

SECTION 22 0101

PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. General provisions and requirements for all plumbing work.

1.2 RELATED SECTIONS

- A. Requirements of this section generally supplement requirements of Division 01.

1.3 REFERENCES

- A. NFPA 10: Portable Fire Extinguishers.
- B. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

1.4 SYSTEM DESCRIPTION

- A. The full set of Contract Documents applies to work of Division 22.
- B. Visit the site and study all aspects of the project and working conditions, as required by General and Supplementary Conditions, Bidding and Contracting Requirements, Drawings, and Specifications. Verify field dimensions.
- C. The work covered in technical sections includes the furnishing of all labor, equipment and materials, and the performance of all operations pertinent to the work described.
- D. Except as required otherwise in Division 01, promptly obtain and pay for, including all necessary signatures and paperwork, all permits, fees and inspections required for work of this division by authorities having jurisdiction, including any utility connection or extension charge. No payment will be made until a copy of the permit is forwarded to the Government.
- E. Plumbing work of this project includes, as a brief general description, the following:
 - 1. Removal of existing domestic water heater, fixtures, and plumbing piping to the extent indicated on the plumbing plans.
 - 2. Installation of new domestic water heater, fixtures, plumbing piping and accessories and valves.
 - 3. Installation of condensate piping to serve new mechanical equipment.
- F. See Division 01 for requirements related to Government's occupancy of the premises, limits on use of site, time restrictions on work, limits on utility outages or shutdowns, and phasing (sequencing) and scheduling.

1.5 PRODUCT OPTIONS

- A. Except as modified by provisions of Bidding and Contracting Requirements and Division 01, these options apply to Division 22 specifications.

- B. General: Where Contractor is permitted to use a product other than the specified item and model named as the basis of design, Contractor is responsible for all coordination and additional costs as specified in the article "Substitutions," below for substitutions.
- C. Products specified by reference standards or by description only: Any product meeting those standards or description.
- D. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance, and shall not be construed as limiting competition. Contractor may use products of any manufacturer, which meet the specifications.
- E. Products specified by naming one manufacturer and particular product, with no provision for other options: No options or substitutions allowed.

1.6 SUBSTITUTIONS

- A. Substitutions will be considered only as permitted or required by the Bidding and Contracting Requirements and Division 01. Except as modified by those requirements, the requirements below apply to Division 22 specifications.
- B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.
- C. Document each request with complete data substantiating compliance of proposed substitution with contract documents.
- D. A request constitutes a representation that the Bidder or Contractor:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Will provide the same warranty for the substitution as for the specified product.
 - 3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to the Government.
 - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
 - 5. Will reimburse the Government for review or redesign services associated with re-approval by authorities.
- E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- F. Substitution submittal procedure is specified in Bidding and Contracting Requirements and Division 01.

1.7 MATERIALS AND EQUIPMENT

- A. All materials and equipment shall be new and the best of their respective kinds, suitable for the conditions and duties imposed on them by the project, and of representative manufacturer. The description, characteristics and requirements of the materials to be used shall be in accordance with the specifications.
- B. All equipment, construction and installation must meet requirements of local, state and federal governing codes.

- C. Singular number: In cases where material, a device, or part of the equipment is referred to in the singular number in the specifications, it is intended that such reference shall apply to as many items of material, devices, or parts of the equipment as are required to complete the installation as shown on the drawings or required for proper operation of the system.
- D. Terms have the following meanings:
 - 1. Furnish: Supply item
 - 2. Install: Mount and connect item
 - 3. Provide: Furnish and install.
- E. All materials and equipment shall be installed and completed in a first class and workmanlike manner and in accordance with the best modern methods, practice and manufacturers' instructions. Any work which shall not present an orderly and neat or workmanlike appearance shall be removed and replaced with satisfactory work when so directed in writing by the DGS Project Manager.
- F. The specifications and drawings are intended to define the minimum requirements, as to quality of materials, construction, finish and overall workmanship.
- G. General Conditions describe the correlation and intent of the Contract Documents. In case of discrepancies between the specifications and drawings, the specifications should be followed as to the general methods and principles and the drawings followed as to sizes, capacities and specifics for corresponding parts. If sizes are omitted, the DGS Project Manager will determine sizes to be utilized.
- H. In all cases of doubt, uncertainty, or conflict as to the true meaning of the specifications or drawings, it is the responsibility of the Contractor to notify the DGS Project Manager of said uncertainty, doubt, or conflict and obtain a decision as to the intent before starting any work which may be affected by this decision.

1.8 COORDINATION

- A. Should a situation develop during construction to prevent the proper installation of any equipment or item where shown on the drawings, call the situation to the attention of the DGS Project Manager and await a written decision.
- B. Plan and coordinate all work to proceed in an orderly and continuous manner without undue delay, and in conformance with project schedule. Submit samples, shop drawings, schedules, insurance policies and certificates, and the like in time to avoid delays in actual construction. Coordinate plumbing work so that work of each trade is completed before other construction begins which would obstruct it.
- C. Coordinate trades to ensure that proper clearances between work of the various trades allow access to items which require operation and maintenance.
- D. Coordinate location and elevation of all piping, ductwork, light fixtures, equipment, and appurtenances in such a manner that the finished installation is as indicated on drawings. In the event difficulties are encountered which prevent this, it is the Contractor's responsibility to bring this to the attention of the DGS Project Manager prior to initiation of work. Correct improperly coordinated installation at no additional cost.

- E. The Contractors' assistants shall include a competent foreman, who shall be on the premises at all times to check, layout, coordinate and superintend the installation of work. The foreman shall establish all grades and lines relative to the work before starting, and be responsible for the accuracy thereof.

1.9 SUBMITTALS

A. Manufacturers' and subcontractors' lists:

- 1. As specified in Division 01, submit a complete list of proposed manufacturers for all equipment, materials and subcontractors used for the work of this division. Lists shall follow the sequence of the specifications. No considerations will be given for partial or incomplete lists. After review of lists, submit shop drawings and product data.

B. Shop drawings and product data:

- 1. Submit in accordance with the requirements of Division 01 or as established at the preconstruction conference, the required number of copies of shop drawings and product data for every item of equipment. Shop drawings or product data will not be considered until manufacturers' lists have been approved. Shop drawings and product data shall be submitted, as required by the General Conditions, with sufficient time for checking, return to Contractor, and resubmission as required before Contractor shall install any item.
- 2. Each item submitted shall be properly labeled, indicating the specific service for which the equipment or material is to be used, section and paragraph number of specification or drawing number to which it applies, Contractor's name and project name and number. Data submitted shall be specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents. Clearly identify each item within the data. Data of a general nature will not be accepted. Each sheet must clearly show the project name and number.
- 3. The review of a shop drawing or product data shall not be considered as a guarantee of the measurements or building conditions or that the shop drawings or product data have been checked to see that item submitted properly fits the building conditions. This review shall not relieve the Contractor of the responsibility for furnishing material or performing work as required by the contract documents, for correctness of dimensions and quantities, or for proper coordination of details and interfaces among trades.
- 4. All exclusively electrical items furnished as items associated with plumbing items but not specifically described in the plumbing item submission, shall be submitted as a separate submittal but shall be clearly marked as associated with the plumbing item by identification specification paragraph.
- 5. Product data sheets shall be 8.5-inch by 11-inch cut sheets for operating and maintenance manual.

C. Submit at least three copies of the results of every test required under any section in this division.

D. Specialist shall submit a list of at least three projects similar to this project in type, size, and quality, which have been in place and operating satisfactorily for at least five years.

- 1. Include project name, address, name and phone number of Government's representative, and project type and size.

E. After the work is completed, submit all required certificates of approval from approved inspection agencies and authorities having jurisdiction over work of this division. Certificates of approval must be received by the Government prior to final acceptance of the work.

1.10 SPECIALIST

- A. The term "Specialist" as used in the specification shall mean an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field,) which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the specification requires installation by a specialist, the term shall also be deemed to mean the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.

1.11 CONTRACT CLOSEOUT SUBMITTALS

A. Project record documents:

1. Maintain on site one set of the following record documents; record actual revisions to the work of this division:
 - a. Contract drawings.
 - b. Specifications
 - c. Addenda
 - d. Change orders and other modifications to the Contract
 - e. Reviewed shop drawings, product data, and samples
2. Maintain record documents separate from documents used for construction.
3. Record information concurrent with construction progress.
4. Specifications: Legibly mark and record in each section a description of actual products installed, including the following:
 - a. Manufacturer's name and product model and number
 - b. Product options, substitutions, or alternates utilized
 - c. Changes made by addenda and modifications
5. Record documents and shop drawings: Legibly mark each item to record actual construction, including:
 - a. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - b. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
 - c. Field changes of dimension and detail.
 - d. Details not on original Contract Drawings.
6. Submit documents as specified in Division 01.

B. Operation and maintenance data:

1. Submit sets prior to final inspection as specified in Division 01. Unless otherwise specified in Division 01, submit no fewer than three sets. In addition to requirements specified in Division 01, submit operating and maintenance manuals for the work of this division as specified below.
2. Lubrication charts: Prepare lubrication charts for each piece of mechanical equipment that requires grease or oil.
 - a. Include the following:

- (1) Types of lubricants required
 - (2) Locations of lubrication points
 - (3) Frequency of lubrication.
- b. Provide one extra set of lubrication charts mounted in plastic covers, besides those required in Operating and Maintenance Manuals.
3. Binders: Three-ring binders with vinyl-covered hard covers. Provide large enough binders, and sufficient quantity, that the required contents can be easily turned, removed, and reinserted.
4. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," and title of project. Print on spine of binder "O & M INSTRUCTIONS." If more than one binder is required, print covers and spines with volume numbers. Include in the front of every binder an index to all binders.
5. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
6. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.
7. Part 1: Directory, listing names, addresses, and telephone numbers of mechanical engineers; Contractor; mechanical subcontractors; and major mechanical equipment suppliers.
8. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:
 - a. Significant design criteria, including pump curves and similar performance charts.
 - b. List of plumbing equipment, including operating weight of each.
 - c. Parts list for each plumbing fixture, faucet, and pump, including recommended spare parts list.
 - d. Operating instructions.
 - e. Maintenance instructions for plumbing equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
 - g. Valve charts, including locations of flow fittings.
9. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data for plumbing systems.
 - b. Photocopies of certificates.
 - c. Photocopies of warranties and guarantees.
 - d. Test reports: Copies of the results of all tests required under all sections of specifications.
10. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.
11. Submit final volumes revised, within ten days after final inspection.

1.12 REGULATORY REQUIREMENTS

- A. When these specifications call for materials or construction of a better quality or larger sizes than required by the following codes and standards, the provisions of the specifications shall take precedence.

- B. Provide, without extra charge, any additional materials and labor which may be required for compliance with these codes and standards even though the work is not mentioned in these specifications or shown on the contract drawings.
- C. Perform the work of this division in strict accordance with the following authorities. The latest revision of these codes accepted by the authority having jurisdiction as of the date of the contract documents shall apply.
 - 1. The plumbing, mechanical, electrical, building, fire, and safety codes of the state and county or city in which the work is being performed.
 - 2. The National Electric Code, NFPA 70 (NEC).
 - 3. The National Fire Protection Association Code. (NFPA).
 - 4. International Energy Conservation, Fire, Fuel Gas, Mechanical, and Plumbing Codes (ICC).

1.13 REFERENCE STANDARDS

- A. Perform the work of this division using the standards of the following organizations, as referred to in technical sections, as a minimum requirement for construction and testing. Unless specified otherwise in Bidding and Contract Documents or Division 01, the latest revision current as of the date of the contract documents shall apply. Products shall be certified by manufacturers to meet the requirements of referenced standards.
 - 1. Federal Specifications (FS)
 - 2. Military Specification (MS)
 - 3. Military Standards (Mil. Std.)
 - 4. Air Conditioning and Refrigeration Institute (ARI)
 - 5. Air Movement and Control Association (AMCA)
 - 6. Associated Air Balance Council (AABC)
 - 7. American Association State Highway and Transportation Officials (AASHTO)
 - 8. American National Standards Institute (ANSI)
 - 9. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - 10. ASME International (ASME)
 - 11. American Society for Testing and Materials (ASTM)
 - 12. American Society of Sanitary Engineering (ASSE)
 - 13. American Water Works Association (AWWA)
 - 14. International Code Council (ICC)
 - 15. Manufacturer's Standardization Society of the Valve and Fittings Industry Inc. (MSS)
 - 16. National Electrical Code, NFPA 70 (NEC)
 - 17. National Electrical Manufacturer's Association (NEMA)
 - 18. National Fire Protection Association (NFPA)
 - 19. National Fuel Gas Code, NFPA 54
 - 20. National Sanitary Foundation (NSF)
 - 21. National Standard Plumbing Code (NSPC)
 - 22. The Occupational Safety and Health Act (OSHA)
 - 23. Piping and Drainage Institute (PDI)
 - 24. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
 - 25. Underwriters Laboratory Inc. (UL)
 - 26. Maryland Occupational Safety and Health Act (MOSHA)

1.14 TEMPORARY STORAGE

- A. Maintain upon premises, where directed, a storage area, and be responsible for all contents within these areas. Provide all security measures necessary for this area.

- B. Area shall be maintained and shall be returned to original condition at the completion of the project.

1.15 PROTECTION

- A. Control dust resulting from construction work to prevent its spread beyond the immediate work area, and to avoid creation of a nuisance.
 - 1. Do not use water to control dust. Use drop cloths or other suitable barriers.
 - 2. In areas where dirt or dust is produced as a result of the work, sweep daily, or more often as required.
 - 3. Provide walk-off mats at entries and replace them at regular intervals.
 - 4. Construct dust partitions, where indicated on the drawings or as required.
- B. Each trade and subcontractor is responsible for preventing damage and soiling of work performed by other trades or subcontractors. Each trade and subcontractor is responsible for providing temporary protection of its own work.
 - 1. Protect work from spills, splatters, drippings, adhesives, bitumens, mortars, paints, plasters, and damage from welding or burning.
 - 2. Protect finished work from damage, defacement, staining, or scratching.
 - 3. Protect finishes from cleaning agents, or grinding and finishing equipment.
 - 4. Protect adjacent and finished work from damage, using tape, masking, covers or coatings and protective enclosures.
 - 5. Coordinate installations and temporarily remove items to avoid damage from finishing work.
- C. Repair all damage or soiling to the complete satisfaction of the DGS Project Manager; replace any materials or work damaged to such an extent that they cannot be restored to their original condition, all at no addition to the Contract Sum.
- D. Protect work stored in place and supplies stored in the building.
 - 1. Store materials and products, subject to damage from moisture, in dry locations. If necessary, protect in wraps or covers.
 - 2. Store plastics, other materials, and products subject to damage from heat or cold at manufacturer's recommended temperatures.
- E. Use of sidewalk or roadway areas outside of the property lines shall be with permission and approval of the local authorities having jurisdiction.

1.16 FIRE PROTECTION

- A. As a minimum, provide hand-carried, portable, UL-rated extinguishers with each work crew working inside the building.
- B. Select extinguishers in accordance with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

1.17 PROJECT CONDITIONS

- A. Drawings showing utilities in concealed locations are based on the best information available but are not represented as being precisely correct. Work of the contract includes digging, cutting, drilling, using nondestructive methods, and other methods of locating concealed utilities in the field, as well as patching and repairing as specified in "Cutting and Patching" below.

- B. If, in the course of the work, workers encounter a material they suspect to present some hazard:
 - 1. Promptly notify the DGS Project Manager in writing.
 - 2. Do not perform any work which would disturb the suspected material until written instructions have been received.

