 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.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- I. 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.
- J. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- K. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.
- L. Testing:
1. Powder-Actuated Inserts: Test powder-actuated insert attachments with a minimum load of 100 pounds.

3.05 FLASHING

- A. Flash and counterflash where piping passes through weather or waterproofed walls, floors and roofs.
- B. Flash vent soil pipes with flashings per Division 01, General Requirements.
- C. Flash floor drains over finished areas and roof drains, 10-inches clear on sides, minimum 36-inches x 36-inches sheet size. See Division 01, General Requirements. Fasten flashing to drain with clamping device.
- D. Install built up fixtures (mop sinks, shower stalls, shower floors) with water sealing systems/membranes to meet Code and as prescribed by Division 01, General Requirements and Section 22 00 00, Plumbing Basic Requirements. Meet all Code testing requirements.

Provide drainage devices with appropriate flanges, clamps, etc. to meet these installation requirements and ensure a water-tight installation.

3.06 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.
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 05 48**VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT****PART 1 - GENERAL****1.01 SUMMARY**

- A. Work Included:
 - 1. Vibration Isolation

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.
 - 1. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
 - 2. Section 22 30 00 - Plumbing Equipment

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. Vibration Isolation:
 - a. Except for packaged equipment with integral isolators, single manufacturer will select and furnish isolation required.
 - b. Deflections indicated will be minimum actual static deflections for specific equipment supported.
 - c. Isolator Stability:
 - 1) Size springs of sufficient diameter to maintain stability of equipment being supported with minimum horizontal to vertical stiffness ratio not less than 1:1. Spring diameters will be not less than 0.8 of the compressed height at rated load.
 - 2) Springs will have minimum additional travel to solid equal to 50 percent of the rated deflection.
 - 3) Springs will support 200 percent of rated load when fully compressed without deformation or failure.
 - d. Maximum Allowable Vibration Levels: Peak vibration velocities not to exceed 0.08 in/sec. correct equipment operating at vibration velocities that exceed this criteria.

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. Vibration Isolation:
 - 1. Amber-Booth.
 - 2. California Dynamics Corporation.
 - 3. Mason Industries, Inc.
 - 4. Kinetics Noise Control.
 - 5. Vibro-Acoustics.
 - 6. Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.

7. Or approved equivalent.

2.02 VIBRATION ISOLATION

- A. Type 1 - Neoprene Pad: Rubber or neoprene waffle pads, single layer, 5/16-inch thick with pattern repeating on 1/2-inch centers; 40 to 50 durometer hardness; maximum loading 50 PSI, 1/4-inch thick steel load distribution plate. Mason Type SWM.
- B. Type 2 - Neoprene Mount: Double-deflection type, with steel or ductile-iron housing containing two separate and opposing, oil-resistant rubber or neoprene elements, factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Minimum static deflection of 0.20-inches. Mason Type BR.
- C. Type 3 - Spring: Freestanding, laterally stable, open-spring isolators, factory drilled for bolting to structure and bonded to 1/4-inch thick rubber isolator pad attached to baseplate underside, mounts with leveling bolts. Mason Type SLFH.
- D. Type 4 - Spring with Restraints: Laterally stable, open-spring isolators, factory drilled for bolting to structure and bonded to 1/4-inch thick rubber isolator pad attached to baseplate underside; mounts with leveling bolts; steel or cast iron housing for directional seismic snubbing with resilient vertical-limit stops. Mason Type SLR or SSLFH.
- E. Type 5 - Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression; designed for 30-degree angular movement before hanger-rod misalignment without binding; seismic rebound washer; 1-inch minimum deflection. Mason Type PC30N.
- F. Seismic Snubbers: Directional interlocking steel members restrained by one-piece molded neoprene bushing, minimum of 3/4-inch thick with minimum 1/8-inch air gap in all directions, capable of withstanding 3 times the rated load capacity. Mason Type Z-1225.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General:
 - 1. Vibration isolators and seismic restraint systems must be installed in strict accordance with manufacturers written instructions and certified submittal data.
 - 2. Set floor-mounted equipment on 4-inch-high concrete housekeeping pads. Extend pad 6-inches beyond footprint of equipment in each direction.
 - 3. Provide mounts for equipment installed outdoors for wind loads of 30 lbs. psf applied to any exposed surface of isolated equipment.
 - 4. Do not install equipment or pipe which makes rigid contact with building slabs, beams, studs, walls, etc.
 - 5. Anchor baseplate to floor or structure. Provide rubber grommets and washers to isolate bolt from base plate. Under no circumstances will isolation efficiency be destroyed when bolting the isolators to floor.
 - 6. Building Penetrations: Isolate water piping penetrating wall, ceilings, floors or shafts from the structure by piping isolator or by 3/8-inch thick foamed rubber insulation. Install units flush with finished structure face, using one for each side as required. Cut units to length if longer than structure thickness. Caulk around pipe at equipment room wall.
 - 7. Pipe Hangers in Equipment Rooms: Support water and gas piping connected to rotating equipment within equipment rooms on spring and neoprene hangers. The first three hangers from a piece of vibrating equipment are to have a minimum of 1/2 static deflection of equipment isolators. Other isolators should have a minimum of 1/4 static deflection of equipment isolators.

