

SECTION 22-0100

PLUMBING

1.1 WORK INCLUDED

- A. Provide all labor, materials, tools, and services for a complete installation of equipment and systems contained in contract documents. Where discrepancies exist between the construction drawings and these specifications, the construction drawings shall take precedence. **All equipment shall be installed in strict accordance with manufacturer's instructions.**
- B. Guarantee - Plumbing work and systems shall be guaranteed against improper operation, faulty material or workmanship for a period of one year from the date of final acceptance. If the project is occupied or the systems placed into operation in several phases at the request of the Owner, then the guarantee of each system or piece of equipment used shall begin on the date that each system or piece of equipment was placed in satisfactory operation and accepted as such, in writing, by the Owner. Such acceptance may not be unreasonably withheld and shall not extend beyond the written substantial completion date of the project.
- C. Principal features of work included are:
 - 1. Plumbing system including interface with outside utilities as shown on the plumbing drawings.
 - 2. Flashing of pipes where they penetrate outside walls.
 - 3. Seismic bracing and anchorage for piping.
 - 4. Demolition of existing piping.
 - 5. Proper vibration isolation of all plumbing equipment.

1.2 PERMITS

- A. Obtain and pay for the required permits and inspection fees, tapping fees, connection charges, and utility company service charges.

1.3 CODES & STANDARDS

- A. The Plumbing work installation shall only comply with State and local Building Codes, applicable Life Safety Code, and with State, Federal and local laws.
- B. Refer to Architectural drawings for applicable codes for this project.
- C. The mechanical and plumbing work shall comply with "Reduction of Lead in Drinking Water Act" effective January 1, 2014.
- D. All components of the potable domestic water system shall comply with NSF/ANSI 372, "Drinking Water System Components – Lead Content."
- E. The entire installation of fuel gas piping shall comply with the National Fuel Code and local authorities.
- F. Equipment shall be U.L. listed. Installation work shall comply with U.L. Standards, where applicable.

- G. Arrange for, pay fees for, and accomplish the work required to pass tests required by agencies having authority. Obtain certificates of compliance where available from said authorities and transmit to the General Contractor.
- H. Complete work shall comply with existing regulatory noise and safety standards. Equipment shall comply with these standards, whether specifically so noted or not.
- I. American Gas Association (AGA).
- J. Air-Conditioning and Refrigeration Institute (ARI).
- K. American Society of Mechanical Engineers (ASME).
- L. Provide necessary seismic hangers, vibration isolators, equipment mounts, etc. as required to accommodate all seismic protection requirements for all of the mechanical and plumbing work associated with this project per International Building Code requirements, along with any local codes or code amendments. Refer to structural documents for specific seismic parameter guidelines applicable to this project, and provide for accordingly. Provide shop drawings noting locations of all seismic devices, types of seismic required, and seismic device calculations signed and sealed by a qualified Professional Engineer, and to meet all local, and state code requirements related to seismic protection in effect on the date bids are received. Provide a certification from the manufacturer's Seismic Design Engineer that the final installed seismic devices will comply with all applicable code requirements. Equipment manufacturers shall provide certification that their equipment is capable of resisting expected seismic loads without failure. Equipment manufacturers shall provide suitable attachment points and/or instructions for attaching seismic devices. Seismic protection devices shall be as manufactured by Amber/Booth Company, Inc.; Mason industries, Inc.; or Kinetics Noise Control, Inc

1.4 RELATED WORK: The following work shall be furnished under other Divisions.

- A. The related electrical work is covered in Division 26, Electrical. Electrical power shall be provided and installed under the Electrical Division. Disconnects shall be furnished and installed under Electrical Division, unless noted otherwise in specific sections of that specification or as noted on Division 23 plans.
- B. Painting including piping shall be done under the Painting Division.
- C. Flashing of ducts and pipes into roofs shall be done under Architectural Division.
- D. Holes, chases and recesses required for mechanical work, where advance notice is given the Contractor.
- E. Miscellaneous steel work, such as equipment supports and framed openings for piping and duct.
- F. Access panels and door grilles shall be installed under other Divisions. Access panels shall be provided for all valves and equipment located above hard ceilings or behind walls. Plumbing contractor shall coordinate locations with General Contractor.
- G. Owner-furnished equipment shall generally be installed by other Divisions with the exception of plumbing related equipment.
- H. Openings in casework shall be provided by Casework Manufacturers.