1.18 WARRANTY

- A. All work and equipment provided as work of this division shall be fully warranted under the general project warranty. In addition, provide added special warranties specified in individual sections.
- B. During the correction period, the Contractor shall begin correcting any work found to be not in accordance with the requirements of the Contract Documents within 4-hours of receiving written notice from the DGS Project Manager. Provide detailed schedule for completion of work within 24-hours of receiving written notice from the DGS Project Manager and revise schedule based on any Government comments generated. Except as otherwise required in General Conditions and Division 01, the correction period is one year after the date of substantial completion of the work. Work requiring correction shall promptly be repaired or completely replaced at no addition to the Contract Sum.
 - 1. Service reports for warranty work shall be provided to the Government.
- C. When use of the permanent equipment has been permitted for temporary heating or ventilation of the building, the warranty and correction periods shall nevertheless begin at the time of substantial completion, unless another date of acceptance has been agreed to by the Government.
- D. Special warranties are warranties required by individual specification sections, incidental product warranties, manufacturers' standard warranties, installer or subcontractor service agreements, and other individual warranties in addition to the general project warranty.
- E. Provide copies of warranties as required for Operation and Maintenance Manual specified above, and by Division 01.
- F. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
- B. Cut walls, floors, partitions, roofs, and other appurtenances for the passage or accommodation of pipes, ducts and appurtenances. Close superfluous openings and remove all debris caused by work of this division.
- C. No cutting of any structure or finish shall be done until the condition requiring such cutting has been examined and approved by the DGS Project Manager.

- D. New or existing surfaces disturbed as a result of such cutting or otherwise damaged shall be restored to match original work and all materials used for any patching or mending shall conform to the class of materials originally installed.
- E. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.2 TEMPORARY FACILITIES

- A. Temporary water facilities, electricity, telephone, toilet facilities, and temporary heat, shall be provided as specified in Division 01.

3.3 PROGRESS MEETINGS

- A. Progress meetings shall be held as specified in Division 01, and also when and if the Contractor or DGS Project Manager finds them necessary or advantageous to progress of work.
- B. Contractor, those subcontractors and those material suppliers concerned with current progress or with the scheduling of future progress, and the DGS Project Manager shall each be represented at these meetings by persons familiar with the details of work and authorized to conclude matters relating to work progress.

END OF SECTION

SECTION 22 0500

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to more than one section of Division 22.
- B. Basic material and equipment required for the plumbing piping work.
- C. Identification of plumbing systems and equipment.
- D. Cleaning and painting.
- E. Backboards for piping specialties.
- F. Treated wood lumber.
- G. Operating instructions.
- H. Piping tests.

1.2 RELATED SECTIONS

- A. Project and special warranties: Division 01 and Section 22 0101.
- B. Operation and Maintenance Manuals: Division 01 and Section 22 0101.

1.3 REFERENCES

- A. American Society of Mechanical Engineers
 - 1. ASME A 13.1: Scheme for the Identification of Piping Systems
 - 2. ASME B 31.9: Building Services Piping
- B. American Society of Testing and Materials
 - 1. ASTM B 32: Standard Specification for Solder Metal
 - 2. ASTM B 88: Standard Specification for Seamless Copper Water Tube
 - 3. ASTM B 813: Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
 - 4. ASTM D 635: Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
 - 5. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials
 - 6. ASTM E 548: Standard Guide for General Criteria Used for Evaluating Laboratory Competence
- C. American Welding Society
 - 1. AWS D1.1: Structural Welding - Steel
 - 2. AWS D10.9: Specification for Qualification of Welding Procedures and Welders for Piping and Tubing

D. NSF

1. NSF/ANSI 61: Drinking Water System Components - Health Affects
2. NSF/ANSI 372: Drinking Water System Components – Lead Content

1.4 DEFINITIONS

- A. Project correction period: A period after Substantial Completion of the work during which the Contractor shall correct every part of the work found to be not in accordance with the requirements of the contract documents, promptly after receipt of written notice.
- B. Qualified testing agency: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- C. DN: Dimension Nominale, nominal pipe size in millimeters, in accordance with the metric system for construction, Systeme Internationale (SI).
- D. NPS: Nominal pipe size in inches, in accordance with standard U.S. designations for manufactured pipe. Pipe sizes do not change when projects are designed and built in metric units; each size has a consistent name (nominal dimension) in each system.

1.5 DESIGN REQUIREMENTS

- A. The drawings and system performances have been designed based on use of the particular manufacturer's products specified and scheduled on the drawings.
- B. Products of other manufacturers that are listed under the article "Available Manufacturers," or permitted as "equal," are permitted provided:
1. Product shall meet the specifications.
 2. Contractor shall make, without addition to the contract sum, all adjustments for deviations so that the final installation is complete and functions as the design basis product is intended.
- C. Do not propose products with dimensions or other characteristics different from the design basis product that render their use impractical, or cause functional fit, access, or connection problems.

1.6 SUBMITTALS

- A. Shop drawings:
1. Schedule of welding and brazing procedures proposed for each piping system in the project.
 2. Shop drawings of backboards for piping specialties.
- B. Certifications: Proof of operator and testing agency personnel qualifications as required for welding and brazing in the article "Quality Assurance" below.
- C. Test reports: Field test results for each piping system as specified in Part 3 below.

1.7 QUALITY ASSURANCE

- A. Provide materials and perform work in accordance with the plumbing, mechanical, electrical, building, fire, health and safety, and other applicable codes and regulations of the state, county or city in which the work is performed.
 - 1. Product specifications herein may not necessarily meet all regulations for the limits on lead content. The Contractors and product suppliers shall be responsible to provide products that comply with NSF/ANSI 61 and NSF/ANSI 372 for domestic water systems.
- B. Welding procedures and operator qualifications for structural welding: AWS D1.1, Structural Welding Code Steel, electric arc process.
- C. Brazing, and soldering procedures and operator qualifications for building systems piping:
 - 1. ASME B31.9, Building Services Piping.
 - 2. Copper Development Association "Copper Tube Handbook."
 - 3. Safe Drinking Water Act.
- D. Electrical control panels, equipment, materials and devices provided or installed as work of Division 22 shall bear UL label or, if UL label is not available, the item shall be tested and labeled by a qualified testing agency, acceptable to authorities having jurisdiction, and in accordance with NFPA 70 (NEC). Provide testing, if required, without addition to the contract sum.
- E. VOC content: Field-applied adhesives and sealants, limits per South Coast Air Quality Management District (SCAQMD), Rule No. 1168.
- F. Products shall contain no urea-formaldehyde content.

PART 2 - PRODUCTS

2.1 GENERAL

- A. General piping techniques, testing, identification, painting, and operating instructions specified in this section apply to products specified in other sections of Division 22.
- B. Equipment that uses or processes date and time data in order to perform its function shall be warranted by the manufacturer to properly function and correctly use or process all time-related data for all dates and times which occur during a reasonable life expectancy of the equipment.

2.2 PIPING MATERIALS

- A. Soldering materials:
 - 1. Solder: Free of lead, antimony, and zinc and meeting the requirements of ASTM B 32. No solder containing lead is permitted.
 - a. Tin 95.5 percent, copper 4 percent, and silver 0.5 percent.
 - (1) Equal to "Silvabrite 100" manufactured by Engelhard Corporation.
 - b. Tin, copper, bismuth, and silver.
 - (1) Equal to "Oatey Silver" manufactured by Oatey.

2. Flux:
 - a. Meeting the requirements of ASTM B 813 and NSF 61 certified.
 - b. Equal to Oatey H-2095.

B. Threaded pipe joint materials:

1. Pipe jointing compound:
 - a. Pipe joint compound recommended by the manufacturer for use at the temperature and pressure of the system.
 - b. For sanitary piping overhead of food storage, preparation, and serving and dining areas: Litharge and glycerin.
2. Pipe joint tape: Polytetrafluoroethylene (PTFE) pipe thread tape, "Teflon."

2.3 IDENTIFICATION DEVICES AND MATERIALS

A. Stenciling materials:

1. Stencils: Manufactured standard stencils prepared for required applications, conforming to ASME A 13.1 for color and size of legend letters, including arrows showing direction of flow.
2. Paint: Exterior type enamel, colors conforming to ASME A 13.1, or black.

B. Equipment identification tags:

1. Laminated plastic with adhesive back, white core and black outer layers, which, when engraved, will produce white letters and numerals on a black background.
2. Tags installed on curved surfaces shall be aluminum or brass.

C. Valve tags: Brass, 1.5 inch (40 mm) in diameter with black-filled numbers not less than 0.25 inch (6 mm) high, complete with brass attachment chains.

D. Ceiling identification tags: Laminated plastic with adhesive back, engraved black letters on white background, minimum 0.5 inch (15 mm) wide and length as required for 0.375 inch (10 mm) high letters for name of concealed device and number.

2.4 MATERIALS FOR BACKBOARDS FOR PIPING SPECIALTIES

A. Backboards: Marine plywood: BS-1080, Veneer Grade A/B, moisture-resistant, spruce-pine-fir multiple ply, 5-ply minimum, pressure-treated construction, 0.563-inch (14-mm) thick minimum

B. Supports: Fiber reinforced plastic (FRP) composite structural shapes: ASTM D 635 and E 84, Pultruded FRP structural shapes, non-corrosive, flame retardant, thermosetting polyester resin, composite factory-fabricated shapes for assorted assemblies and field erection.

1. Ultimate tensile strength: 30,000 psi (207 MPa).
2. Modulus of elasticity: 2.8×10^6 psi (19,300 MPa).
3. Specific gravity: 1.6 to 1.75.
4. Density: 0.062 to 0.070 pounds/cubic inch (1.72 to 1.94 grams/cubic centimeter).
5. Flame spread: ASTM E 84 Class A, 25 maximum.
6. Color: Yellow.
7. Shapes and sizes as required to support the load, and in accordance with minimum sizes indicated on the drawings
8. Acceptable manufacturers:

- a. Bedford Reinforce Plastics Company
- b. Composites USA, Inc.
- c. Liberty Pultrusions, Inc.
- d. Strongwell Corporation
- e. Structural Fiberglass, Inc.

C. Fasteners: Corrosion-resistant and suitable for secure anchorage into wall behind backboards.

2.5 TREATED WOOD LUMBER

A. Wood-preservative-treated lumber: Treated by pressure process, AWPA C2, with chemicals acceptable to authorities having jurisdiction, and marked with treatment quality mark of an inspection agency approved by ALSC Board of Review.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS AND EQUIPMENT

A. Manufacturers' instructions: Except as modified by drawings or specifications, install products and equipment in accordance with manufacturers' instructions and recommendations applicable to the project conditions.

1. Immediately notify the DGS Project Manager if a difference or discrepancy is found between manufacturers' instructions and the drawings or specifications.

B. The contract drawings are diagrammatic and do not indicate all fittings or offsets in pipe, all access panels, or all specialties required. Provide required fittings, offsets, access panels, and specialties to coordinate the work.

C. No pipe shall be run below the head of a window or door.

D. Equipment and pipes installed in areas without a suspended ceiling shall be as tight to structure as possible, but at least above a height of 6'-8", unless otherwise noted.

E. Items which require access for operation or maintenance shall be easily accessible. Do not cut or form hand holes for operation or maintenance of appliances through walls or ceilings.

3.2 PIPE INSTALLATION

A. Install pipe exposed to view parallel to building lines and as close to walls, columns, and ceilings as may be practical, maintaining proper clearances for access at all parts requiring servicing.

B. Install pipe a sufficient distance from other work to permit a clearance of not less than 0.5 inch (15 mm) between its finished covering and adjacent work.

C. Remove burrs resulting from cutting pipe or from any other operation.

D. Provide for expansion and contraction of piping and connections so that no breakage or excessive strain will occur. Provide anchors and guides of approved design where shown on drawings and where necessary to allow for proper expansion and contraction. At the time of installation, expansion loops shall be cold sprung to one-half of the calculated expansion.

E. Pipe connection flexibility:

1. Connect domestic hot water risers and branch connections to mains with at least five pipe fittings, including tee in main.
 2. Connect domestic hot water risers and branch connections to equipment and fixtures with at least four pipe fittings, including tee in riser.
 3. Connect mains and branch connections to equipment and fixtures with at least four pipe fittings, including tee in main.
 4. Connections shall be arranged so that movement in piping due to expansion and contraction will not transmit excessive force to equipment or fixtures.
- F. Install unions or flanges in the piping at each item of equipment, solenoid valve, central thermostatic mixing valve, and appliance, so as to provide easy removal of the equipment, valve, or appliance.
- G. Pitch water piping so that air in the system can be properly vented. Provide shutoff valves where necessary to isolate parts of system for repairs without draining the entire system.
- H. Interface with other products:
1. Where pipe is provided through walls, provide finished, permanent, waterproof installation complete with inserts, sleeves, supports or hangers, seals, and other appurtenances as required. Do not pierce, cut, or notch any footing or other structural member.
 2. Waterproofing and dampproofing of the building shall be unharmed by the installation of the work. Where pipe has to pierce waterproofing or dampproofing, including outside walls, the penetration shall be made watertight. Waterproofing damaged or destroyed shall be repaired or replaced with new waterproofing.
- I. Thoroughly clean pipe and fittings before they are installed, and keep them clean until the acceptance of the completed work. Cap or plug the ends of the lines so as to prevent earth and other debris from entering during construction.
- J. Threaded connections:
1. Cut threads full and clean.
 2. Apply specified pipe joint compound or tape on male threads only.
 3. Where piping is installed in crawl spaces and tunnels, cover exposed threads with rust-inhibitive paint. Apply after joints have been assembled and tested.
- K. Copper tubing installation:
1. Cut pipe with a tubing cutter or fine-tooth saw. Cuts made with a saw shall be true and square, and the end shall be filed smooth with a fine-tooth file. Remove all marks and burrs with sandpaper.
 2. Solder joints for copper tubing: Clean ends of tubing and inside of fitting ends thoroughly with emery cloth before applying flux.
 3. Provide dielectric fittings between copper and steel piping to prevent electrolysis.
 4. Follow the techniques for soldering and brazing pipe, fittings, and valves as recommended by the manufacturer.

3.3 IDENTIFICATION

- A. General: Do not apply identification until insulation and finish painting work is complete.
- B. Equipment:

1. Stencil equipment with minimum two-inch (50-mm) -high letters or provide identification tags. Clearly identify function, equipment served, and area served.
2. Firmly fasten each identification tag to its appropriate piece of equipment with drive screws, sheet metal screws, or rivets. Do not interfere with operation of, or damage the item being marked.

C. Piping:

1. Mark by stenciling.
2. Mark to identify service with arrows showing direction of flow. Apply markings near building walls where pipes enter or leave an accessible space and in intermediate locations so that markings are no more than 30 feet (9 m) apart. They shall be readily visible to a person standing on the floor.
3. Fully identify all piping installed as work of the project.
4. Mark pipe with letters of height and with colors as required by OSHA and conforming to ASME A 13.1.
5. Identify every thermometer, gauge, and control device.
6. Provide valve tags for all valves except shutoff valves on individual fixtures or equipment where their function is obvious, or where the fixture or equipment is immediately adjacent. Numbers shall correspond to those shown on the Valve Chart. Attach tags to valve shaft.

D. Ceiling identification tags: Provide on the access door or, in suspended ceilings, on the ceiling support adjacent to the unit.

1. Valves: Identify with the same number shown on the valve tag.

3.4 CLEANING AND PAINTING

- A. Cleaning: Clean all piping and equipment. Where items are to be painted, clean ready for painting.
- B. Painting: Coordinate painting with requirements of Division 09. Paint the items identified below to be painted. Use paint materials and systems specified in Division 09.
- C. Items to be painted:
 1. Piping exposed in finished spaces, insulated and uninsulated.
- D. Items not to be painted: Copper, stainless steel, and equipment furnished with manufacturer's finish.
- E. Paint systems for exposed piping: Primer compatible with the substrate, whether steel, galvanized steel, insulation jacket, or other material; one coat or two, if required to cover, to match adjacent surfaces in color and texture.