3.02 VIBRATION ISOLATION EQUIPMENT INSTALLATION

- A. Install isolation as indicated on Drawings by type and location and where indicated below.
- B. Isolation Mounts:

1. Position vibration isolation hanger elements as high as possible in hanger rod assembly but not in contact with building structure. Install hangers so that hanger housing may rotate full 360 degrees about rod axis without contacting any object.
 2. Where parallel running pipes are hung together on a trapeze which is isolated from the building, provide isolator deflections for largest determined by provisions for pipe isolation. Do not mix isolated and non-isolated pipes in the same trapeze.
 3. Install Type 3 and 4 isolators such that installed and operating heights of vibration isolated equipment is identical. Install limit stops so that they are out of contact during normal operation.
 4. Adjust leveling bolts and hanger rod bolts so isolated equipment is level and in proper alignment with connecting pipes.
- C. Isolating Pipe Hangers:
1. Install on compressed air and water piping connected to rotating equipment in the mechanical rooms. Provide isolating hanger supports for each piece of isolated equipment outside of mechanical rooms and where indicated.
 2. Isolated equipment items include base mounted pumps and line mounted pumps.
- D. Pump Inertia Bases:
1. Fill with concrete to provide base weight equal to 2 times combined pump, motor, pipe, and water weight.
 2. Provide a minimum operating clearance of 1-inch between structural steel frames and concrete housekeeping pads or floor beneath equipment.
 3. Support heels of suction and discharge elbows from base.
 4. Secure pump and heel supports with inserts and grout.
- E. Other Inertia Bases: Unless otherwise indicated, provide a minimum operating clearance of 1-inch between structural steel frames and the concrete housekeeping pad or floor beneath equipment. Position isolator mounting brackets so that the required clearance is maintained.
- F. Vibration isolators must not cause change of position of equipment or piping which would stress piping connections or misalign shafts or bearings.
- G. Vibration isolators and seismic restraint systems must be installed in strict accordance with manufacturers written instructions and certified submittal data.
- H. Anchor baseplate to floor or structure. Provide rubber grommets and washers to isolate bolt from base plate. Under no circumstances will isolation efficiency be destroyed when bolting the isolators to floor.
- I. Anchorage: Adequately anchor or brace plumbing equipment and piping to resist displacement due to seismic action, include snubbers on equipment mounted on spring isolators, pumps and the like.

END OF SECTION

SECTION 22 05 53**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT****PART 1 - GENERAL****1.01 SUMMARY**

- A. Work Included:
 - 1. Plastic Nameplates
 - 2. Tags
 - 3. Plastic Pipe Markers

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.
- B. In addition, submit Valve Schedule for each piping system, in tabular format using Microsoft Word or Excel software. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shutoff and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals. Provide schedules organized as follows:
 - 1. Equipment Type:
 - a. Identification:
 - b. Background:
 - 1) Size:
 - 2) Color:
 - c. Lettering:
 - 1) Size:
 - 2) Color:
- C. For renovations or expansions of existing systems, coordinate with Owner and develop valve schedule on existing schedule naming and format.

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. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 22, Plumbing Sections. Where more than a single type is specified for application, provide single selection for each product category.
- B. Plastic Nameplates:
 - 1. Brady Corporation
 - 2. Or approved equivalent.
- C. Tags:
 - 1. Brady Corporation

2. Brimer
 3. Champion America Inc.
 4. Craftmark
 5. Seton Identification Products
 6. Or approved equivalent.
- D. Plastic Pipe Markers:
1. Brady Corporation
 2. Brimer
 3. Champion America Inc.
 4. Craftmark
 5. Seton Identification Products
 6. Or approved equivalent.