1.5 PRE-DEMOLITION WORK

- A. Record the discharge temperature and return temperature of the existing domestic hot water system(s) at each heater. Identify each system if more than one exists. Record manufacturer, model number and btu rating of each water heater.
- B. Record temperature readings and time taken to reach maximum hot water temperature at a minimum of five locations for each domestic hot water system. A minimum of two such locations shall be near the expansion work to be performed. The total number of readings required shall be sufficient in number to show a pattern of water temperatures in the area of renovation, areas adjacent to the renovation and on each floor.
- C. Record the length of time required to obtain domestic hot water at a minimum of five lavatories at the farthest ends of domestic hot water system on each floor affected by the renovation.
- D. Submit a written report, along with data collected in tabular form, on all findings to the Architect, Engineer and Owner's representative prior to beginning any demolition work. Where domestic hot water circulation problems are identified within the facility, the contractor shall bring it to the attention of the Architect, Engineer and Owner's representative prior to beginning any work. Work shall not proceed until such problem areas are identified and acknowledged by the Owner's representative.

1.6 DEMOLITION

- A. It shall be the Contractor's responsibility to verify the existing condition of all equipment affected by this project and the exact location of material to be removed (or relocated) before demolition work is started. Report any discrepancies with the Contract Documents immediately to the Architect.
- B. Demolition work shall be phased to accomplish replacement with minimum allotted downtime. Contractor shall be responsible for coordinating shut-downs or service interruptions with the Owner's representative.
- C. Schedule / phase demolition work in advance with the Owner's representative. Coordination with facility operating hours and access to areas affected by this project shall be the Contractor's responsibility.
- D. Provide temporary equipment and connections where critical equipment is being taken offline temporarily. Coordinate all such activities with the Owner's representative prior to taking equipment offline.
- E. Remove existing and abandoned hangers, supports, and piping which are not indicated on the drawings to remain or to be reused.
- F. Provide shut-off valves and cap pressure piping as near to the mains as possible.
- G. Where existing piping (domestic water, gas, medical gas, sanitary sewer, storm, etc.) is discovered in walls to be removed, offset and reroute piping into the new partition layout. Coordinate piping drops with wall thickness. Reinsulate rerouted piping in accordance with Section 22 0700.
- H. Unless specifically noted on the drawings, piping shall not be abandoned.

- I. All unused floor penetrations to be sealed per the Architectural and Structural Contract Documents.
- J. In addition to demolition shown on the plumbing drawings, demolish all plumbing fixtures and associated piping in accordance with this section as shown on the Architectural demolition plans.
- K. All existing or new holes in slabs and fire or smoke-rated walls shall be patched with a fire/water-proof sealant to match the existing structure. Refer to the Architectural and Structural Contract Documents.
- L. The Contractor shall be responsible for removing, storing and reinstalling any equipment noted as existing to be relocated. The Contractor shall repair or replace any such equipment that is damaged or lost throughout the duration of this project without additional cost to the Owner.
- M. All equipment to be demolished is the property of the Owner and shall be turned over to the Owner's representative by the Contractor. At the discretion of the Owner's representative, any or all of such equipment may be refused and released to the Contractor for disposal. All material being discarded shall be done in a legal manner.

1.7 SUBMITTALS: Submit for review complete brochures and shop drawings for materials and equipment proposed in accordance with Division 1. Submit for review, a list of major equipment within 25 days after award of contract.

- A. Brochures: Submit complete descriptions, illustrations and specification data for materials and equipment proposed. Clearly indicate proposed items when other items are shown on same sheet. Submit samples on request and/or set up for inspection. Samples will be returned to Contractor.
- B. Shop Drawings:
 - 1. Complete piping systems.
 - 2. Press Firestop systems.
- C. Each product data sheet shall be clearly labeled with identifying equipment number, fixture number, intended service, etc.
- D. Each product data sheet shall be clearly labeled with the manufacturer's name.
- E. Each pipe, fitting, and valve product data sheet shall clearly state country of manufacture. Foreign made pipe, fittings and appurtenances, manufactured outside the United States, will not be accepted. If this information is not provided on data sheets, the contractor shall provide a letter from the manufacturer stating country of manufacture.
- F. Provide press fitting certification if soldered fittings are not used
- G. When information other than submitted item appears on a data sheet, the applicable information shall be clearly identified.
- H. When submitting on items other than those in the schedules of the construction documents, prior approval shall be requested and approved prior to submission.
- I. Submittals that do not meet these requirements will not be considered and will be

returned as REJECTED.