3.5 BACKBOARDS FOR PIPING SPECIALTIES

- A. Provide wall-mounted backboards, sizes and locations as indicated on the drawings, for mounting piping specialties. Assembly shall consist of plywood board, FRP supports, and fasteners.

3.6 TREATED WOOD LUMBER

- A. Provide wood-preserved-treated lumber where wood members are required as detailed on the drawings and in the following applications:

1. Cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, or waterproofing.
2. Sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
3. Framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.

3.7 OPERATING INSTRUCTIONS (DEMONSTRATION)

- A. Furnish the necessary technicians, skilled workers, and helpers to operate all the plumbing systems and equipment of the entire project for one 8-hour day.
- B. Where specified in technical sections, provide longer periods required for specialized equipment.
- C. Instruct the Government's designated personnel in operation, maintenance, lubrication, and adjustment of all systems and equipment.
 1. Instructions by manufacturer's technical representative for each type of equipment shall include the performance of the recommended preventive maintenance procedures for that equipment.
- D. The Operating and Maintenance Manual shall be available at the time of the instructions, for use by instructors and Government personnel.
- E. Schedule the general and specialized instruction periods for a time agreed upon by DGS Project Manager.

3.8 PIPING TESTS

- A. Hydrostatic testing:
 1. Notify Government in writing at least 24 hours prior to the test.
 2. Test before pipes are concealed or insulated.
 3. Piping may be tested in sections as the work progresses.
 4. Provide fluid, pumps, valves, and gages required for testing.
 5. Where water is used as the test fluid, provide ambient temperature water and provide means to avoid freezing. Drain and dispose of test fluid when testing is concluded.
 6. Isolate equipment and expansion tanks during test.
 7. Isolate or remove any components with a pressure rating below the required test pressure.
 8. Brace and support piping during the test, so that no movement, displacement, or damage results from the application of the test pressure.
 9. Provide a pressure relief valve, set at a pressure no more than one-third higher than test pressure, to protect against damage caused by expanding liquid or other source of overpressure during test.
 10. Replace piping or fittings found defective with new material.
 11. Sanitary and storm drainage piping tests:
 - a. Before connection of the plumbing fixtures, and before connection to the sewer, cap or plug all new sanitary and storm drainage piping systems of the building.
 - b. Test following the methods of testing required by the plumbing code, and no less than the duration and pressures required in the Schedule of Piping Systems Tests.
 - c. Where pipes are in trenches, leave the trenches open until the completion of the test.
 12. Air conditioning condensate piping tests:

- a. Before connection of condensate producing HVAC equipment, cap or plug all new air conditioning condensate drain piping systems of the building.
 - b. Test following the methods of testing required by the plumbing code, and no less than the duration and pressures required in the Schedule of Piping Systems Tests.
 - c. Where pipes are in trenches, leave the trenches open until the completion of the test.
13. Documentation of tests: Prepare a test report for each portion of piping tested, identified by service, material, location, and pipe size. Include these items:
- a. Date of test.
 - b. Starting and completion times.
 - c. Initial test pressure.
 - d. Final test pressure.
 - e. Problems or leaks detected.
 - f. Corrective actions taken.
 - g. Record of successful completion of testing.
 - h. Name, title, and signature of person conducting test.

14. Piping Systems Test Schedule:

System	Test Pressure psig (kPa)	Duration	Allowable Drop	Medium
Domestic water service & exterior water piping	150 (1030)	4 Hours	None	Water
Domestic water piping (cold, hot, tempered, & recirculated)	125 (860)	4 Hours	None	Water
Air conditioning condensate drain piping	4.3 (30)	4 Hours	None	Water
Sanitary waste piping	4.3 (30)	4 Hours	None	Water

* If pressure drops, locate leaks with soap and water solution

END OF SECTION

SECTION 22 0501

EXCAVATION AND FILL FOR PLUMBING WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Trenching, backfilling, and compacting for plumbing work underground inside the building and extending five feet beyond exterior building walls.

1.2 RELATED SECTIONS

- A. Cutting and patching: Division 01 and Section 22 0101.
- B. Piping:
 - 1. Domestic water piping: Section 22 1116.
 - 2. Sanitary waste and vent piping: Section 22 1316.
 - 3. Storm drainage piping: Section 22 1413.

1.3 REFERENCES

- A. ASTM D 1557: Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbs/cu ft (2700 kN-m/cu m).

1.4 SUBMITTALS

- A. Shop drawings: At the same scale as the contract drawings, showing field verified locations of utilities, and proposed detailed trenching plan.
- B. Product data: Warning tape
- C. Certifications: Test reports showing that compaction meets specified requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Backfill: Earth materials, free from perceptible amounts of wood, debris, or topsoil, free of frost at the time of placement, and not containing marl or other elements which tend to stay in a plastic state.
- B. Underground warning tape: Polyethylene 0.004 inch (0.102 mm) thick for metallic lines, and for non-metallic lines polyethylene both sides with metallic lining, six inches (152 mm) wide.
 - 1. Colors: In accordance with APWA and AASHTO standards.
 - 2. Markings: Repeated continuously along the entire length, legend appropriate for line being identified.

2.2 EQUIPMENT

- A. Mechanical tampers for compacting backfill: Capable of exerting a blow equal to 250 pounds per square foot (12 kPa) of area of the tamping face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Contact local utility company underground information service (BGE Miss Utility) before beginning excavation outside buildings.
- B. The general locations of underground utilities are indicated on the drawings and are not to be assumed to be accurate or complete. Before beginning work, field check the area with the most accurate instruments available, such as Fisher Labs' Pipe and Cable Locators.

3.2 INSTALLATION

- A. Perform all excavating, cutting of paved areas, trenching, sheeting, shoring, backfilling, and compacting required for the proper installation of the work.
- B. Where obstructions are encountered, obtain written approval and make necessary changes in line, grade or location.
- C. Protect existing utilities from damage during excavation and backfilling. Repair damaged new or existing work at no addition to the contract sum. Bracing, shoring and other protection of existing utilities is part of this work.
- D. Do not damage or remove existing shrubs or trees including their root systems, without prior notification to the DGS Project Manager.
- E. Provide temporary roadways over trenches with railings and other safeguards, including amber blinker lamps or other warnings for night use.
- F. Note the depths of footings. In cases where piping is in close proximity to or below footings and where the natural earth under footings is disturbed, after the line is installed, the voids shall be filled up to bottoms of such footings with solid concrete.

3.3 CUTTING

- A. Cut concrete and asphalt concrete with masonry saw prior to breaking it into smaller pieces for removal.
- B. Cut sidewalks perpendicular to the length at the closest existing joint that is a minimum of 24 inches back from either side of the top of the new trench.

3.4 TRENCHING

- A. Excavations inside the building shall be carefully planned. Stockpile excavated earth so as not to interfere with other construction. Dig trenches to the proper depths, providing extra depressions where required for hubs of pipes.
- B. Trenches shall be of necessary depth and width for the proper laying of pipe with a minimum of 8 inches (205 mm) on each side of the joint.
 - 1. The sides shall be as nearly vertical as practicable. Unless local regulations are more strict, trenches 4 ft. (1220 mm) and deeper shall have shored sides as required by OSHA trenching regulations.

2. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its entire length, except for bell holes and for the proper sealing of the pipe joints.
 3. No greater length of trench shall be left open, in advance of the completed structure placed in it, than can be completed in that day's operation.
 4. Except where rock is encountered, do not excavate below the depths required. Where rock excavation is required, excavate to a depth of at least 6 inches (150 mm) below the trench depth and fill the overdepth with compacted crusher run or bank run stone or sand. Unauthorized overdepths in excavation shall be backfilled with crushed stone, slag or gravel, thoroughly compacted.
 5. Whenever wet or otherwise unstable soil is encountered, it shall be removed to the depth and extent directed, and the trench backfilled to the proper grade with crushed stone, slag or gravel.
- C. Should springs be encountered within the work area, or soft soil conditions at the elevations required for load bearing, immediately notify the DGS Project Manager and do not place any portion of the work on such surfaces until instructions are received.
- D. Furnish and maintain pumps, flumes, gutters, and appurtenances if required to keep the excavations free from water. Water shall be directed to a point remote from building operations, shown on the approved shop drawing.
- E. Excavation for manholes and similar structures shall be sufficient to leave a minimum of 12 inches (305 mm) and a maximum of 24 inches (610 mm) clearance on all sides. Fill over-depth excavation with concrete.

3.5 BACKFILL

- A. Place no backfill until the adjacent construction or the utility to be covered has been inspected, tested, and approved.
- B. Installing underground warning tape: Install in backfill above exterior buried lines not encased in concrete. Select legend and color appropriate for type of line. Install metallic lined tape for non-metallic lines. Install approximately 12 inches (305 mm) below grade.
- C. Plumbing systems backfill:
1. Backfill and compact in six-inch (150-mm) layers up to spring line of the pipe. The installations shall then be inspected and tested.
 2. Following inspection, backfill in six-inch (150-mm) layers, each compacted, until the pipe has a cover of not less than one foot (305 mm). Place the remainder of the backfill material in the trench in eight-inch (200-mm) compacted layers.
 3. Excavations improperly backfilled shall be reopened, then refilled and compacted to the required grade and compaction, and smoothed off.
 4. Open trenches across roadways or other areas to be paved shall be backfilled as specified above, except that the entire depth of trench shall be backfilled in six-inch (150-mm) layers, and each layer shall be mechanically compacted.
 5. Completed work shall have uniform graded surface, in accordance with the surface and grade indicated on the drawings.
- D. Structure backfill:
1. Do not backfill against structures with cement mortar joints until the mortar is at least twelve hours old.

3.6 **COMPACTION**

- A. Test in accordance with the requirements of ASTM D 1557.
- B. Compact under slabs, roads, and sidewalks to a 95 percent density.
- C. Compact unpaved areas to a 90 percent density.
- D. Backfill and compact trench in unpaved areas to within 4 inches (102 mm) of existing grade.
Furnish and install compacted select topsoil for the final layer to finish even with existing grade.
Remove surplus earth and rake unpaved areas for final planting.
- E. Take particular care in compaction of earth under joints of plumbing piping.

END OF SECTION

SECTION 22 0502

SLEEVES AND PLATES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Sleeves and escutcheon plates for piping systems.
- B. Mechanical seals for piping penetrations.

1.2 SUBMITTALS

- A. Product data: Sleeves, plates, sealants, and mechanical penetration seals.

PART 2 - PRODUCTS

2.1 SLEEVES, PLATES, AND ACCESSORIES

- A. Steel sleeves: Schedule 40 black steel pipe, ASTM A 53.
- B. Copper sleeves: Type L, ASTM B 88 hard drawn.
- C. Cast-iron sleeves:
 - 1. Extra heavy, with waterstop and ends as shown on the drawings.
 - 2. Equal to product of U.S. Pipe Co.
- D. Plastic sleeves: Schedule 40 PVC, ASTM D 1785.
- E. Sealing compound in walls and floors:
 - 1. Bare and insulated pipes carrying fluids 150 degrees F (65 degrees C) and below:
 - a. High-performance, moisture cured, 1-component, polyurethane-based, non-sag, elastomeric sealant. Use a primer for applications required by the manufacturer.
 - b. Basis of design: Sika Corporation "Sikaflex - 1a."
 - 2. Bare and insulated piping carrying fluids 151 degrees F (66 degrees C) and above:
 - a. One-part RTV silicone, neutral-cured, architectural grade sealant. Use a primer for applications required by the manufacturer.
 - b. Basis of design: Dow Corning Corporation "795 Silicone."
- F. Floor, wall, and ceiling plates for existing piping: Stamped or cast brass with chrome finish and set screw, split and tabbed.
- G. Floor, wall, and ceiling plates for new piping: Stamped or cast brass with chrome finish and set screw.
- H. Mechanical penetration seals:

1. Seals shall be modular mechanical type, consisting of interlocking synthetic links shaped to continuously fill the annular space between the pipe and wall opening. Bolt and nut fasteners for the seals shall be stainless steel for units used in penetrations below grade.
2. Basis of design: PSI "Link-Seal Modular Seals" or Calpico Sealing Link "LINX".

PART 3 - EXECUTION

3.1 INSTALLING SLEEVES

- A. Install sleeves for piping, or piping with insulation continuous through sleeve, passing through walls, partitions, beams, or slabs.
- B. Do not cut, drill, or burn structural steel for installation of piping without specific instructions from the DGS Project Manager.
- C. Locations in nonfire-rated construction:
 1. Install steel sleeves for penetrations of steel, iron, and insulated piping.
 2. Install copper sleeves for penetrations of uninsulated copper tubing and piping.
 3. Install plastic sleeves for penetrations of plastic piping. Plastic piping and sleeves are not permitted in ceiling spaces used as HVAC system plenums, or in shafts used for building HVAC air distribution.
- D. Locations in floors and fire-rated construction: Sleeves used in piping penetrations through fire-rated construction shall be an acceptable component of the through-penetration firestop assembly as specified in Division 07.
 1. Where firestop assembly is UL listed, sleeve material shall be as directed in the listing.
 2. Where other specified approval and acceptance is required, sleeve shall be as described in the approved assembly.
- E. Install sleeves through walls and partitions flush with finished surfaces.
- F. Sleeves through floors shall extend 0.375 inch (10 mm) above top of finished floor and be finished neat and level. Sleeves through mechanical or equipment room floors shall extend one inch (25 mm) above finished floor. Provide projecting sleeves with anchor clips to prevent them from being loosened and knocked down in the floor construction.
- G. Sleeves for insulated piping shall be large enough to pass piping and insulation.
- H. Seal spaces between sleeves and pipe, or pipe insulation, in nonrated walls, with mineral wool.
- I. Penetrations in exterior masonry or concrete walls and foundations:
 1. Sleeves: Cast iron, or in cast concrete may be core drilled.
 2. Above grade: Mechanical penetration seal at outside face of wall.
 3. Below grade: Mechanical penetration seal, at outside face of wall.

3.2 INSTALLING PLATES

- A. Exposed piping passing through interior walls, partitions, floors, and ceilings shall be fitted with plates of size and depth to conceal sleeves. Secure plates firmly in place with set screws.

END OF SECTION

SECTION 22 0504

PLUMBING DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Extent and location of demolition are shown on the drawings.

1.2 RELATED SECTIONS

- A. Demolition: Section Division 02.

1.3 QUALITY ASSURANCE

- A. Demolition shall be carried out as expeditiously as possible in accordance with accepted practice and applicable building code provisions.

1.4 PROJECT CONDITIONS

- A. If, in the course of the work, workers encounter a material they suspect to be asbestos, to contain lead or PCBs, or to present some other hazard:
 - 1. Promptly notify the DGS Project Manager in writing.
 - 2. Do not perform any work which would disturb the suspected material until written instructions have been received.
- B. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
- C. Locate, identify, and protect mechanical and electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 DEMOLITION

- A. Comply with demolition and disposal requirements of Division 02.
- B. Perform removal work neatly with the least possible disturbance to the building.
- C. Provide temporary barriers, danger signals, and appurtenances for protection of personnel and equipment during removal operations.
- D. Demolish, remove, demount, and disconnect inactive and obsolete piping, fittings and specialties, equipment, ductwork, controls, fixtures, and insulation.

1. Piping and ducts embedded in floors, walls, and ceilings may be abandoned in place if they do not interfere with new installations. Cut back to at least one inch below finished surface.
2. Remove materials above accessible ceilings.
3. Drain and cap items to remain behind finished surfaces.
4. Patch and repair surface materials as required in Division 01 and Section 22 0101 article, "Cutting and Patching."