2.02 PLASTIC NAMEPLATES

- A. Description: Engraving stock melamine plastic laminate 1/8-inch thick, engraved with engraver's standard letter style of the sizes and wording indicated.
1. Letter Color: White.
 2. Letter Height: 1/2 inch.
 3. Background Color: Black.
 4. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
 5. Access Panel Markers: Manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve or devices/equipment. Include center hole to allow attachment.
 6. Signage for hot water outlets on 140 degree F hot water systems not protected by ASSE 1070 mixing valves; hose bibbs, janitor sinks, and fixtures used by trained personnel.
 - a. Manufacturer's standard 1/8-inch thick engraved plastic laminate signage 4 by 4-inches.
 - b. Letter Color: Red.
 - c. Letter Height: 1/2 inch.
 - d. Background Color: White.
 - e. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.03 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2-inch diameter.
- B. Metal Tags: Polished Brass with stamped letters; tag size minimum 1-1/2-inch diameter with smooth edges.
- C. Valve designations to be coordinated with existing valve identifications to ensure no repetitive designations are utilized.
- D. Chart/Schedules: Valve Schedule Frames. For each page of a valve schedule, provide glazed display frame with removable mounting as appropriate for wall construction upon which frame is to be mounted. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.
- E. Valve Tag Fasteners: Solid brass chain (wire link or beaded type), or solid brass S-hooks.
- F. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
1. Size: Approximately 4 by 7-inches.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
 4. Color: Yellow background with black lettering.

2.04 PLASTIC PIPE MARKERS

- A. Color: Conform to ASME A13.1 and ANSI Z535.1.
- B. Plastic Pipe Markers (for external diameters of 6-inches and larger including insulation):
Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering;
minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers (for external diameters less than 6-inches including insulation):
Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
Minimum information indicating flow direction arrow and identification of fluid being conveyed.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Lettering and Graphics:
 - 1. General: Coordinate names, abbreviations and other designations used in plumbing identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
 - 2. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Chiller No. 3, Air Handling Unit No. 42, Standpipe F12, and the like).
- B. Preparation: Degrease and clean surfaces to receive adhesive for identification materials.
- C. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.
- D. Install valve schedule at each mechanical room.
- E. Access Doors: Provide markers or stenciled signs on each access door and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions.

3.02 PLASTIC NAMEPLATES

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners.

3.03 TAGS

- A. Coordinate with the facility maintenance personnel to ensure consistency with the existing tagging system.
- B. Tag balancing valves with balanced GPM or CFM indicated after balancing is completed and accepted.
- C. Install tags with corrosion resistant chain.
- D. Identify pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates riveted to equipment body. Small devices, such as in-line pumps, may be identified with tags.
- E. Identify control panels and major control components outside panels with plastic nameplates riveted to equipment body.
- F. Identify valves in main and branch piping with metal tags. Indicate valve function and the normally open or closed positions on the valve tag.

3.04 PLASTIC PIPE MARKERS

- A. Install plastic pipe markers in accordance with manufacturer's instructions.
- B. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

- C. For exterior underground piping installations, Install underground plastic pipe markers with tracer wire 6 to 8-inches below finished grade directly above buried pipe.
- D. Identify piping, concealed or exposed, with plastic tape pipe markers. Use metal tags on piping 3/4-inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20-feet (reduced to 10-feet in congested areas and mechanical equipment rooms) on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction. Locate near branches, valves, control devices, equipment connections, access doors, floor/wall penetrations.

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 5, Glass Wool Equipment Insulation
 - 4. Type 7, ADA Accessible Lavatory/Sink Insulation Kit
 - 5. Accessories
 - 6. 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.

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.

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. Glue:
 - a. Armacell LLC Armaflex Low VOC Adhesive
 - b. Halstead
 - c. Or approved equivalent.
 - 2. Paint:
 - a. Armacell LLC Armaflex
 - b. Halstead
 - c. Or approved equivalent.
- C. Type 5, Glass Wool Equipment Insulation:

1. Knauf
 2. Owens-Corning
 3. Johns Manville
 4. Or approved equivalent.
- D. 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.
- E. Accessories:
1. ITW Insulation Systems
 2. Or approved equivalent.
- F. 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 5, GLASS WOOL EQUIPMENT INSULATION

- A. Flexible Glass Wool Blanket: ASTM C612; flexible.
1. Thermal Conductivity Value: 0.24 BTU*in/(hr*sf°F) at 75 degrees F.
 2. Maximum Service Temperature: 450 degrees F.

2.05 TYPE 7, ADA ACCESSIBLE LAVATORY/SINK INSULATION KIT

- A. P-traps, trap arms, tail pieces, hot water and cold water insulating guards. 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.

2.06 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.