1.8 SUBMITTAL SUBMISSION

- A. Submit one (1) electronic copy of certified shop drawings to the Engineer for review on material furnished under this Division. Submittal data shall be checked and stamped approved by the Engineer prior to his transmitting to the Architect. Submittals shall contain rating data, accessories, and features the same as listed in specifications and capacities shall be stated in the terms specified.
- B. It is the contractor's responsibility to identify all deviations on the shop drawings from the specified item and review of the shop drawings with no exceptions taken will not be considered acceptance of the deviation unless it has been explicitly identified. If equipment other than what is in the schedules is submitted, contractor is verifying that it will perform as the specified equipment as shown on the construction documents.
- C. Additional installation costs associated with substituted equipment requiring additional work on the part of this contractor or other subcontractors to satisfy the manufacturer's installation requirements shall be the responsibility of the submitting contractor.
- D. Submittals shall include but not be limited to the following:
 - 1. All equipment and fixtures shown or indicated on the plumbing drawings and specifications.
 - 2. Pipe pressure test reports with witness signature from facility representative.

PART 2 - PRODUCTS

- 2.1 MATERIALS AND EQUIPMENT:** Provide materials and equipment bearing the U.L. label when such label is available.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate locations of piping to eliminate conflict with other divisions.
- B. Carefully examine contract documents to be thoroughly familiar with items that require plumbing connections and coordination.
- C. Field verify all existing conditions prior to bidding and verify no conflicts exist. Notify engineer and architect if any discrepancies are found. Any tie in points shall be field verified for their exact location. No additional costs will be accepted due to the lack of verification prior to bidding.
- D. Plumbing drawings are diagrammatic in nature. Due to the small scale of the Drawings, it is not possible to indicate all offsets, fittings, changes in elevations, interferences, etc. Make necessary changes in the work, equipment locations, etc. as part of the contract to accommodate work to obstacles and interferences encountered. Before installing, verify exact location and elevation at work site.
- E. Coordinate work with other trades and determine route or location of each duct, pipe, conduit, etc., before fabrication and installation.

- F. Provide proper chases and openings. Place sleeves and supports prior to pouring concrete or installation of masonry.
- G. Contractor shall protect piping routed through metal studs using manufactured products to protect piping from dissimilar metals and from noise. Metal stud insulators shall be sioux chief series 558 or equal. The use of tape shall be prohibited.

3.2 CUTTING AND PATCHING

- A. Repair or replace routine damage caused by cutting.
- B. Correct unnecessary damage caused due to installation of plumbing work.

3.3 Perform repairs with materials that match existing in accordance with the appropriate section of these specifications.

3.4 CONNECTION TO EQUIPMENT:

- A. Rough-in and connect to kitchen equipment and Owner furnished equipment and provide a shutoff valve and union at each connection. Operating valves and/or controls for this equipment will be provided as an integral part of the equipment.

3.5 TRENCHING, EXCAVATING, AND BACKFILLING

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.6 IDENTIFICATION

- A. Identify exposed or accessible piping with stenciling or labels contents indicating pipe contents and direction of flow on piping not more than 30 feet apart, at valves, at access panels, and at least once above each space.
- B. Waste, vent, sprinkler, rainwater, and buried lines need not be marked.
- C. Identify all mechanical equipment with engraved brass, aluminum, or stainless steel nameplates or tags. Use equipment names and numbers appearing in schedules on drawings. Fasten nameplates to equipment using screws. Glue or adhesive is not acceptable. Fasten tags to equipment using brass, aluminum or stainless steel chains
- D. Identify each valve with engraved brass, aluminum, or stainless steel identification tag indicating valve service and sequential identification number. Attach tag to valve handle with brass, aluminum or stainless steel chain. Provide two bound manuals to Owner listing each valve sequentially and indicating valve manufacturer, style, size, service, normal position, and specific location for each valve. Service valves directly at the equipment served will not be tagged.
- E. No stenciling or labeling shall be performed until all painting required under architectural section has been performed.

3.7 PIPE CLEANING

- A. The system cleaning and testing described herein are minimum requirements. Additional tests as required by the authority having jurisdiction shall also be

performed.

- B. Piping and related items such as valves, etc., shall be inspected for sharp edges or other hazardous conditions. Such conditions shall be corrected by removal, modification or covering.
- C. Factory applied prime coat paints shall be touched up to cover bare places and scratches. Weld joints shall be cleaned and painted with rust inhibitive paint, Galv-con, or approved equal, where galvanized pipe has been welded.