E. Remove anchors, bolts, and fasteners associated with piping and equipment to be removed.

3.2 DISPOSAL

- A. Dispose of equipment and materials removed, and rubbish and waste material, as work progresses. Do not allow demolition debris to accumulate on site. Remove products of demolition from the building daily.

3.3 PROTECTION

- A. Provide adequate and positive protection to existing building and equipment that is to remain, particularly to prevent entry of either dust or water. Ensure weathertightness at all times. Keep standby patching materials on hand to patch and maintain protection as required.

END OF SECTION

SECTION 22 0506

CURBS AND FLASHINGS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe boot assemblies and flashing devices for plumbing items and equipment penetrating roof and mounted on roof.

1.2 RELATED SECTIONS

- A. Rough carpentry: Division 06.
- B. Piping:
 - 1. Domestic water piping: Section 22 1116.
 - 2. Sanitary waste and vent piping: Section 22 1316.
 - 3. Storm drainage piping: Section 22 1413.

1.3 SUBMITTALS

- A. Shop drawings: Flashing assemblies and devices showing compatibility with roof membrane, insulation, and slope, and configuration for the supported equipment.
- B. Product data: Each type of manufactured unit, accessory, and accessory material.

1.4 SEQUENCING

- A. Coordinate installation of supports with roof structure and membrane. Loads and penetrations shall not exceed or damage structural capacity or weathertightness.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Wood-preserved-treated lumber: As specified in Division 06 and in Section 22 0500.
 - 1. Application: Treat items indicated on the drawings, and the following:
 - a. Wood cants, nailers, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, or waterproofing.

2.2 PENETRATIONS OF SINGLE PIPE OR VENT

- A. Basis-of-design product: Subject to compliance with requirements, provide the specified product, or comparable product by another manufacturer.
- B. Plumbing vents on sloped roofs:
 - 1. Base size 15 by 15 inch (380 by 380 mm); weight of lead, 4 lbs (1.8 kg per 0.09 sq. m); angle of roof as shown on the drawings. Flashing shall be formed to fit over top of pipe and in one continuous piece down to roof.
 - 2. Basis of design: Oatey Flashings type "Hi Collar Lead Flashing"

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Plumbing vent shall extend 8 inches (205 mm) above finished roof. Clamp devices shall be tightly sealed to vent. Space between vent hub and pipe shall be lightly caulked with lead to provide for movement in piping.
- B. Flashing of roofing felts into clamping devices of roof drains and sleeves through roof, and flashing shall be as specified under Division 07, including all material and labor to waterproof roof.
- C. Where dissimilar metals would come in contact with each other, coat them with bituminous protective coating or other coating compatible with adjacent materials.

END OF SECTION

SECTION 22 0509

PLUMBING EXPANSION SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Precharged bladder-type expansion tank for potable water system.

1.2 RELATED SECTIONS

- A. Piping: Section 22 1116.
- B. Supports: Section 22 0529.

1.3 SUBMITTALS

- A. Product data: Each type of expansion system or tank, including each relief and air separation device and all accessories.
 - 1. Certification that products comply with NSF/ANSI 61 and NSF/ANSI 372.

1.4 QUALITY ASSURANCE

- A. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61, NSF/ANSI 372 with requirements for "lead-free" plumbing as defined by state laws and U.S. Safe Drinking Act.
- B. Acceptance product marking: NSF®-61 and NSF®-372 (or NSF®-61-G) or other accepted certifier marks demonstrating third party certification with these requirements.
- C. Product specifications herein may not necessarily meet all regulations for the limits on lead content. The Contractors and product suppliers shall be responsible to provide products that comply with NSF/ANSI 61 and NSF/ANSI 372 for domestic water systems.

PART 2 - PRODUCTS

2.1 AVAILABLE MANUFACTURERS

- A. Basis-of-design product: Subject to compliance with requirements, provide the specified and scheduled products, comparable products by one of the following, or approved equal:
 - 1. Expansion tanks:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell and Gossett Domestic Pump Div of ITT
 - d. Taco
 - e. Wessels
 - f. Or approved equal.

2.2 EXPANSION TANK FOR POTABLE WATER

- A. Pressurized bladder type tank, containing impermeable bladder which separates the air cushion from the system water. Operating temperature: 240 degrees F maximum. Precharge to manufacturer's standard pressure.
- B. Shell: Welded steel, constructed, tested and stamped in accordance with ASME BPV for Unfired Pressure Vessels for a working pressure of 125 psi. Lined with protective coating.
- C. Bladder: Butyl rubber, flexible but not stretchable under working conditions, removable for inspection.
- D. FDA approval: Wetted components FDA-approved materials.
- E. Size and capacity: Shown on the drawings.
- F. Supports: For horizontal or vertical support on concrete equipment foundation, as diagramed on the drawings.
- G. Basis of design: Taco PAX model number scheduled on the drawings.

2.3 AUTOMATIC AIR VENT

- A. Float type vent, size and capacity recommended by manufacturer for tank and system.

PART 3 - EXECUTION

3.1 INSTALLING EXPANSION TANKS

- A. Follow manufacturer's instructions and recommendations.
- B. Install piping, air separation apparatus, and vents as diagramed on drawings.
- C. Install supports as shown on drawings.

3.2 OPERATING INSTRUCTIONS

- A. As specified in Section 22 0500, provide operating instructions.

END OF SECTION

SECTION 22 0523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Valves for various piping systems.

1.2 RELATED SECTIONS

- A. Piping installation and testing: Section 22 0500.
- B. Piping systems:
 - 1. Domestic water piping: Section 22 1116.
 - 2. Sanitary waste and vent piping: Section 22 1316.
 - 3. Storm drainage piping: Section 22 1413.
- C. Automatically operating valves: Section 22 1119.
- D. Access doors: Section Division 08.
- E. Automatic water temperature control valve for domestic hot water: Section 22 1119.

1.3 REFERENCES

- A. ASME B16.10: Face-to-Face and End-to-End Dimensions of Valves.
- B. ASME B16.34: Valves - Flanged, Threaded, and Welding End.

1.4 SUBMITTALS

- A. Product data: For each type of valve. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.
 - 1. Certification that products comply with NSF/ANSI 61 and NSF/ANSI 372.
- B. Maintenance data: For inclusion in operation and maintenance manual specified in Division 01 and Section 22 0101. Include manufacturer's instructions for adjusting, servicing, disassembling, and repairing.
- C. Valve charts: Furnish valve charts typed on 8.5 by 11-inch (216 by 279-mm) bond paper, showing locations of all manual and automatic control valves, and flow meters. Include:
 - 1. Number
 - 2. Location
 - 3. Service
 - 4. Function
 - 5. Area served

- D. Valve numbering system shall be approved by the Government prior to final submittal. Place one copy of approved chart in a plastic envelope and mount on wall where directed. Provide another copy for each of the Operating and Maintenance Manuals.

1.5 QUALITY ASSURANCE

- A. Ferrous valves shall conform to ASME B16.10 and B16.34 for dimension and design criteria.
- B. Copper alloy valves (brass and bronze) shall have no more than 15 percent zinc in the alloy.
- C. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61, NSF/ANSI 372 with requirements for "lead-free" plumbing as defined by state laws and U.S. Safe Drinking Act.
- D. Acceptance product marking: NSF®-61 and NSF®-372 (or NSF®-61-G) or other accepted certifier marks demonstrating third party certification with these requirements. Product specifications herein may not define all product options necessary to meet all regulations for the limits on lead content. The Contractors and product suppliers shall be responsible to provide products that comply with NSF/ANSI 61 and NSF/ANSI 372 for domestic water systems.

PART 2 - PRODUCTS

2.1 AVAILABLE MANUFACTURERS

- A. Ball valves: Subject to compliance with requirements, provide the specified NIBCO valve, comparable product by one of the following, or approved equal:
 - 1. Apollo Valves
 - 2. Milwaukee Valve Co.
 - 3. NIBCO
 - 4. Stockham Valve & Fittings
 - 5. Walworth Co.
 - 6. Watts Regulator Co.
 - 7. Or approved equal.
- B. Check valves: Subject to compliance with requirements, provide the specified NIBCO valve, comparable product by one of the following, or approved equal:
 - 1. Combination Pump and Valve Co.
 - 2. Mueller Steam Specialty
 - 3. NIBCO
 - 4. Or approved equal.
- C. Drain valves: Subject to compliance with requirements, provide the specified NIBCO valves, comparable products by one of the following, or approved equal:
 - 1. Apollo Valves
 - 2. Milwaukee Valve Co.
 - 3. NIBCO
 - 4. Stockham Valve & Fittings
 - 5. Walworth Co.
 - 6. Watts Regulator Co.
 - 7. Or approved equal.

2.2 VALVES

A. Ball valves:

1. Valves NPS 0.25 (DN 8) through NPS 2 (DN 50):
 - a. 600 psi CWP, two-piece silicon bronze alloy body, full port, blowout-proof stem, PTFE seats, stainless-steel ball and stem, extension handle for use in insulated piping, threaded or soldered ends.
 - b. Basis of design: NIBCO T-685-66-LF or S-685-66-LF.

B. Check valves:

1. Center-guided, spring-loaded silent-action type check valves:
 - a. Valves NPS 0.5 (DN 15) through NPS 2 (DN 50):
 - (1) 250 psi CWP, silicone bronze body, PTFE disk, stainless-steel stem and spring, threaded or soldered ends.
 - (2) Basis of design: NIBCO T-480-Y-LF or S-480-Y-LF.

2.3 DRAIN VALVES

A. Drain valves:

1. Provide with supplemental ASSE 1011 backflow preventer.
2. Full-port, two-piece ball valve, bronze body, bronze ball, replaceable PTFE seats and seals, vinyl-covered steel handle, threaded or soldered inlet, threaded cap with brass chain. Provide extension handles where used in insulated piping. Remove handle where valve is accessible to the general public.
3. Pressure rating: 600-psig (4137-kPa).
4. NPS 0.75 (DN 20) inlet.
5. NPS 0.75 (DN 20) ASME B1.20.7 garden-hose thread outlet.
6. Basis of design: NIBCO T-585-80-LF-HC or T-585-80-LF-HC.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install valves to be readily accessible for operation and maintenance, and with ample clearance for turning handles or operators.
- B. For valves in inaccessible locations, provide access doors as specified in a related section.
- C. Identify valves as specified in Section 22 0500, Common Work Results for Plumbing.
 1. Provide tags for all valves except stop valves on individual fixtures or equipment where their function is obvious, or where the fixture or equipment is immediately adjacent. Numbers shall correspond to those shown on the Valve Chart. Attach tags to valve shaft.
 2. Provide ceiling identification tags where valves are above an accessible suspended ceiling. Number shall correspond to tag number.

3.2 INSTALLING GATE VALVES AND BALL VALVES

- A. Install shutoff valves for water piping where indicated:

1. Sizes NPS 4 (DN 50) and smaller: Ball valves.

3.3 INSTALLING CHECK VALVES

- A. Provide center-guided, spring-loaded silent-action type check valves in domestic water lines.

3.4 INSTALLING DRAIN VALVES

- A. Provide drain valve at every low point of a water system, and where indicated.

END OF SECTION

SECTION 22 0529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe hangers and supports.
- B. Metal framing systems.
- C. Insulation protection.
- D. Fasteners.
- E. Equipment supports

1.2 RELATED SECTIONS

- A. Plumbing Piping Insulation: Section 22 0719.

1.3 REFERENCES

- A. American Society of Mechanical Engineers
 - 1. ASME B31.9: Building Services Piping.
- B. ASTM International
 - 1. ASTM A 36: Standard Specification for Carbon Structural Steel
 - 2. ASTM A 53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 3. ASTM A 307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
 - 4. ASTM A 563: Standard Specification for Carbon and Alloy Steel Nuts
 - 5. ASTM A 1064: Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - 6. ASTM C 533: Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
 - 7. ASTM C 552: Standard Specification for Cellular Glass Thermal Insulation
 - 8. ASTM F 594: Standard Specification for Stainless Steel Nuts
 - 9. ASTM F 3125: Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated
- C. American Welding Society
 - 1. AWS-D.1.1: Structural Welding – Steel
- D. Metal Framing Manufacturer's Association
 - 1. MFMA-4: Metal Framing Standards Publication
 - 2. MFMA-103: Guidelines for the Use of Metal Framing
- E. Manufacturer's Standardization Society

1. MSS SP-58: Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.4 DEFINITIONS

- A. Hot Systems: Maximum operating (service) temperatures 120 degrees F (49 degrees C) and above.
- B. Ambient Systems: Maximum operating temperatures 60 to 119 degrees F (16 to 48 degrees C).
- C. Cold Systems: Maximum operating temperatures 59 degrees F (15 degrees C) and below.

1.5 SUBMITTALS

- A. Product data:
 1. Provide manufacturer's literature showing compliance with specifications for each type of hanger, framing system, support, fastener and accessory materials.
 2. Provide a schedule of piping types and sizes and associated pipe hanger types.
 3. Provide a schedule of building attachment types and associated attachment hardware.
 4. Provide a schedule of pipe types and sizes and proposed hanger spacing and support rod diameters.
 5. Provide manufacturer's recommended pipe hanger spacing criteria for stainless steel piping.
 6. For supports used as components of fire protections systems, include certification of listing and label as required in "Quality Assurance" below.
- B. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Qualifications of welders: As specified in Section 220500, Common Work Results for Plumbing.
- B. Hangers and supports used as components of fire protection systems shall:
 1. Comply with NFPA 13.
 2. Be listed and labeled by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7.

PART 2 - PRODUCTS

2.1 AVAILABLE MANUFACTURERS:

- A. Pipe hangers:
 1. Anvil International
 2. Carpenter and Paterson, Inc.
 3. Cooper Industries
 4. National Pipe Hanger Corporation
 5. PHD Manufacturing, Inc.
 6. PHP Systems/Design
 7. Or approved equal.
- B. Metal framing systems:
 1. Anvil International

2. Cooper Industries
3. Hydra-Zorb
4. PHD Manufacturing, Inc.
5. PHP Systems/Design
6. Unistrut
7. Or approved equal.

C. Pipe covering protection shields:

1. Anvil International
2. Carpenter and Patterson, Inc.
3. Cooper Industries
4. National Pipe Hanger Corporation
5. PHD Manufacturing, Inc.
6. Pipe Shields, Inc.
7. Rilco Manufacturing Co., Inc.
8. Or approved equal.

2.2 PIPE HANGERS AND SUPPORTS

A. General: Comply with requirements of MSS SP-58.

B. Hangers and clamps:

1. Crawl spaces, tunnels, and wet areas: Galvanized steel.
2. Typical interior applications: Galvanized steel or factory painted.
3. Exterior and corrosive applications: Stainless steel.
4. For use with uninsulated copper pipe: Copper plated.

C. Supplemental materials:

1. Threaded rod: Continuously threaded.
 - a. Zinc-plated or galvanized carbon steel for indoor applications.
 - b. Stainless steel for outdoor and corrosive applications.
2. Nuts and washers: Provide the same material used for threaded rods (ASTM A 563 for steel, ASTM F 594 for stainless steel).
3. Structural carbon-steel shapes: ASTM A 36.
4. Steel pipe: ASTM A 53, Grade B, Type E (electric resistance welded), Schedule 40, black and galvanized steel.

D. Metal framing systems:

1. Description: Shop- or field-fabricated, pipe-support assembly made of channels, nuts, bolts, structural connections, accessories, fittings, and other manufactured components.
2. Standard: Comply with MFMA-4 for factory-fabricated components for field assembly.
3. Channels: Continuous slotted galvanized steel channel with inturned lips, width selected for applicable load criteria.
4. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Metal framing system pipe clamps:
 - a. Galvanized steel clamp pipe support with elastic stop nut, and hex head machine screw, and manufactured to connect to metal framing system channels.