2.07 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.
 - b. Cover insulation on pipes above ground, outside of building, with aluminum jacketing. Position lap on bottom of pipe.
- 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. Piping Surfaces to be Insulated:

Item to be Insulated	System Insulation Type	Pipe Size	Insulation Thickness
Hot Water Piping Above Grade	1	Runouts up to 1-1/2-inch	1-inch
		Mains ≤1-1/2-inch	1-inch
		Mains >1-1/2-inch	1-1/2-inch

Hot Water Circulation Piping Above Grade	1	Runouts up to 1-1/2-inch	1-inch
		Mains =<1-1/2-inch	1-inch
		Mains >1-1/2-inch	1-1/2-inch
Domestic 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

3.02 TYPE 1, GLASS WOOL PIPE INSULATION

- A. See General Installation Requirements above.
- B. 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.
- C. 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.
- D. Above Grade Roof Drain/Overflow Drain Piping: Cover all roof drain piping and overflow drain piping with sectional pipe covering.
- E. 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).
- F. Install in accordance with manufacturer's instructions for below grade installation.

3.03 TYPE 2, FLEXIBLE ELASTOMERIC INSULATION

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

3.04 TYPE 5, GLASS WOOL EQUIPMENT INSULATION

- A. See General Installation Requirements above.
- B. Apply insulation and accessories to roof drain underbodies per manufacturer's recommendations.

3.05 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.

3.06 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.

3.07 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 (Rain/Stormwater) DWV Piping, Buried Within 5-feet of Building
 - 2. Sanitary, Drainage (Rain/Stormwater) DWV Piping, Above Grade
 - 3. Pump Waste Pressure Piping (Pumped Discharge)
 - 4. Water Piping, Buried Within 5-feet of Building
 - 5. Hot and Cold Domestic Water Above Grade
 - 6. Condensate Piping
 - 7. Primer Piping
 - 8. 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. Dodge Phelps
- E. Tyler

- F. ADS
- G. Charlotte
- H. Elkhart
- I. Enfield
- J. Fusesseal
- K. Gruvlok
- L. Spears
- M. Nibco
- N. Aquatherm
- O. Orion
- P. American-USA
- Q. Sioux Chief
- 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: Each item to be furnished 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 (RAIN/STORMWATER) 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. Standard Duty: ASTM C1277 or CISPI 310.
- B. PVC Pipe: ASTM D 2665 IPS Schedule 40, Solid wall for waste and drainage only. Use of foam core ASTM F891 is approved for vent piping only.
 - 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 (RAIN/STORMWATER) 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. Copper Tube: ASTM B 306, DWV
 1. Fittings: ASME B16.29, wrought copper.
 2. Joints: ASTM B32, alloy Sn50 solder.
- C. PVC Pipe: ASTM D 2665 IPS Schedule 40, Solid wall for waste and drainage only. Use of foam core ASTM F891 is approved for vent piping only.
 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 PUMP WASTE PRESSURE PIPING (PUMPED DISCHARGE)

- A. Above Grade : Type "L" copper with solder joints.
- B. Below Grade: Type "L" copper with brazed joints.

2.06 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.

2.07 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. 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: Brass Fittings or Engineered Plastic Fittings above grade applications. Engineered plastic fittings 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. Stubout Ells and Stubout Brackets: Provide premanufactured Type L copper stubout ells and copper stubout brackets.

2.08 CONDENSATE PIPING

- A. Copper Tube: ASTM B 88 (ASTM B898M), Type K (A), L (B), or M (C)
 - 1. Fittings: ASME B16.29, wrought copper.
 - 2. Joints: ASTM B32, alloy Sn50 solder.
- B. Piping for drainage of condensate from combustion fuel sources (such as condensing boilers and water heaters) is to be chemical resistant piping as noted in this Section for area of application.

2.09 PRIMER PIPING

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

2.10 CLEANOUTS

- A. General: 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 standard screws.
 - 2. Carpeted Floor Cleanout: J. R. Smith 4020-X with carpet clamping frame, round heavy-duty nickel bronze top, taper thread, ABS plug, carpet clamping device and standard screws.
 - 3. Concrete Floor Cleanout (General): J. R. Smith 4020 with round heavy-duty nickel bronze top, taper thread and ABS plug with standard 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 standard 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 Examination:
 - 1. Verify that excavations are to required grade, dry, and not over-excavated.
- B. General:
 - 1. Perform necessary excavation and backfill required for installation of plumbing work. Repair piping or other work at no expense to Owner.
 - 2. Water: Keep excavations free of standing water. Reexcavate 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.
 - 3. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of testing laboratory.
 - 4. 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.
 - 5. 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 Sections of Specifications 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.
6. 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."
7. 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.
- C. 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. Mating flange faces to be true and parallel to each other and not to require 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.