3.8 PIPE TESTING

- A. Testing shall be completed before insulation and concealment is started.
- B. All tests shall apply full test pressure to the piping for a minimum of twenty-four hours.
- C. All tests shall be conducted at the water working pressure of the pipe installed. When Schedule 40 or standard weight pipe is used, the test pressure shall be 150 pounds per square inch. When Schedule 80 or extra strong pipe is used, the test pressure shall be 250 pounds per square inch.
- D. When the test pressure has fallen over five percent during the twenty-four hour test period, the point of leakage shall be found, repaired and the test repeated. This procedure shall be followed until the piping system has been proven absolutely tight.
- E. The use of chemicals or so-called stop-leak compounds will not be permitted at any time.
- F. When delicate control mechanisms and other items having a rating less than the test pressure are installed in the piping system, they shall be removed during the tests to prevent shock damage. This does not apply to control valves.
- G. Leaks and other defects shall not be repaired by mastic or other temporary means. All leaks shall be repaired by removal of the valve, fitting joint, or section that is leaking and reinstalling new material with joints as specified hereinbefore.
- H. Piping may be tested a section at a time to facilitate construction. All gauges and instrumentation used shall have been recently calibrated in accordance with manufacturer's recommendations.
- I. PVC piping is not allowed to be tested with air pressure.

- 3.9** Provide proper equipment vibration isolation using either spring isolators or rubber in shear isolators as directed by the manufacturer.

END OF SECTION

SECTION 22-0110

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE

- A. The work covered under this section consists of furnishing all necessary labor, supervision, materials, and equipment required to completely execute the pipe hanger and supports as described in this section.

1.2 REFERENCES

- A. ASTM B 633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- B. ASTM A 123 – Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
- C. ASTM A 653 – Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip process.
- D. ASTM A 1011 – Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability.
- E. MSS SP-58 – Manufacturers Standardization Society: Pipe Hangers and Supports – Materials, Design, and Manufacture.
- F. MSS SP-69 – Manufacturers Standardization Society: Pipe Hangers and Supports – Selection and Application

1.3 QUALITY ASSURANCE

- A. Steel pipe hangers and supports shall have the manufacturer's name, part number, and applicable size stamped in the part itself for identification.
- B. Hangers and supports shall be designed and manufactured in conformance with MSS SP-58.

1.4 SUBMITTALS

- A. Submit product data on all hanger and support devices, including shields and attachment methods. Product data to include, but not limited to materials, finishes, approvals, load ratings, and dimensional information.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Cooper B-Line, Inc., Anvil International, Inc., or approved equal.

2.2 PIPE HANGERS AND SUPPORTS

- A. Hangers:
 - 1. Un-insulated steel pipes ½" to 24" with NO LONGITUDINAL MOVEMENT:
 - a. Adjustable steel clevis hanger equal to B-Line B3100.

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2. Un-insulated copper tubing and PVC pipe ½" O.D. to 4" O.D. with NO LONGITUDINAL MOVEMENT:
 - a. Plastic coated adjustable tubing ring hanger equal to B-Line B3170CTC.
 3. Un-insulated cast iron soil pipe ¾" to 8":
 - a. Adjustable swivel, split ring type equal to B-Line B3171.
 4. Un-insulated cast iron soil pipe 10" to 15":
 - a. Adjustable swivel, split ring type equal to B-Line B3100.
 5. Insulated steel piping ½" to 24", galvanized steel piping ½" to 24", copper piping ½" O.D. to 4" O.D., and PVC pipe with NO LONGITUDINAL MOVEMENT:
 - a. Adjustable clevis hanger equal to B-Line B3100.
 - b. Galvanized steel insulation protection shield sized for maximum 10' span on 4 psi compressive strength insulation equal to B-Line B3151.
- B. Pipe Clamps:
1. When flexibility in the hanger assembly is required due to horizontal movement, use pipe clamps with weldless eye nuts, B-Line B3140 or B3142 with B3200 or approved equal. For insulated lines, use double bolted pipe clamps equal to B-Line B3144 or B3146 with B3200.
- C. Multiple or trapeze hangers
1. Trapeze hangers shall be constructed from 12 gauge roll formed ASTM A1011 SS Gr. 33 structural steel channel, 1-5/8" x 1-5/8" minimum equal to B-Line B22 strut or stronger as required.
 2. Mount pipes to trapeze with two piece pipe straps sized for outside diameter of pipe equal to B-Line B2000 series.
 3. For pipes subject to axial movement:
 - a. Strut mounted roller support equal to B-Line B3126. Use pipe protection shield or saddles on insulated lines.
 - b. Strut mounted pipe guide equal to B-Line B2417.
- D. Wall Supports
1. Pipes 4" and smaller:
 - a. Carbon steel hook equal to B-Line B3191.
 - b. Carbon steel J-hanger equal to B-Line 3690.
 2. Pipes larger than 4":
 - a. Welded strut bracket and pipe straps equal to B-Line B3064 and B2000 series.
 - b. Welded steel brackets equal to B-Line B3066 or B3067, with roller chair or adjustable steel yoke pipe roll equal to B-Line B3120 or B3110. Use pipe protection shield or saddles on insulated lines.