- b. For insulated piping: Clamp shall have friction tape on inside of clamp surface, manufactured to connect to pipe clamp insulating insert over pipe.
 - c. For uninsulated piping: Clamp shall have an integral molded thermoplastic elastomer clamping insert on inside of clamp surface, manufactured to connect to uninsulated pipe.
- E. Insulation protection:
- 1. Pipe covering protection shield:
 - a. Shield: Galvanized steel, meeting the requirements of MSS SP-58 Type 40. Provide with alignment ridges when used in conjunction with pipe hanger.
 - b. Structural insulation insert: Structural insulation insert to form the insulation for the lower half of, or the entire pipe circumference Provide ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength; or ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength. Insert thickness shall match adjacent piping insulation thickness.
 - 2. Combination insulating insert and insulation protection shield:
 - a. Insulating insert material for cold and ambient system piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier. Insert thickness shall match adjacent piping insulation thickness.
 - b. Insulating insert material for hot system piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength; or ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength. Insert thickness shall match adjacent piping insulation thickness.
 - c. Insulation protection shield: Galvanized steel.
 - d. Insulating insert and insulation protection shield shall cover entire circumference of pipe.
 - e. Insulating insert length: Extend 2 inches minimum (50 mm) beyond insulation protection shield.
 - 3. Pipe covering protection saddle:
 - a. Saddle: Steel, meeting requirements of MSS SP-58 Type 39
 - b. Insulation insert: Insulating material located in the space between saddle and pipe.
 - 4. Pipe clamp insulating insert:
 - a. Insulating insert material: Closed-cell, sponge or expanded rubber, ASTM C 534, Type I for tubing material, with integral supports constructed from non-compressive closed cell material, single piece construction with self-adhesive closure strips. Insert thickness shall match adjacent piping insulation thickness. If insulation thickness is not available, provide maximum available thickness and seal insulation vapor barrier at thickness transition.
 - b. Insulation protection jacket: Aluminum or stainless steel, bonded to insulation insert.
 - c. Insulating insert and jacket shall cover entire circumference of pipe.
 - d. Basis of design: Armacell "Armafix" insulating inserts.

2.3 FASTENERS

- A. Mechanical expansion anchors:

1. Self-drilling type expansion shields or machine bolt drop-in anchors for drilled holes. Fasteners to floor slabs shall be vibration and shock resistant. Load applied to fasteners shall not exceed 25 percent of manufacturer's stated load capacity in 3500 psi (24,000 kPa) concrete. Provide zinc-coated anchors for indoor applications and stainless-steel anchors for outdoor applications.
 2. Basis of design: ITT Phillips Anchors "Red Head."
- B. Fasteners to drywall or cavity wall construction:
1. Toggle bolts with hollow wall drive anchors or nylon anchors as required.
 2. Basis of design: ITT Phillips Anchors "Red Head" toggle bolts.
- C. Fasteners to wood construction: Lag bolts.
- D. Bolts, nuts, and washers: ASTM A 307, or ASTM F 3125 where high strength is required.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide hangers and supports in accordance with schedules at the end of this section, as modified by specifications for each location and type.
- B. Comply with MSS SP-58. Provide hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- C. Provide hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- D. Where required, provide structural steel shapes or metal framing system channels and hardware to transfer load from a hanger location to multiple locations in the structure in order to get support from an appropriate location or to increase the strength of the connection to the structure.
- E. Support horizontal piping from above with hangers and threaded rod where possible, unless otherwise indicated.
- F. Secure vertical piping at stack bases.
- G. Support vertical piping at each floor with riser clamps. Provide additional supports as needed not to exceed scheduled maximum vertical support spacing.
- H. Provide hanger sizes to allow for continuous insulation for insulated piping systems.
- I. Fabricate wall-mounted and floor-mounted supports using metal framing systems or structural steel where required.
- J. Support groups of small piping along a structural wall using a metal framing system secured to the wall.
- K. Trim threaded rods with a maximum excess length of 1 inch (25 mm). Provide protective rubber red end caps on the ends of threaded rods exposed and within 8 feet (2.4 meters) of the floor, roof, or grade below.

- L. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- M. Install lateral bracing with pipe hangers and supports to prevent swaying.
- N. Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- P. Coordinate with requirements for hangers that require vibration control. See Section 230548.
- Q. Metal framing systems: Provide where required for grouping of parallel runs of piping, and support together on field-assembled strut systems. Comply with MFMA-103 for metal framing system selections and applications.

3.2 BUILDING ATTACHMENTS

- A. Attaching to concrete slabs:
 - 1. Obtain approval from the structural engineer and confirm allowable loads prior to supporting pipe from concrete slabs or composite slabs. Where approved, provide mechanical expansion anchors and steel bolts or rods.
- B. Attaching to steel decks: Not permitted.
- C. Attaching to wood construction:
 - 1. Trusses: Follow roof truss manufacturers' recommendations for attachment locations, loads, spacing, and methods of attachment.
 - 2. Joists: Provide MSS SP-58 Type 34 side beam connectors.

3.3 INSTALLING CAST-IRON PIPING

- A. Support piping within 18 inches (460 mm) of each horizontal joint in addition to satisfaction of maximum hanger spacing. Where there are multiple joints in a 4 foot (1.2 m) section, supports may be provided at every other joint.
- B. Support piping at changes in direction.
- C. Where pipe is supported by hangers more than 18 inches (460 mm) long, provide lateral support at a maximum interval of 40 feet (12.2 m) with sway bracing.
- D. Secure closet bends, traps, and similar items against movement in any direction.

3.4 INSTALLING EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor. Provide lateral bracing, to prevent swaying.
- B. Coordinate exact size, configuration and location of equipment, foundations, and supports using approved shop drawings of equipment.

3.5 PIPING HANGER AND SUPPORT SCHEDULES

- A. Insulated cold and ambient applications: Applications include, but are not limited to, domestic cold water and insulated sanitary and storm water systems.

HANGERS & SUPPORTS FOR INSULATED COLD AND AMBIENT APPLICATIONS		
MSS SP-58 Classification	Description	Piping Applications
Hung from Above		
Types 1 & 40	Clevis hanger & pipe covering protection shield.	NPS 0.5 (DN 15) through NPS 2 (DN 50)
Types 1 & 40 (with structural insulation insert)	Clevis hanger & pipe covering protection shield, with structural insulation insert.	NPS 2.5 (DN 65) and larger
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 4 (DN 100)
Supported from Below		
Type 37 (with combination insulating insert and insulation protection shield)	Adjustable pipe stanchion saddle with U-bolt and floor flange anchored to floor (with combination insulating insert and insulation protection shield).	All sizes where supported from floor or a concrete support pier.
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 8 (DN 200)

- B. Insulated hot applications: Applications include, but are not limited to domestic hot water and domestic hot water return systems.

HANGERS & SUPPORTS FOR INSULATED HOT APPLICATIONS		
MSS SP-58 Classification	Description	Piping Applications
Hung from Above		
Types 1 & 40	Clevis hanger & pipe covering protection shield.	NPS 0.5 (DN 15) through NPS 2 (DN 50)
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 4 (DN 100)
Supported from Below		
Type 37 (with combination insulating insert and insulation protection shield)	Adjustable pipe stanchion saddle with U-bolt and floor flange anchored to floor (with combination insulating insert and insulation protection shield).	All sizes where supported from the floor or a concrete support pier. Use only where no significant horizontal pipe movement is anticipated.
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 6 (DN 150)

- C. Uninsulated applications: Applications include, but are not limited to uninsulated storm water, sanitary, vent, compressed air, and laboratory gas systems.

HANGERS & SUPPORTS FOR UNINSULATED APPLICATIONS		
MSS SP-58 Classification	Description	Piping Applications
Hung from Above		
Type 1	Clevis hanger	All sizes
Type 10	Adjustable swivel ring	NPS 0.5 (DN 15) through NPS 4 (DN 100)
N/A	Metal framing system with metal framing system pipe clamps for uninsulated piping.	NPS 0.5 (DN 15) through NPS 4 (DN 100)
Supported from Below		
Type 37	Adjustable pipe stanchion saddle with U-bolt, with floor flange and base anchored to floor.	All sizes where supported from the floor or a concrete support pier.
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 8 (DN 200)

- D. Minimum threaded rod sizes: Provide at least the following minimum rod diameters for single rods supporting a single pipe hanger.

Pipe Size	Minimum Rod Diameter
NPS 2 (DN 50) and below	0.375 inches (10 mm)
NPS 2.5 and NPS 3 (DN 65 and DN 75)	0.5 inches (15 mm)

- E. Maximum hanger and support spacing for pressurized piping: Provide additional hangers or supports for concentrated loads such as flanges, valves, expansion compensators, fittings, and other specialties.

1. Horizontal spacing:

Pipe Size	Copper Piping
NPS 0.75 (DN 20) and below	5 feet (1.5 m)

2. Vertical spacing:

Copper Piping
10 feet (3 m)

- F. Maximum hanger and support spacing for metal and PVC gravity piping: Provide additional hangers or supports for concentrated loads such as fittings, and other specialties.

1. Horizontal spacing:

Pipe Size	Copper DWV Tubing	Cast-iron (Hub & Spigot)	Cast-iron (No-hub)
1.5 inches (40 mm)	8 feet (2.4 m)	N/A	5 feet (1.5 m)
2 inches (50 mm)		5 feet (1.5 m)	
3 inches (75 mm)	10 feet (3 m)		
4 inches (100 mm)			
Cast-iron horizontal support spacing may be increased up to but not in excess of 10 feet (3 m) where 10 foot (3 m) or greater lengths of pipe are used.			

2. Vertical spacing:

Copper DWV Tubing	Cast-iron (Hub & Spigot)	Cast-iron (No-hub)
10 feet (3 m)	15 feet (4.5 m)	15 feet (4.5 m)

END OF SECTION

SECTION 22 0700

PLUMBING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Definitions and general requirements applicable to the insulation systems specified in "Related Sections."

1.2 RELATED SECTIONS

- A. Plumbing piping insulation: Section 22 0719.

1.3 REFERENCES

- A. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials
- B. NFPA 255: Standard Method of Test of Surface Burning Characteristics of Building Materials
- C. UL 723: Standard for Test for Surface Burning Characteristics of Building Materials

1.4 DEFINITIONS

- A. Concealed insulation shall include work:
 - 1. Above ceilings.
 - 2. Where furred in and in pipe chases.
- B. Exposed insulation shall include work:
 - 1. In all rooms and areas.
 - 2. In mechanical equipment rooms, penthouses, or other similar utility spaces.
 - 3. In storage rooms.
- C. Unconditioned areas: Areas outside of the insulated envelope.
- D. Finished spaces: Areas of the building accessible to the public and to building occupants other than service personnel.

1.5 QUALITY ASSURANCE

- A. Perform work in strict accordance with the building, fire and safety codes of the state, county or city in which the work is performed.
- B. Insulation, including fittings and butt strips, jackets, facings, and accessories such as adhesives, mastics, cements, tapes and cloth, shall have a fire and smoke hazard rating and label as tested by ASTM E84, NFPA 255, and UL 723, not exceeding Flame Spread 25, Fuel Contributed 50, Smoke Developed 50.
- C. All insulation and accessories shall be free of asbestos.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation and accessory products in manufacturers' wrapping or cartons, identified on the exterior and bearing labels showing conformance to flame and smoke rating requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Refer to sections listed in "Related Sections."

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 22 0719

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Plumbing piping insulation for the interior piping systems listed in the minimum insulation thickness schedule at the end of this section.
- B. Plumbing piping insulation for the exterior piping systems.
- C. Work of this section includes:
 - 1. Insulation for new piping installed under this contract.
 - 2. Patching existing insulation where removed to make connections to existing piping.
 - 3. Patching existing insulation damaged during demolition and construction.

1.2 RELATED SECTIONS

- A. Firestopping: Division 07.
- B. Painting: Division 09.
- C. Definitions and general insulation requirements: Section 22 0700.
- D. Pipe hangers and protection shields: Section 22 0529.

1.3 REFERENCES

- A. American Society of Testing and Materials
 - 1. Standards for mineral fiber insulation materials
 - a. ASTM C 449: Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
 - b. ASTM C 547: Mineral Fiber Pipe Insulation.
 - c. ASTM C 553: Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - d. ASTM C 1136: Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
 - 2. Standards for flexible elastomeric insulation materials
 - a. ASTM C 534: Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - 3. Standards for all insulation materials
 - a. ASTM C 450: Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
 - b. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

4. Standards for field applied jackets and accessories
 - a. ASTM D 1784: Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

1.4 SUBMITTALS

- A. Material list: Each type of insulation and accessory, with manufacturer's name and material name and number. Identify locations for use, thickness of material, type of jacket, vapor barrier, and method of application.
- B. Product data: Sufficient to show that the product meets the specified requirements for materials, composition, and performance.
- C. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.
- D. Installer qualifications.

1.5 QUALITY CONTROL SUBMITTALS

- A. Manufacturer's instructions: Recommended accessory materials and products; installation instructions.

1.6 QUALITY ASSURANCE

- A. Installers shall be mechanics skilled in this trade, employed with a firm that has a minimum of five years of experience installing mechanical insulation.

PART 2 - PRODUCTS

2.1 AVAILABLE MANUFACTURERS

- A. The listed manufacturers and particular products are intended to set a standard for materials, composition, and performance. Products of other manufacturers may be proposed as permitted by the provisions of Division 01 and the article "Product Options" in Section 22 0101.
- B. Mineral fiber insulation:
 1. CertainTeed Corporation.
 2. Johns Manville
 3. Knauf Fiber Glass GmbH
 4. Owens-Corning
 5. Or approved equal.
- C. Flexible elastomeric insulation:
 1. Aeroflex USA
 2. Armacell LLC
 3. K-Flex USA
 4. Rubatex
 5. Or approved equal.
- D. Coatings, adhesives, and fabrics:

1. Childers
2. Foster
3. Manville Building Materials Group
4. Rock Wool Manufacturing Company
5. Trimac
6. Or approved equal.

2.2 MINERAL FIBER INSULATION MATERIALS

- A. Mineral fiber preformed pipe insulation: Glass fibers bonded with a thermosetting resin, ASTM C 547 Type I, with factory-applied ASJ-SSL jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
- B. ASJ-SSL jacket:
 1. All service jacket with self-sealing lap.
 2. White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
 3. Complying with ASTM C 1136, Type I.
- C. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, pressure sensitive, complying with ASTM C 1136; 3 inch (75 mm) width. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
- D. Mineral fiber blanket insulation: Glass fibers bonded with a thermosetting resin, ASTM C 553, Type IV, without facing. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
- E. Mineral fiber preformed fitting and valve covers: Glass fibers bonded with a thermosetting resin, made from the same material and density as adjacent pipe insulation, meeting ASTM C 450 requirements for dimensions used in forming insulation to cover valves, elbows, tees, flanges, strainers, and unions. Provide with preformed PVC field-applied jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
- F. Mineral fiber insulation adhesive:
 1. Solvent free, low VOC, water-based adhesive designed for bonding mineral fiber insulation to steel or aluminum surfaces, and compatible with service temperatures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
 2. Basis of design: Foster 85-60 "Quick-Tack".
- G. Mineral fiber insulation vapor barrier mastic:
 1. Vapor barrier coating for use over ASJ jackets to give a vapor barrier seal at joints, laps and punctures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
 2. Basis of design: Foster 30-65 "Vapor-Fas".
- H. Insulating cement: Mineral fiber cement with a hydraulic-setting binder, conforming to ASTM C 449. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

2.3 FLEXIBLE ELASTOMERIC INSULATION MATERIALS

- A. Flexible elastomeric preformed pipe insulation: Closed-cell, sponge- or expanded-rubber, ASTM C 534, Type I for tubular materials. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
- B. Flexible elastomeric preformed fitting and valve covers: Closed-cell, sponge- or expanded-rubber, made from the same material and density as adjacent pipe insulation, meeting ASTM C 450 requirements for dimensions used in forming insulation to cover valves, elbows, tees, flanges, strainers, and unions. Provide with preformed PVC field-applied jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
- C. Flexible elastomeric insulation adhesive:
 - 1. Water resistant contact cement designed especially suited for bonding two impermeable surfaces and recommended for rubber foam, steel, or aluminum surfaces, and compatible with service temperatures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
 - 2. Basis of design: Foster 85-75 "Drion".
- D. Flexible Elastomeric Tape: Black, closed cell, self-adhering, elastomeric thermal insulation tape for insulating pipes and fittings, 0.125 inch (3 mm) thick, 2 inches (50 mm) wide, ASTM C 534, Type I — Grade 1. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
- E. Flexible elastomeric insulation vapor barrier coating:
 - 1. Water-based latex enamel coating for use over flexible elastomeric insulation, providing a moisture-resistant protective finish suitable for both indoor and outdoor applications. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
 - 2. Basis of design: Armacell "WB Armaflex" latex enamel.