D. 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.
- E. 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.
- F. 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.
- G. 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.
- H. Piping to be cut squarely, free of rough edges and reamed to full bore. Piping to be fully inserted into fittings.
- I. Provide joints of type indicated in each piping system.
- J. 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.
- K. 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 (RAIN/STORMWATER) DWV PIPING, BURIED WITHIN 5-FEET OF BUILDING

- A. **Excavation and Backfill:**
 - 1. See 3.01B. 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. Piping to be graded 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 direct 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.
 - 4. **Drains:**

- a. Install drains to suit finished floor or roof surface. Install drains and components per manufacturer's instructions. Arrange for flooring to be sloped 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: Coating of cut piping: The piping terminus of any cut piping shall be coated with an applied epoxy per manufacturer's instructions. Denso - Protal 7200 fast cure epoxy repair coating.

3.03 SANITARY, DRAINAGE (RAIN/STORMWATER) 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. Joints to be cleaned 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 meets CDA standard test method 1.0 and ASTM B813-91. Solder to be applied until a full fillet is present around the joint. Solder and flux not to be applied 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 and Storm Drainage:
 1. Piping to be graded 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 direct 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.
 4. Drains:
 - a. Install drains to suit finished floor or roof surface. Install drains and components per manufacturer's instructions. Arrange for flooring to be sloped 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 PUMP WASTE PRESSURE PIPING (PUMPED DISCHARGE)

- A. Excavation and Backfill:
 1. See 3.01 B. 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. 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.
- 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. Braze copper tube and fitting socket with BCUP series filler metal without flux. Listed brazing flux to be used for joining of copper tube to brass or bronze fittings and will meet AWS FB3A or FB3C. "Shock" cooling is prohibited. a continuous fillet is to be visible around the completed joint. After cooling, flux residue to be thoroughly removed with warm water and a brush prior to testing. Do not use BCUP filler on copper alloys containing over 10 percent nickel. Piping is to be capped or plugged during construction to prevent entry of foreign material.
- F. Welders performing work under this Contract to be certified and qualified in accordance with tests prescribed by the National Certified Welding Bureau (NCWB) or by other approved test procedures using methodology and procedures covered in the ASME Boiler and Pressure Vessel Code, Section IX, "Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators". Installation to conform to ANSI 31.1 "Power Piping".
 1. Submit for approval the names, identification, and welder's assigned number, letter or symbol for welders assigned to this project.
 2. The assigned identification symbol to be used to identify the work of each welder and to be indelibly stamped immediately upon completion of each weld.
 3. Welders to be tested and certified for all positions.
 4. Submit identifying stenciled test coupons made by each operator.
 5. Welders may be required to retake welding certification tests without additional expense.
 6. When so requested, a welder will not be permitted to work as a welder on this project until he has been recertified in accordance with NCWB.
 7. Recertification of the welder to be made after the welder has taken and passed the required tests.
- G. Weld pipe joints in accordance with recognized industry practice and as follows:
 1. Weld pipe joints only when ambient temperature is above 0F.
 2. Bevel pipe ends at a 37.5 degree angle where possible, smooth rough cuts, and clean to remove slag, metal particles, and dirt.
 3. Use pipe clamps or tack-weld joints with 1-inch long welds, 4 welds for pipe sizes to 10-inches, 8 welds for pipe sizes 12-inches to 20-inches.
 4. Build up welds with a stringer-bead pass, followed by a hot pass, followed by a cover or filler pass. Eliminate valleys at center and at edges of each weld. Weld by procedures

- which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes, and non-metallic inclusions.
5. Do not weld out piping system imperfections by tack-welding procedures. Re-fabricate to comply with requirements.
 6. At Installer's option, install forged branch-connection fittings whenever branch pipe is indicated, or install a regular T-fitting.
- H. Sanitary and Storm Drainage:
1. Piping to be graded 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 direct 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.
 4. Drains:
 - a. Install drains to suit finished floor or roof surface. Install drains and components per manufacturer's instructions. Arrange for flooring to be sloped 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.

3.05 WATER PIPING, BURIED WITHIN 5-FEET OF BUILDING

- A. Excavation and Backfill:
1. See 3.01 B. 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. Piping connections to equipment to be made up with unions.
 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. Exposed connections to equipment to be installed with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping to be permitted.
 10. Ferrous to non-ferrous connections to be made by means of 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.
 14. Backflow Preventers: Pipe relief to nearest drain. Slope at 2 percent.
- 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 Preinsulated Pipe Installation:
1. Installation and Testing: Install and test products in accordance with manufacturer's installation instructions.
 2. Manufacturer's installation instructions shall 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.

3.06 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. Joints to be cleaned 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 meets CDA standard test method 1.0 and ASTM B813-91. Solder to be applied until a full fillet is present around the joint. Solder and flux not to be applied 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. Listed brazing flux to be used for joining of copper tube to brass or bronze fittings and will meet AWS FB3A or FB3C. "Shock" cooling is prohibited. a continuous fillet is to be visible around the completed joint. After cooling, flux residue to be thoroughly removed with warm water and a brush prior to testing. Do not use BCUP filler on copper alloys containing over 10 percent nickel. Piping is to be capped or plugged 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. Piping connections to equipment to be made up with unions.
 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. Exposed connections to equipment to be installed with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping to be permitted.
 10. Ferrous to non-ferrous connections to be made by means of 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.
 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.

3.07 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.

3.08 PRIMER PIPING

- A. Excavation and Backfill:
1. See 3.01 B. 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.

3.09 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 30 00
PLUMBING EQUIPMENT

PART 1 - GENERAL**1.01 SUMMARY**

- A. Work Included:
 - 1. Domestic Expansion Tanks Non-ASME
 - 2. Domestic Expansion Tanks ASME
 - 3. Domestic Circulation Pump

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 compliant.
- C. Products approved for installation by state authorizing agency, no exceptions.

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. Domestic Expansion Tanks Non-ASME:
 - 1. Bell and Gossett Series PT
 - 2. American Wheatley
 - 3. Amtrol
 - 4. Armstrong
 - 5. Watts
 - 6. Or approved equivalent.
- B. Domestic Expansion Tanks ASME:
 - 1. Bell and Gossett Series PT
 - 2. American Wheatley
 - 3. Amtrol
 - 4. Armstrong
 - 5. Watts
 - 6. Hansen
 - 7. Or approved equivalent.
- C. Domestic Circulation Pumps:
 - 1. Bell and Gossett Series PL
 - 2. Armstrong
 - 3. Grundfos
 - 4. Paco
 - 5. Taco

6. Or approved equivalent.

2.02 GENERAL

- A. Reference drawings for capacities and specific model numbers.

2.03 DOMESTIC EXPANSION TANKS NON-ASME

- A. Welded steel, constructed, tested and stamped in accordance with IAPMO Standards for working pressure of 125 PSI. Support floor mounted tanks with steel legs or base. Provide single flexible diaphragm securely sealed into tank to separate air charge from system water, to maintain design expansion capacity. Provide pressure gauge and air-charging fitting, and drain fitting. Diaphragm: Removable and replaceable in line.

2.04 DOMESTIC EXPANSION TANKS ASME

- A. System: Domestic water.
- B. Welded steel, constructed, tested and stamped in accordance with ASME Boiler and Pressure Vessel Code for working pressure of 125 PSI. Support floor mounted tanks with steel legs or base. Provide single flexible diaphragm securely sealed into tank to separate air charge from system water, to maintain design expansion capacity. Provide pressure gauge and air-charging fitting, and drain fitting. Diaphragm: Removable and replaceable in line.

2.05 DOMESTIC CIRCULATION PUMPS

- A. System: Domestic water.
- B. Provide in-line factory tested pumps, cleaned, and painted with enamel prior to shipment. Pumps to be rated for domestic water. Provide pumps of same type by same manufacturer.
- C. Type: Horizontal, oil-lubricated, designed for 150 PSI working pressure, 225 F continuous water temperature.
- D. Body: Bronze or Stainless steel construction.
- E. Shaft: Stainless or Carbon steel, ground and polished, integral thrust collar.
- F. Bearings: Two horizontal sleeve sealed steel bearings permanently lubricated designed to circulate oil.
- G. Seal: Mechanical, with carbon seal face rotating against ceramic seat.
- H. Face plate: Stainless steel.
- I. Motor: Nonoverloading at any point on pump curve, open, drip-proof, sleeve bearings, quiet operating, rubber mounted construction, built-in thermal overload protection.
- J. Elastomers: EPDM.
- K. Provide Honeywell 115 volt immersion aquastat set at 115 or 118 degrees F.
- L. Option. Pump may be operated from Building Automation System. Coordinate installation of additional devices with controls contractor.