2.4 FASTENERS

- A. Aluminum bands: ASTM B 209, 0.75 inches (19 mm) wide and 0.020 inches (0.4 mm) thick.

2.5 FIELD-APPLIED JACKETS

- A. Polyvinyl chloride (PVC) jacket:
 - 1. Jacket material: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
 - 2. Color: White
 - 3. Adhesive: As recommended by jacket material manufacturer. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
 - 4. Fitting covers: Manufacturer's factory-fabricated fitting covers made from the same material, finish, and thickness as the jacket, suitable to the size of fittings and thickness of insulation. Provide factory fabricated fitting covers for elbows, tees, flanges, unions, reducers, end caps, valves, and other fittings. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

5. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket and fitting covers with acrylic adhesive; suitable for indoor and outdoor applications, 2 inch (50 mm) width, 6 mil (0.15 mm) thickness. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

2.6 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Fabric-reinforcing mesh:

1. Woven Glass-Fiber Fabric: Approximately 2 ounces per square yard (68 grams per square meter) for covering pipe and pipe fittings.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Provide interior piping insulation in accordance with the Minimum Insulation Thickness Schedule for Interior Applications at the end of this section, as modified by specifications for each location and type.
- B. Provide field applied jackets in accordance with the Field-Applied Jacket Schedule at the end of this section, as modified by specifications for each location and type.
- C. Provide mineral fiber insulation unless otherwise indicated.
- D. Apply insulation in a neat and workmanlike manner and in accordance with manufacturer's printed instructions.
- E. Maintain a continuous vapor barrier on systems that convey fluid at below-ambient temperatures, including the following applications:
 1. Domestic cold water piping
 2. Air-conditioning condensate piping
- F. Where a continuous vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
- G. Installation at pipe hangers:
 1. Insulation shall be continuous through hangers for all piping systems.
 2. Install pipe covering protection shields with thickness of structural insulation inserts equal, under load, to that of adjoining insulation.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
 5. Shields and structural insulation inserts are specified in Section 22 0529, Hangers and Supports for Plumbing Piping and Equipment.
- H. Where insulated piping systems pass through sleeves or openings in partitions and floors, the insulation shall be continuous through the sleeves and openings. See Firestopping specifications for coordinating insulation and firestopping.

- I. Do not insulate chrome-plated piping connections to plumbing fixtures, except wheelchair-accessible lavatories shall be insulated with special insulation and finish assemblies specified in Section 22 4200.
- J. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- K. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- L. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- M. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- N. Install insulation with least number of joints practical.
- O. Finish installation with systems at operating conditions. Repair separations and cracking caused by thermal movement.

3.2 INSTALLING MINERAL FIBER INSULATION

- A. Install insulation with factory-applied jackets as follows:
 - 1. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive.
 - 2. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap.
 - 3. Cover circumferential joints and longitudinal seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 4. Where a continuous vapor barrier is indicated, apply vapor-barrier mastic on longitudinal seams and circumferential joints and at ends adjacent to pipe flanges and fittings.
 - 5. Repair damaged insulation jackets by applying same jacket material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere and seal patches.
- B. Installation on fittings, valves, strainers, flanges, and unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate using mineral fiber preformed fitting and valve covers whenever possible. Install preformed fittings with adhesive.
 - 3. Where mineral fiber preformed fitting and valve covers are not available, insulate using mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining pieces and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation. Coat with mastic. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - 4. Valves: Insulate up to and including the bonnets, stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 5. Strainers: Insulate so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover.

6. Flanges and unions: Install preformed pipe insulation to outer diameter of flange or union. Make width of insulation section same as overall width of union or flange and bolts, plus twice the thickness of pipe insulation. Fill voids between inner circumference of flange or union insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
7. Install fitted PVC cover. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

C. Installation of floor drain bodies that receive air-conditioning condensate and roof drain bodies:

1. Provide mineral fiber blanket insulation, 1 inch thick minimum, adhered to drain body.
2. Coat with mastic.
3. Finish with two coats of lagging finish coating with glass cloth and tape embedded between coats.

3.3 INSTALLING FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and circumferential joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Installation on fittings and flanges:

1. Install insulation over fittings and flanges with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate using flexible elastomeric preformed fitting covers whenever possible. Install preformed fittings with adhesive. Tape and seal with vapor barrier coating.
3. Where flexible elastomeric preformed fitting covers are not available, insulate using mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining pieces and bonded with adhesive. Tape and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Seal with vapor barrier coating.
4. Flanges: Install pre-formed pipe insulation to outer diameter of pipe flange. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation. Secure insulation to flanges and tape and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Seal with vapor barrier coating.
5. Install fitted PVC cover. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

3.4 INSTALLING FIELD-APPLIED JACKETS

A. Installing PVC jacket:

1. Provide jacket tight to insulation.
2. Provide with 1-inch (25-mm) overlap at longitudinal seams and circumferential joints.
3. For horizontal applications, install with longitudinal seams along top and bottom of pipes.
4. Seal with manufacturer's recommended adhesive. Apply two continuous beads of adhesive to seams and joints, one bead under the jacket lap and another finish bead along each seam and joint edge.
5. Seams and joints shall completely prevent the entrance of water.

3.5 INSTALLING EXTERIOR PIPING INSULATION

- A. Locations: Provide insulation for piping systems exterior of building heated space, including but not limited to attics.
- B. Insulation: Material as specified for interior systems unless otherwise indicated, minimum 2 inches (50 mm) thick, or 0.5 inches (13 mm) thicker than scheduled for interior insulation on similar system, whichever is greater.
- C. Start insulation 30 inches (760 mm) below grade, 30 inches (760 mm) below roof or 30 inches (760 mm) inside exterior wall. Secure insulation with aluminum bands on 12-inch (305-mm) centers.

3.6 SCHEDULES

- A. Minimum insulation thickness schedule for interior applications:

MINIMUM INSULATION THICKNESS SCHEDULE FOR INTERIOR APPLICATIONS (3)		
Application	Fluid Temperature Range	All Pipe Sizes
Domestic Hot Water Piping (2)	105F to 140F (40C to 60C)	1.5-inch (38 mm)
Domestic Cold Water Piping (1)	--	1-inch (25 mm)
Air-conditioning Condensate Piping, Gravity and Pumped (1)	--	1-inch (25 mm)
(1) - Contractor's Option within partitions only: 0.5-inch (13mm) flexible elastomeric insulation. (2) - Contractor's Option within partitions only: 1-inch (25 mm) flexible elastomeric insulation for piping NPS 1.25 (DN 32) and smaller. (3) - See additional specified thickness requirements for exterior applications.		

- B. Field-applied jacket schedule:

FIELD-APPLIED JACKET SCHEDULE	
Application	PVC Jacket
Exterior applications	X
Pipe insulation exposed in mechanical rooms, penthouses, and other service areas not accessible to the public.	X

END OF SECTION

SECTION 22 1116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Domestic cold water piping.
- B. Domestic hot water piping.

1.2 RELATED SECTIONS

- A. Piping installation and testing: Section 22 0500.
- B. Trenching: Section 22 0501.

1.3 REFERENCES

- A. American Society of Mechanical Engineers
 - 1. ASME B 16.18: Cast Copper Alloy Solder Joint Pressure Fittings
 - 2. ASME B 16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
 - 3. ASME B16.24: Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500
- B. American Society of Mechanical Engineers/American National Standards Institute
 - 1. ASME/ANSI B16.5: Pipe flanges and flanged fittings
- C. American Society of Testing and Materials
 - 1. ASTM B 75: Standard Specification for Seamless Copper Tube
 - 2. ASTM B 88: Standard Specification for Seamless Copper Water Tube
 - 3. ASTM B 584: Standard Specification for Copper Alloy Sand Castings for General Applications
- D. National Sanitation Foundation/American National Standards Institute
 - 1. NSF/ANSI 61: Drinking Water System Components – Health Effects
 - 2. NSF/ANSI 372: Drinking Water System Components – Lead Content

1.4 DEFINITIONS

- A. Domestic water system: Potable water system for general human use, including hot and cold water supply and return.

1.5 SUBMITTALS

- A. Product data: Each type of pipe and fitting included in the project.
 - 1. Certification that products comply with NSF/ANSI 61 and NSF/ANSI 372.
- B. Certifications: Disinfection test report

- C. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

1.6 QUALITY ASSURANCE

- A. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61, NSF/ANSI 372 with requirements for "lead-free" plumbing as defined by state laws and U.S. Safe Drinking Act.
- B. Acceptance product marking: NSF®-61 and NSF®-372 (or NSF®-61-G) or other accepted certifier marks demonstrating third party certification with these requirements.
- C. Product specifications herein may not necessarily meet all regulations for the limits on lead content. The Contractors and product suppliers shall be responsible to provide products that comply with NSF/ANSI 61 and NSF/ANSI 372 for domestic water systems.
- D. Pipe shall be certified by the manufacturer to meet referenced standards and shall bear a label directly on the pipe, indicating compliance.

PART 2 - PRODUCTS

2.1 AVAILABLE SUPPLIERS

- A. Disinfection of domestic water system:
 - 1. ARC Water Treatment Company, Inc.
 - 2. Ecolab
 - 3. Water Chemical Services, Inc.
 - 4. Olin Water Services
 - 5. Or approved equal.

2.2 ABOVE GROUND PIPE

- A. Copper: ASTM B 88, Type L hard drawn.

2.3 ABOVE GROUND FITTINGS

- A. Cast or wrought fittings for copper pipe:
 - 1. General: Solder joint, cast brass, ASME B16.18; or wrought copper, ASME B16.22.
 - 2. Flanges: Bronze, solder type, ASME B16.24, Class 150.
- B. Dielectric nipples:
 - 1. Standard: IAPMO PS 66.
 - 2. Electroplated steel nipple complying with ASTM F 1545.
 - 3. Pressure Rating and Temperature: 300 psig (2,070 kPa) at 225 degrees F (107 degrees C).
 - 4. End Connections: Male threaded or grooved.
 - 5. Lining: Inert and noncorrosive, propylene.

2.4 UNDERGROUND PIPE AND FITTINGS

- A. Copper Type K pipe and fittings:
 - 1. Pipe: Copper tubing, ASTM B 88, Type K, hard drawn, plain end.

2. Fittings: Solder joint, cast brass, ASME B16.18, or wrought copper, ASME B16.22.

B. Abutments: Concrete, not less than three pipe diameters wide and two pipe diameters high.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install domestic water piping as shown on the drawings and in accordance with the provisions of Section 22 0500, Common Work Results for Plumbing.

B. Install piping in accordance with the Schedule of Pipe Systems, Sizes, and Materials at the end of this section.

C. Provide drain valves at low points of domestic water system for drainage.

3.2 INSTALLING DIELECTRIC ISOLATION

A. Provide dielectric flanges with isolation sleeves for bolts and isolation washers on each side of flanged connection at flanged points of connection between ferrous piping and copper piping.

B. Provide dielectric nipples at connections between existing ferrous piping and copper piping.

3.3 INSTALLING UNDERGROUND PIPE AND FITTINGS

A. General installation:

1. Provide electrical continuity in water service pipe joints. Provide conductivity strips, wedges, or other approved methods where required.
2. Provide a shutoff valve at the point of water service entrance.

B. Ductile iron pipe installation:

1. Prevent injury to the pipe coating.
2. Install abutments at each change in pipe direction, resting on and transmitting thrust to undisturbed earth.
3. Anchor pipe at the point of building entrance with clamps or special fittings.

3.4 TESTING OF DOMESTIC WATER SYSTEM

A. When domestic water piping is completed, and before strainer baskets are installed, pressure test at the pressure shown in Piping Test Table in Section 22 0500.

3.5 CLEANING OF DOMESTIC WATER SYSTEM

A. Flushing of building systems:

1. Flush domestic cold water, domestic hot water, recirculated hot water, and tempered water piping before using. Unless prescribed otherwise by the county or state health department, the method of flushing shall be as follows:
2. Do not allow flushing water for piping to travel through plumbing equipment. Isolate equipment by closing isolation valves and opening bypass valves or by leaving piping disconnected from equipment.
3. Flush new piping segments as the work progresses.

4. Provide temporary domestic water and drain piping as needed. Remove when flushing is complete.
5. Drain water from the segment low point to a safe location and replace water at the same rate.
6. Continue until drain water is free from sediment, scale, rust and other foreign substances.
7. Flush every new branch of piping, for a minimum of 15 minutes after running clean.
8. Install strainer baskets.
9. Disinfect piping as described below.

B. Disinfection of building systems:

1. Disinfect domestic cold water, domestic hot water, recirculated hot water, and tempered water piping before using. Unless prescribed otherwise by the county or state health department, the method of flushing shall be as follows:
2. Provide temporary domestic water and drain piping as needed. Remove when disinfection is complete.
3. Through a NPS 0.75 (DN 20) hose connection in the main downstream of the backflow preventer, pump in sodium hypochlorite to produce a free available chlorine residual of not less than 200 ppm. Provide plumbing connections and power for pumping chlorine into the system.
4. Fill all piping systems with chlorinated water.
5. Proceed downstream from the point of chlorine application, opening each water source for each faucet and outlet until chlorine is detected at a concentration of 200 ppm. Close each water source for each faucet and outlet when chlorine is evident at the required concentration.
6. Energize domestic water recirculation systems or provide another means of filling domestic hot water return piping with chlorinated water at a concentration of 200 ppm.
7. Retain this water in the system for at least three hours, but no more than 3.5 hours.
8. At the end of the retention period, verify that no less than 100 ppm of chlorine are present at the most remote end of the system.
9. Open all faucets and outlets and flush all piping until the chlorine residual in the water is less than 1 ppm.
10. Obtain a representative water sample from the system for analysis by a recognized bacteriological testing laboratory.
11. If the sample tested for coliform organisms is negative, the testing organization shall submit a letter and laboratory report to the Contractor, certifying successful completion of the disinfection. Submit the letter and report.
12. If any samples tested indicate the presence of coliform organisms, repeat the entire disinfection procedure.

3.6 SCHEDULE OF PIPE SYSTEMS, SIZES AND MATERIALS

- A. Pipe schedules apply to domestic cold water, domestic hot water, domestic hot water return, and domestic temper water piping.
- B. Above ground piping:

	Copper Type L cast or wrought fittings
NPS 2.5 (DN 65) and smaller	X

C. Above ground water service entrance or combination fire and water service entrance piping:

	Copper Type L cast or wrought fittings
NPS 2.5 (DN 65) and smaller	X

D. Below ground piping:

	Copper Type K cast or wrought fittings
NPS 2.5 (DN 65) and smaller	X

END OF SECTION

SECTION 22 1119

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Backflow preventers.
- B. Strainers.
- C. Water hammer arresters (shock absorbers).
- D. Thermostatic water temperature controllers.