PART 3 - EXECUTION

3.01 GENERAL

- A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- C. Orients so controls and devices needing service and maintenance have adequate access.
- D. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.
- E. Connect water piping to units with shutoff valves and unions.

- F. Equipment Rigging: Heavy duty rigging eye bolts for Crosby Group swivel hoist rings installed over pump access covers for removal or maintenance.
- G. Equipment Start-Up:
 - 1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.
 - 2. Start-up performed by authorized manufacturer's representative or agent. Provide credentials of start-up personnel to Architect and Owner's Representative for approval.
 - 3. Remove and replace filters when start-up testing is executed.
 - 4. Manufacturer adjusts operating parameters of equipment to compensate to elevation of 500-feet above sea level.
 - 5. Architect, Commissioning Agent, and Owner's Representative will be notified 10 days prior to start-up and will be present at start-ups.
 - 6. Provide written report from manufacturer's representative on results of start-up within 48 hours.
 - 7. Technical Training of maintenance staff includes two hours minimum per each piece of equipment.
 - 8. Seismic Verification:
 - a. Contractor will retain structural engineer who will submit stamped and signed anchoring and restraint details on plumbing equipment with submittal data in accordance with Division 22, Plumbing requirements.
 - b. Contractor's Structural Engineer will test and verify in writing that seismic restraints have been installed in accordance with their details.

3.02 DOMESTIC EXPANSION TANKS NON-ASME

- A. Precharge tank per manufacturers recommendation.
- B. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- C. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- D. Orients so controls and devices needing service and maintenance have adequate access.
- E. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.
- F. Connect water piping to units with shutoff valves and unions.

3.03 DOMESTIC EXPANSION TANKS ASME

- A. Precharge tank per manufacturers recommendation.
- B. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- C. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- D. Orients so controls and devices needing service and maintenance have adequate access.
- E. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.
- F. Connect water piping to units with shutoff valves and unions.

3.04 DOMESTIC CIRCULATION PUMPS

- A. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Orients so controls and devices needing service and maintenance have adequate access.

- C. Connect water piping to units with shutoff valves and unions.
- D. Provide lift check valves 5 diameters downstream of pump discharge for circulating pumps piped in a parallel configuration.
- E. Equipment Start-Up:
 - 1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.
 - 2. Architect, Commissioning Agent, and Owner's Representative will be notified 10 days prior to start-up and will be present at start-ups.
 - 3. Seismic Verification:
 - a. Contractor will retain structural engineer who will submit stamped and signed anchoring and restraint details on plumbing equipment with submittal data in accordance with Division 22, Plumbing requirements.
 - b. Contractor's Structural Engineer will test and verify in writing that seismic restraints have been installed in accordance with their details.

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. Enameled Cast Iron Fixtures, White Only
 - c. Faucet Fittings
 - d. Fiberglass Fixtures, White Only
 - e. Molded Resin or Stone Fixtures
 - f. Stainless Steel Fixtures
 - g. Thermostatic Mixing Valves
 - h. Trench Drains
 - 2. Carriers
 - 3. Drinking Fountains
 - 4. Electric Water Coolers
 - 5. Emergency Showers/Eyewash
 - 6. Fixture Trim
 - 7. Floor Drains
 - 8. Floor Sinks
 - 9. Flushometers - Water Closet/Urinal
 - 10. Hose Bibbs
 - 11. Hub Drains
 - 12. Water Closet Seats
 - 13. Drain Boxes
 - 14. Water Supply Boxes

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. Provide fixtures, faucets and accessories to meet barrier free requirements of the governing code with respect to plumbing fixtures provided for the physically handicapped.
 - 4. 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, General Plumbing 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. Crane
 - d. Eljer
 - e. Kohler
 - f. Universal-Rundle
 - g. Or approved equivalent.
 - 2. Enameled Cast Iron Fixtures - White Only:
 - a. American Standard
 - b. Briggs
 - c. Crane
 - d. Eljer
 - e. Kohler
 - f. Universal-Rundle
 - g. Or approved equivalent.
 - 3. Faucet Fittings:
 - a. Public:
 - 1) American Standard
 - 2) Chicago
 - 3) Delta Commercial
 - 4) Moen Commercial
 - 5) Sloan
 - 6) Symmons
 - 7) T & S Brass
 - 8) Or approved equivalent.
 - 4. Fiberglass Fixtures - White Only:
 - a. Aqua-Glass
 - b. Briggs
 - c. Crane
 - d. Fiber-Fab
 - e. Hytec
 - f. Mustee
 - g. Universal-Rundle
 - h. Or approved equivalent.
 - 5. Molded Resin or Stone Fixtures:
 - a. Fiat
 - b. Mustee
 - c. Stern Williams
 - d. Or approved equivalent.
 - 6. Stainless Steel Fixtures:
 - a. Elkay
 - b. Haws
 - c. Just
 - d. Or approved equivalent.
 - 7. Thermostatic Mixing Valves:
 - a. Bradley
 - b. Powers