1.2 RELATED SECTIONS

- A. Domestic water piping: Section 22 1116.
- B. Insulation: Section 22 0719.

1.3 SUBMITTALS

- A. Product data: Each specialty device or equipment, with installation instructions.
- B. Certification that products comply with NSF/ANSI 61 and NSF/ANSI 372.

1.4 QUALITY ASSURANCE

- A. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61, NSF/ANSI 372 with requirements for "lead-free" plumbing as defined by state laws and U.S. Safe Drinking Act.
- B. Acceptance product marking: NSF®-61 and NSF®-372 (or NSF®-61-G) or other accepted certifier marks demonstrating third party certification with these requirements.
- C. Minimum working pressure for domestic water specialties: 125 psig (860 kPa) unless otherwise indicated.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

- A. Available Manufacturers
 - 1. Ames
 - 2. Febco
 - 3. Watts Industries
 - 4. Zurn-Wilkins
 - 5. Or approved equal.

2.2 STRAINERS

A. Available Manufacturers

1. Keckley
2. Mueller Steam Specialty
3. Spirax Sarco Inc.
4. Tate Andale, Inc. "Guardian"
5. Watts Industries, Inc.
6. Or approved equal.

B. Minimum pressure rating: 125 psi (860 kPa)

C. Y-type strainers: Include with plugged blow-down connections and stainless steel strainers with maximum 0.045-inch (1.2-mm) perforations.

1. Pipe sizes NPS 2.0 (DN 50) and smaller: Brass body, threaded ends.
 - a. Basis of design: Watts Series LF777SI.

2.3 WATER HAMMER ARRESTORS

A. Available Manufacturers:

1. MIFAB, Inc.
2. Josam Company
3. Jay R. Smith Manufacturing Company
4. Wade
5. Watts Drainage
6. Zurn Plumbing Products
7. Or approved equal.

B. ASSE 1010 or PDI-WH 201 certified:

1. Construction: Metal bellows or copper tube with piston.
2. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.4 THERMOSTATIC WATER TEMPERATURE CONTROLLERS

A. Available manufacturers:

1. Powers Regulator Company
2. Lawler Manufacturing Company, Inc.
3. Leonard Valve Company
4. Symmons Industries, Inc.
5. Or approved equal.

B. General:

1. Provide units of sizes, capacities, and piping arrangements as indicated on the drawings.
2. Construction: Copper or bronze body with corrosion-resistant interior components.
3. Minimum pressure rating: 125 psi.
4. Paraffin-based thermal actuation technology to sense and adjust outlet temperature with vandal-resistant locking mechanism to secure temperature setting.

5. 10 psi maximum water pressure drop at design flow rate.
6. Set units for the discharge temperatures specified below unless otherwise indicated on the drawings.

C. Lavatory thermostatic tempering valves.

1. ASSE 1070 listed.
2. Integral checks and screen strainers at inlets and union end connections.
3. Discharge temperature adjustment range: 80 degrees F - 120 degrees F. Set at 110 degrees F.
4. Capacity of valve: 12.0 gpm at 45 psi differential.
5. Perform to a minimum flow of 0.5 gpm.
6. Basis of design: Powers Regulator Company "Hydroguard" Series LFLM 495.

PART 3 - EXECUTION

3.1 INSTALLING BACKFLOW PREVENTERS

- A. Install backflow preventers in the building water supply, each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
- B. Mount 48-inches (120 mm) above the floor unless otherwise noted on the drawings. Strainers may be deleted with backflow preventers at the water service entrance if a strainer is included at the water entrance valving assembly.
- C. Install drains for backflow preventers with atmospheric-vent drain connections with air-gap fitting, and pipe as indicated on the drawings.
- D. Do not install bypass piping around backflow preventers.

3.2 INSTALLING STRAINERS

- A. Install Y-pattern strainers where indicated on the drawings.

3.3 INSTALLING WATER HAMMER ARRESTORS

- A. Size and locate water hammer arrestors as recommended by the Plumbing and Drainage Institute Standard PDI-WH 201 or ASSE 1010.
 1. Install water hammer arrestors in each branch domestic water pipe (hot and cold) which feeds either a battery of fixtures or a single fixture.
 2. Install water hammer arrestors upstream of quick-closure valves.
 3. Install water hammer arrestor in accessible locations.

3.4 INSTALLING WATER TEMPERATURE CONTROLLERS

- A. Install and connect controllers as shown on the drawings and in compliance with the manufacturer's recommendations.
- B. Adjust controllers to specified supply temperatures or as indicated on the drawings.

END OF SECTION

SECTION 22 1316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Sanitary piping

1.2 RELATED SECTIONS

- A. Piping installation and testing: Section 22 0500.
- B. Sanitary waste piping specialties: Section 22 1319.

1.3 REFERENCES

- A. Cast iron piping standards
 - 1. ASTM A 74: Standard Specification for Cast Iron Soil Pipe and Fittings
 - 2. ASTM C 564: Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
 - 3. ASTM C1540: Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings
 - 4. CISPI 301: Standard Specification for hubless cast iron soil pipe and fittings for sanitary and storm drain, waste, and vent piping applications
- B. Copper (DWV) piping standards
 - 1. ANSI/ASME B16.29: Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fitting: DWV
 - 2. ASME/ANSI B16.23: Cast Copper Alloy Solder Joint Drainage Fittings: DWV
 - 3. ASTM B 306: Standard Specification for Copper Drainage Tube (DWV)

1.4 SUBMITTALS

- A. Product data: Each specified material and product.
- B. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

1.5 QUALITY ASSURANCE

- A. Cast iron pipe and fittings shall be marked with the collective trademarks of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.
- B. Prior to any new piping installation, the Contractor shall verify the inverts of all piping to which new work is to be attached. The Contractor shall demonstrate to the satisfaction of the DGS Project Manager, that the connections to existing sanitary pipes meet the intent of the contract.
- C. Pipe shall be certified by the manufacturer to meet referenced standards and shall bear a label, directly on the pipe, indicating compliance.
- D. The Contractor shall rod, clean, and flush existing sanitary piping as necessary to maintain gravity flow.

- E. Prior to beginning the addition construction or work in any phase, the Contractor shall inspect via video camera and digitally record, for turnover to the Government, all existing underground sanitary pipes sized 3 inches in diameter or above. The Contractor shall notify the DGS Project Manager immediately of any clogged, broken, or collapsed piping which is to remain or any conditions preventing free gravity flow.
- F. Upon completion of the addition or each phase, the Contractor shall re-inspect via video camera and digitally record, for turnover to the Government, all existing underground sanitary pipes sized 3 inches in diameter or above.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

- A. Install each type of pipe and fittings in locations required or permitted in Part 3, including the Pipe Installation Schedule at the end of the section.
- B. Cast-iron hub and spigot pipe and fittings:
 - 1. Pipe: ASTM A 74 service class
 - 2. Neoprene gaskets joints:
 - a. Lifetime ASTM C 564 neoprene gasket joints
 - b. Basis of design: Fernco "Multi-Tite", Tyler Pipe "Ty-seal", or Mission Rubber "Mission-Tite."
- C. Cast-iron no-hub pipe and fittings:
 - 1. Pipe and fittings: Cast Iron Soil Pipe Institute Standard 301.
 - 2. Joints: Use one of the no-hub coupling options below
 - a. Option 1 (for use in any location):
 - (1) ASTM C 564 neoprene gaskets and two-piece cast-iron housing clamps and stainless-steel bolts and nuts.
 - (2) Basis of design: Products of MG Piping Products Company.
 - b. Option 2 (for use in any location):
 - (1) Corrugated 304 stainless-steel shields with four or six clamps and holding bolts conforming to ASTM C 1540 and rubber gasket sealing sleeves conforming to ASTM C 564
 - (2) Basis of design: Husky "Series 4000" coupling or Mission "Heavy Weight Series CHW" coupling.
 - c. Option 3 (for use only where readily accessible, concealed from view, and in buildings that are 40 feet (12 meters) or less in height):
 - (1) ASTM C 564 neoprene gaskets and 24-gauge Type 304 stainless-steel housing, two stainless-steel bolted clamps.
 - 3. Pipe and fitting restraints:
 - a. Provide for piping NPS 5 (DN 125) and larger

- b. Factory fabricated pipe and fitting restraint assemblies rated to prevent pipe separation under fluid thrust forces up to 50 feet of head in conformance with CISPI 301.
 - c. Basis of design: Holdrite No. 117 No-Hub Pipe and Fitting Restraint.
- D. Copper tube (DWV) pipe and fittings:
- 1. Pipe: copper tubing Type DWV, ASTM B 306
 - 2. Fittings: Wrought copper drainage fittings and soldered joints conforming to ASME/ANSI B16.29 or cast-brass fittings conforming to ASME/ANSI B16.23.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Connect piping as shown on the drawings. Check elevations of connection points before installing new work.

3.2 INSTALLATION, GENERAL

- A. Use suitable tools and appliances for the safe and convenient handling and laying of pipe. Examine each section of pipe for defects. Do not lay any piece that is known to be defective. If any defective piece should be discovered after having been laid, remove and replace it at no change to the contract price.
- B. Install piping in accordance with the Pipe Installation Schedule at the end of this section, as indicated on the drawings, and in accordance with Section 22 0500, Common Work Results for Plumbing. Materials and work shall conform to local plumbing codes and health department regulations.
- C. Thoroughly clean all pipe and fittings before installing them, and keep them clean until the acceptance of the completed work. Cap or plug ends of lines to prevent debris from entering during construction.
- D. Make changes in direction of sanitary piping with approved sanitary fittings, Y branches, 1/8 or 1/16 bends.
- E. In soil, waste, and vent stacks where branches occur that are smaller than stacks, provide properly sized reducing fittings.
- F. Install all sanitary piping at a 2 percent minimum downward slope in the direction of flow unless otherwise indicated.
- G. Install vent piping at a 1 percent slope down toward vertical fixture vent or toward vent stack.

3.3 INSTALLING CAST-IRON PIPING

- A. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings." Install restraint assemblies at pipe couplings and fittings for piping NPS 5 (DN 125) and larger.

3.4 INSTALLING COPPER PIPING

- A. Install aboveground copper tubing according to Copper Development Association, Inc. (CDA) "Copper Tube Handbook."

3.5 CONNECTING TO EXISTING PIPING

- A. Clean the inside of existing piping at connections to new piping using a water blasting device.
- B. Blasting device: Flexible high pressure hose with self-propelling nozzle which blasts to front, sides, and rear (propulsion).
- C. Operation: Blasting device is operated with water at 15,000 psi (10⁷ kPa). The piping system being cleaned is not pressurized.
- D. Clean from the connection point to at least 5 feet (1.5 m) outside the exterior building wall.

3.6 SCHEDULES

- A. Sanitary pipe installation schedule.

SANITARY PIPE INSTALLATION SCHEDULE			
Contractor has option where more than one x appears on a line			
MATERIAL TYPE			
Application	Cast-iron hub and spigot	Cast-iron no-hub	Copper tube (DWW)
Sanitary, exterior or below slab on earth	X		
Sanitary, concealed within walls, partitions, or ceiling space		X	X
Sanitary, interior exposed		X	X
All information in this schedule is subject to local plumbing code and health department requirements.			

END OF SECTION

SECTION 22 1319

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Cleanouts.
- B. Flashing material.

1.2 RELATED SECTIONS

- A. Piping: Section 22 1316.

1.3 SUBMITTALS

- A. Product data: Each specialty device or equipment, with installation instructions.

PART 2 - PRODUCTS

2.1 AVAILABLE MANUFACTURERS

- A. General: Model numbers are provided in the articles below to set a standard for materials, quality of construction, options and details, and performance. Provide named products, or equal products by the available manufacturers listed.
- B. Cleanouts:
 - 1. Josam Company
 - 2. Jay R. Smith Manufacturing Company
 - 3. MIFAB, Inc.
 - 4. Wade
 - 5. Watts Drainage
 - 6. Zurn Plumbing Products
 - 7. Or approved equal.

2.2 FLEXIBLE FLASHING

- A. Polyvinyl chloride sheet, flexible, waterproof, unreinforced, 40 mil minimum thickness, intended for use as a drain flashing.

2.3 CLEANOUTS

- A. Cleanouts: Those installed in slab on grade and in slab above crawl spaces do not require membrane flashing device. All others shall have flashing devices.
- B. In sanitary lines:
 - 1. Concealed piping:
 - a. Coated cast-iron cleanout tee with bronze cleanout plug and polished bronze cover.
 - b. Basis of design: Zurn ZB-1446.

- C. In underfloor sanitary lines: (See Floor Finish Schedule) All units complete with adjustable floor cleanout, coated cast-iron body, and bronze threaded plug.
 - 1. In exposed areas with plain or painted concrete floors: Polished nickel bronze light-duty top.
 - a. Basis of design: Zurn ZN-1400.
 - 2. In resilient tile floors: Polished nickel bronze light-duty square top recessed for 1/8-inch tile.
 - a. Basis of design: Zurn ZN-1400-TX.
 - 3. In ceramic tile floors: Polished nickel bronze light-duty square top.
 - a. Basis of design: Zurn ZN-1400-T.
 - 4. In terrazzo floors: Corrosion resistant ductile-iron cover with severe and heavy-duty service.
 - a. Basis of design: Zurn Z-1400-DC.

PART 3 - EXECUTION

3.1 INSTALLING CLEANOUTS

- A. Install cleanouts at base of each vertical, soil, waste, and vent stack, in the vertical piping.
- B. Cleanouts shall be the same size as the pipe into which they are installed, except no cleanout shall be larger than NPS 4 (DN 100).
- C. Install cleanouts in horizontal piping where indicated on drawings. Where cleanouts occur directly below a floor, the cleanout shall terminate with top flush with floor. Provide for the floor finish to be installed on the cleanout cover, and separated from surrounding material. Install carpet markers after carpet installation is completed. Install ceramic tile and terrazzo per manufacturer's instructions.

END OF SECTION

SECTION 22 1413

STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Air-conditioning condensate drain.

1.2 RELATED SECTIONS

- A. Piping installation and testing: Section 22 0500.

1.3 REFERENCES

- A. Copper Type L and M piping standards
 - 1. ASME/ANSI B 16.18: Cast Copper Alloy Solder Joint Pressure Fittings
 - 2. ASME/ANSI B 16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
 - 3. ASTM B 88: Standard Specification for Seamless Copper Water Tube
- B. PVC (DWV) piping standards
 - 1. ASTM D 1785: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - 2. ASTM D 2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
 - 3. ASTM D 2564: Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
 - 4. ASTM D 2665: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

1.4 SUBMITTALS

- A. Product data: Each specified material and product.
- B. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

1.5 QUALITY ASSURANCE

- A. Pipe shall be certified by the manufacturer to meet referenced standards and shall bear a label, directly on the pipe, indicating compliance.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

- A. Install each type of pipe and fittings in locations required or permitted in Part 3, including the Pipe Installation Schedule at the end of the section.
- B. Copper Type L and M pipe and fittings:
 - 1. Pipe: ASTM B 88, Type L or M, hard drawn.

2. Fittings: Solder joint, cast brass, ASME B16.18; or wrought copper, ASME B16.22.

C. PVC (DWV) pipe and fittings:

1. Pipe: PVC, Schedule 40, ASTM D 1785.
2. Fittings: PVC, DWV, ASTM D 2665.
3. Solvent cement: PVC, ASTM D 2564.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Connect piping as shown on the drawings. Check elevations of connection points before installing new work.