- c. Symmons
 - d. Holby
 - e. Or approved equivalent.
- 8. Trench Drains:
 - a. Channel-Slope
 - b. JR Smith
 - c. PolyDrain
 - d. Polycast
 - e. Quazite
 - f. Zurn
 - g. 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. Emergency Showers/Eyewash:
 - 1. Bradley
 - 2. Encon
 - 3. Guardian
 - 4. Haws
 - 5. Speakman
 - 6. Or approved equivalent.
- G. Fixture Trim:
 - 1. McGuire
 - 2. Dearborn Brass
 - 3. Oatey
 - 4. Or approved equivalent.
- H. Floor Drains:
 - 1. Mifab
 - 2. Sioux Chief
 - 3. Smith
 - 4. Wade
 - 5. Watts
 - 6. Zurn
- I. Floor Sinks:
 - 1. Commercial Enameling
 - 2. Mifab
 - 3. Sioux Chief

4. Smith
 5. Wade
 6. Watts
 7. Zurn
 8. Or approved equivalent.
- J. Flushometers - Water Closet/Urinal:
1. Delaney
 2. Sloan
 3. Zurn
 4. Or approved equivalent.
- K. Hose Bibbs:
1. Chicago
 2. JR Smith
 3. Mifab
 4. Wade
 5. Woodford
 6. Zurn
 7. Or approved equivalent.
- L. Hub Drains:
1. JR Smith
 2. Zurn
 3. Or approved equivalent.
- M. Water Closet Seats:
1. Bemis
 2. Or approved equivalent.
- N. Drain Boxes:
1. Sioux Chief
 2. Or approved equivalent.
- O. Water Supply Boxes:
1. Sioux Chief
 2. 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 Flow Rates:
 1. Water Closets: Single flush at 1.28 GPF.
 2. Lavatories in public core areas to be set for a maximum of 0.5 GPM flow. Other lavatories to be 1.0 GPM flow.
 3. Sinks to be set for a maximum of 1.5 GPM flow.
 4. Showers factory set at a maximum of 1.8 - 2 GPM flow.

F. 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 913). Coupling type or plate type with bearing plate 300 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.****E. Wall Hung Drinking Fountain: Z-1225-BL (JR Smith 834-97-98). Plate 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 EMERGENCY SHOWERS/EYEWASH****A. Provide emergency showers/eyewash products that are compliant with ANSI Z358.1, Standards for Emergency Eyewashes and Shower Equipment.****2.07 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: T-handle or 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.**

2.08 FLOOR DRAINS

- A. See Schedule on Drawings for types.

2.09 FLOOR SINKS

- A. See Schedule on Drawings for types.
- B. Plastic components are not allowed.

2.10 FLUSHOMETERS - WATER CLOSET/URINAL

- A. See Schedule on Drawings for types.

2.11 HOSE BIBBS

- A. See Schedule on Drawings for types.

2.12 HUB DRAINS

- A. See Schedule on Drawings for type.

2.13 WATER CLOSET SEATS

- A. See Schedule on Drawings for type.

2.14 DRAIN BOXES

- A. See Schedule on Drawings for Type.
- B. Provide fire rated ASTM E-84 rated boxes where required by building construction.

2.15 WATER SUPPLY BOXES

- A. See Schedule on Drawings for Type.
- B. Provide fire rated ASTM E-84 rated boxes where required by building construction.

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 EMERGENCY SHOWERS/EYEWASH INSTALLATION

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

3.06 FIXTURE TRIM INSTALLATION

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

3.07 FLOOR DRAINS INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.

- B. Set plumb, level and rigid.

3.08 FLOOR SINK INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid. Set fixture rim/grate flush with surrounding finish surface unless specifically noted otherwise.

3.09 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. Set fixture rim/grate flush with surrounding finish surface unless specifically noted otherwise.

3.10 HOSE BIBB INSTALLATION

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

3.11 HUB DRAINS INSTALLATION

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

3.12 WATER CLOSET SEAT INSTALLATION

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

3.13 DRAIN BOX INSTALLATION

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

3.14 WATER SUPPLY BOX INSTALLATION

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

END OF SECTION