3.2 INSTALLATION, GENERAL

- A. Use suitable tools and appliances for the safe and convenient handling and laying of pipe. Examine each section of pipe for defects. Do not lay any piece that is known to be defective. If any defective piece should be discovered after having been laid, remove and replace it at no change to the contract price.
- B. Install piping in accordance with the Pipe Installation Schedule at the end of this section, as indicated on the drawings, and in accordance with Section 22 0500, Common Work Results for Plumbing. Materials and work shall conform to local plumbing codes and health department regulations.
- C. Thoroughly clean all pipe and fittings before installing them, and keep them clean until the acceptance of the completed work. Cap or plug ends of lines to prevent debris from entering during construction.
- D. Make changes in direction of storm water piping with approved sanitary fittings, Y branches, 1/8 or 1/16 bends.
- E. Install all storm water piping at a 2 percent minimum downward slope in the direction of flow unless otherwise indicated.
- F. Seal air-conditioning condensate drain where it passes through outside wall and provide splash block if required.

3.3 INSTALLING COPPER PIPING

- A. Install aboveground copper tubing according to Copper Development Association, Inc. (CDA) "Copper Tube Handbook."

3.4 INSTALLING PVC (DWV) PIPING

- A. Install aboveground PVC piping according to ASTM D 2665.
- B. Install underground PVC piping according to ASTM D 2321.
- C. Provide listed plastic pipe penetration protection at penetrations of fire-rated floors and assemblies.
- D. PVC piping is not permitted in ceiling plenums or shafts used to convey HVAC system air.

3.5 INSTALLING AIR CONDITIONING CONDENSATE PIPING

- A. Above ground piping: Brace piping at changes in direction.

3.6 SCHEDULES

- A. Storm water pipe installation schedule.

STORM WATER PIPE INSTALLATION SCHEDULE		
MATERIAL TYPE		
Application	Copper Type L or M	PVC (DWW)
Air conditioning condensate, interior NPS 1 (DN 25) and smaller	X	
Air conditioning condensate, exterior		X
All information in this schedule is subject to local plumbing code and health department requirements.		

END OF SECTION

SECTION 22 3300

ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Commercial, storage electric water heaters.

1.2 RELATED SECTIONS

- A. Equipment foundation: Section 22 0529.

1.3 SUBMITTALS

- A. Product data: Each type and size water heater. Include nominal capacity and pressure rating; shipping, installed, and operating weights; and specialties and accessories furnished for this project. Indicate dimensions, wall thicknesses, required clearances, method of assembly, and piping connections.

- 1. Certification that products comply with NSF/ANSI 61 and NSF/ANSI 372.

- B. Shop drawings: Diagram power, signal, and control wiring.

- C. Include product data which verifies compliance with the energy performance requirements of ASHRAE 90.1, or provide certified performance ratings by a qualified independent testing agency.

- D. Include operation and maintenance instructions and parts list for each type of water heater.

1.4 QUALITY ASSURANCE

- A. Each water heater shall meet the energy performance requirements of ASHRAE 90.1.

- B. Electrical components, devices, and accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- C. ASME compliance: Fabricate and label water heater, hot-water storage tanks to comply with ASME Boiler and Pressure Vessel Code.

- D. UL label and local testing (if required): As specified in Section 22 0500, Common Work Results for Plumbing.

- E. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with the NSF/ANSI 61, NSF/ANSI 372 with requirements for "lead-free" plumbing as defined by state laws and U.S. Safe Drinking Act.

- F. Acceptance product marking: NSF®-61 and NSF®-372 (or NSF®-61-G) or other accepted certifier marks demonstrating third party certification with these requirements.

- G. Product specifications herein may not necessarily meet all regulations for the limits on lead content. The Contractors and product suppliers shall be responsible to provide products that comply with NSF/ANSI 61 and NSF/ANSI 372 for domestic water systems.

PART 2 - PRODUCTS

2.1 AVAILABLE MANUFACTURERS

- A. Scheduled units are the basis for design of the Project. If units by other manufacturers should be proposed, verify that they meet requirements specified in Division 01 and the article "Product Options" in Section 22 0101, and submit shop drawings as specified in the "Submittals" article above.
- B. Electric water heaters:
 - 1. A.O. Smith Corporation
 - 2. Hubbell
 - 3. PVI
 - 4. State Industries, Inc.
 - 5. Or approved equal.

2.2 ELECTRIC TANK WATER HEATER

- A. Model, capacity, and electrical characteristics scheduled on the drawings, rated at maximum working pressure of 150 psi (1035 kPa), listed and labeled in accordance with UL 174.
- B. Tank: Internal surfaces exposed to water lines with glass. Insulation: Foam. Jacket: Steel, containing full-size control compartments for service and maintenance through front. Finish: Manufacturer's standard baked enamel.
- C. Equipment:
 - 1. Inlet carries entering cold water to bottom of tank.
 - 2. Tank-mounted, replaceable, magnesium anode.
 - 3. Combination thermostat and high-temperature-limit control.
 - 4. 0.75-inch top opening for field installation of relief valve.
 - 5. Relief valve: ASME-rated temperature and pressure relief valve for field installation. Include relieving capacity at least as great as heat input, and pressure setting less than heater working pressure rating.
 - 6. Drain valve: Non-metal ball valve with positive on-off and full flow capacity, mounted on front of tank.
- B. Basis of design: A.O. Smith EJC.

2.3 WATER HEATER SPECIALTIES

- A. Vacuum relief valve: Designed for vacuum relief in hot water tanks and heaters, ANSI Z21.22, brass body, high-heat-resisting disk.
 - 1. Working pressure: At least 200 psi.
 - 2. Temperature rating: At least 250 degrees F.
 - 3. Operation: Closes under pressure and opens on vacuum of not more than 0.5 inches of mercury.
 - 4. Basis of design: Watts No. LFN36.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide each heater with ASME rated temperature and pressure relief valves.

3.2 INSTALLING DOMESTIC WATER HEATER

- A. Set heater on an equipment foundation (housekeeping pad). Plug all unused tapings.
- B. Install level and plumb, according to drawings and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so that controls and devices are accessible.
- C. Anchor water heaters to substrate.
- D. Install and connect water heaters in accordance with applicable code for electric water heaters.
- E. Install temperature and pressure relief valves. Extend relief valve outlet with water piping in continuous downward pitch and discharge to closest floor drain.
- F. Install vacuum relief valves.

3.3 MANUFACTURER'S FIELD SERVICE

- A. Provide manufacturer's startup and adjustment for water heaters.

3.4 OPERATING INSTRUCTIONS

- A. As specified in Section 22 0500, provide operating instructions.

END OF SECTION

SECTION 22 4200

INSTITUTIONAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Institutional grade plumbing fixtures and trim, faucets, other fittings, and related components.

1.2 RELATED SECTIONS

- A. Piping:
 - 1. Domestic water piping: Section 22 1116.
 - 2. Sanitary waste and vent piping: Section 22 1316.
 - 3. Storm drainage piping: Section 22 1413.
- B. Valves: Section 22 0523.
- C. Plumbing specialties:
 - 1. Domestic water piping specialties: Section 22 1119.
 - 2. Sanitary waste piping specialties: Section 22 1319.

1.3 SUBMITTALS

- A. Product data: For each type of plumbing fixture specified, including fixture and trim, fittings, accessories, appliances, appurtenances, equipment, supports, construction details, dimensions of components, and finishes.
 - 1. Certification that products comply with NSF/ANSI 61 and NSF/ANSI 372.
- C. Shop drawings:
 - 1. Provide a schedule of fixtures and trim proposed for use, in the same order as the lists in the specification.
 - 2. Wiring diagrams for field-installed wiring of electrically operated units.

1.4 QUALITY ASSURANCE

- A. UL label and local testing (if required): As specified in Section 22 0500, Common Work Results for Plumbing.
- B. Fixtures shall be of the best commercial grade of their respective kinds, free from flaws, cracks, craze or other imperfections, complete with fittings and connections. Residential grade fixtures shall not be acceptable. Fixtures manufactured by acceptable manufacturers are acceptable provided they are equal and similar to those specified.
- C. Fixtures and trim where required to be accessible to disabled people, identified in this section as "for disabled," shall comply with requirements of the Americans with Disabilities Act (ADA) Regulations, as applicable to each type of fixture or its use.
 - 1. Trim must meet requirements for force of operation at water pressures up to 80 psi.

2. Water closet models must be selected and installed so that flush controls will be on the fixture's open side.
- D. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61, NSF/ANSI 372 with requirements for "lead-free" plumbing as defined by state laws and U.S. Safe Drinking Act.
- E. Acceptance product marking: NSF®-61 and NSF®-372 (or NSF®-61-G) or other accepted certifier marks demonstrating third party certification with these requirements.
- F. Product specifications herein may not necessarily meet all regulations for the limits on lead content. The Contractors and product suppliers shall be responsible to provide products that comply with NSF/ANSI 61 and NSF/ANSI 372 for domestic water systems.

PART 2 - PRODUCTS

2.1 AVAILABLE MANUFACTURERS

- A. Basis-of-design products: Subject to compliance with requirements, provide specified or scheduled products, or comparable product by one of the following.
 1. Fixtures:
 - a. Acorn Engineering Co.
 - b. American Standard
 - c. Bradley Corporation
 - d. Commercial Enameling Co.
 - e. Crane Co.
 - f. Eljer
 - g. Elkay Manufacturing Co.
 - h. Haws Corp.
 - i. Just Co.
 - j. Kohler Co.
 - k. Zurn Plumbing Products
 - l. Or approved equal.
 2. Faucets:
 - a. Chicago Faucet Co.
 - b. American Standard
 - c. T & S Brass and Bronze Works, Inc.
 - d. Or approved equal.
 3. Supplies, traps, and miscellaneous trim:
 - a. Acorn Engineering Co.
 - b. Bradley Corporation
 - c. Brass-Craft Manufacturing Co.
 - d. Chicago Faucet Co.
 - e. Elkay Manufacturing Co.
 - f. Engineered Brass Co.
 - g. Guy Gray; IPS Corporation
 - h. Haws Corp.
 - i. McGuire Manufacturing Co.
 - j. T & S Brass and Bronze Works, Inc.

- k. Or approved equal.
- 4. Toilet seats:
 - a. Bemis
 - b. Beneke Corp.
 - c. Church Seats
 - d. Olsonite Co.
 - e. Sperzel Co.
 - f. Or approved equal.
- 5. Fixture supports and carriers:
 - a. Josam Mfg. Co.
 - b. J.R. Smith
 - c. Zurn Plumbing Products
 - d. Or approved equal.

2.2 FIXTURES

- A. Model numbers are intended to describe complete fixtures. Furnish all parts and fittings regularly required such as tailpieces for lavatory faucets, escutcheons, and appurtenances, including low-voltage devices and wiring for fixtures which require them to operate.
- B. Fixtures shall be white except where another color is specified for a particular fixture.
- C. Water closet models specified or noted to be accessible in accordance with ADA requirements: Select models such that flush controls will be on the fixture's open side when fixtures are installed.

2.3 WATER CLOSETS

- A. F-1 water closet, tank type: Kohler pressurized "Wellworth Pressure Lite" K-3505.
 - 1. Material: Vitreous china.
 - 2. Bowl type: Elongated.
 - 3. Passageway: 2.25 inches (57 mm).
 - 4. Mounting: Freestanding, floor-mounted.
 - 5. Tank type: Pressure-assist flushing system.
 - 6. Consumption: No more than 1.6 gallons (6.0) per flushing cycle.
 - 7. Trim:
 - a. Seat: No. 1
 - b. Supply: No. 23
 - c. Bolt caps: Two, No. 115

2.4 LAVATORIES

- A. F-2 lavatory: Kohler "Hudson" K-2812
 - 1. Material: Cast iron with acid-resisting enamel.
 - 2. Lavatory type: Rectangular, front overflow, single hole faucet centers.
 - 3. Dimensions: 20 by 18 inches (508 by 457 mm).
 - 4. Mounting: Wall-mounted, 32 inches (813 mm) rim to floor. Include cast-iron carrier fitting to connect to support specified in the article "Support for Wall-Mounted Fixtures" below.
 - 5. Trim:

- a. Faucet: No. 51
- b. Tailpiece: Two No. 24
- c. Supply: Two No. 22
- d. Nipple: Two No. 62
- e. Drain: No. 80
- f. Trap: No. 106

2.5 TRIM

- A. Exposed trim shall be chrome-plated.
- B. Faucets: Equal to the named model shall mean similar in appearance, function, and design. Internal parts are not required to be interchangeable.
- C. Trim numbers listed in the fixture descriptions above represent the descriptions in the article "Trim Schedule" at the end of the section.

2.6 SUPPORTS FOR WALL-MOUNTED FIXTURES

- A. Lavatories mounted on shafts or partitions where there is no floor on the opposite side: Equal to Zurn Z-1259 plate carriers.
 - 1. Single lavatory: The plate carrier shall have a backup plate of 10-gauge steel, at least 6 inches (152 mm) high by 38 inches (965 mm) long.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Furnish, provide rough-in for, and set fixtures to extent and number indicated on drawings. The fixtures shall be left in first class condition, properly adjusted, cleaned and ready for satisfactory operation.
 - 1. Where water closets are specified or noted to be accessible in accordance with ADA requirements, ensure that flush controls are installed on the fixture's open side.
 - 2. Coordinate elevations of water closet flush valve rough-ins with rough-ins for grab bars and other wall-mounted items.
- B. Protect plumbing fixtures and board them over so that they cannot be used until final acceptance of the work.

3.2 SETTING OF FIXTURES

- A. In locations where fixtures are set against walls, seal crack between wall and fixture with silicon sealant.
- B. Set floor outlet fixtures on floor flanges with gaskets and cement-grout them to rest firmly and evenly on floors. Water closets shall be secured with two bolts attaching to the floor flanges and the base shall be sealed to the floor using a clear silicone caulk. The fixtures shall be secured over these bolts with Trim No. 115 bolt caps.
- C. Securely attach wall hung fixtures to wall using specified supports.
- D. After installation, paint undersides of cast-iron lavatories and service sinks. Paint galvanized traps with two coats of white enamel.

E. Maximum length of risers shall be 8 inches.

3.3 TRIM SCHEDULE

<u>Trim No.</u>	<u>Description</u>
1	Seat: Church No. 295 SSCT white solid plastic, elongated, open front; stainless-steel hinge posts with combination self-sustaining and check hinge.
22	Rigid supply and stop: Chicago No. 1010-1003-3ABCP angle stop fitting with supply tube and loose key, with slow compression operating cartridge. Chrome-plated brass construction with 0.375-inch female threaded inlet and slip wall flange with set screw. Rigid supply riser with reducer for 0.25-inch female threaded outlet.
23	Water closet supply: Brass Craft No. SR1712DLX C 0.375-inch OD tube riser, 0.5-inch threaded inlet by 0.375 compression outlet multi-turn stop valve with loose key, 0.5-inch by 3 inch long brass nipple, shallow escutcheon, chrome plated assembly.
24	Tailpiece, straight: Brass Craft No. 56825X C complete with coupling nut.
51	Faucet: Kohler "Taut" single-hole commercial faucet with 0.5 gpm (1.9 lpm) maximum flow rate, water-saving vandal resistant aerator, and high-temperature limit setting.
62	Nipples: Brass Craft triple-plated polished chrome of length and size as required.
80	Drain: McGuire No. 155 A, non-removable open grid strainer, 1.25 by 6 inch tailpiece.
106	P trap: McGuire No. 8090, 1.25 by 1.5 inch IPS outlet, cast-brass, ground joint, swivel type, with cleanout and complete with McGuire No. 2127, NPS 1-1/2 (DN 40) brass nipple with cast set screw escutcheon.
115	Bolt caps: Chrome-plated acorn nuts, size as required.

END OF SECTION