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E. Floor Supports

1. Piping with NO LONGITUDINAL MOVEMENT and piping under 6" WITH LONGITUDINAL MOVEMENT:
 - a. Carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation equal to B-Line B3093 and B3088T or B3090 and B3088. Pipe saddle shall be screwed or welded to appropriate base stand.

F. Vertical Supports

1. Steel riser clamp sized to fit outside diameter of pipe equal to B-Line B3373 or B3374.

2.3 UPPER ATTACHMENTS

A. Beam Clamps

1. Beam clamps shall be used where piping is to be suspended from building steel. Clamp type shall be selected on the basis of load to be supported, and load configuration.
2. C-Clamps shall have locknuts and cup point set screws equal to B-Line B351L or B3036L. Top flange C-clamps shall be used when attaching a hanger rod to the top flange of structural shapes and shall be equal to B-Line B3034 or B3033. Refer to manufacturers' recommendation for setscrew torque. Retaining straps shall be used to maintain the clamp's position on the beam where required. Retaining straps are REQUIRED for all seismically braced items.
3. Center loaded beam clamps shall be used where specified. Steel clamps shall be B-Line B3050 or B3055. Malleable iron or forged steel beam clamps with cross bolt shall be equal to B-Line B3054 or B3291 – B3297 series as required to fit beams.

B. Concrete Inserts

1. Cast in place spot concrete inserts shall be used where applicable, either steel or malleable iron body equal to B-Line B2500 or B3014. Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Select insert nuts to suit threaded hanger and rod sizes equal to B-Line N2500 or B3014N series.
2. Continuous concrete inserts shall be used where applicable. Channels shall be 12 gauge, ASTM A 1011 SS Grade 33 structural quality carbon steel, complete with Styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete inserts shall have a load rating of 2,000 lbs/ft in concrete and shall be equal to B-Line B221, B321, or B521 (B521 is limited to 1,500 lbs/ft). Select channel nuts suitable for strut and rod sizes.

2.4 ACCESSORIES

- A. Hanger rods shall be threaded on both ends and shall be equal to B-Line B3205. Continuous threaded rods of circular cross section may also be used. Use

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adjusting locknuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.

- B. Shields shall be 180 degree galvanized sheet metal, 12 inch minimum length, 18 gauge minimum thickness, designed to match the outside diameter of the insulated pipe and shall be equal to B-Line B3151. Pipe hangers serving all insulated piping shall be provided with suitable protection shields and/or saddles at the pipe hanger. Pipe hanger insulation shields shall be fabricated with a minimum metal gauge thickness in compliance with MSS SP-69, and insulation shields and/or saddles shall be properly centered inside pipe hangers to ensure that the piping insulation is not damaged. As an alternate, utilize per-fabricated hanger/insulation shield combinations, which are clevis hangers with insulation protection shields spot welded in place.
- C. Pipe protection saddles shall be formed from carbon steel, 1/8" minimum thickness, sized for insulation thickness. Saddles for pipe sizes greater than 12" shall have a center support rib.

2.5 FINISHES

- A. Hangers and strut located indoors and all hanger hardware shall be electro-plated zinc in accordance with ASTM B 633 SC1 or SC3.
- B. Hangers and strut located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A 123. All hanger hardware shall be hot dip galvanized or stainless steel.
- C. Hangers and strut located in corrosive areas shall be Type 304 stainless steel with stainless steel hardware.

2.6 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

PART 3 - EXECUTION

3.1 PIPE HANGERS AND SUPPORT

- A. Pipe shall be adequately supported by pipe hanger and supports specified in Part 2 - Products. Hangers for insulated pipes shall be sized to accommodate insulation thickness.
- B. Horizontal steel piping shall be supported in accordance with MSS SP-69, Tables 3 and 4. The following is an excerpt from those tables:

Nominal Pipe Size	Rod Diameter	Maximum Spacing
3/8" – 1-3/4"	3/8"	7'-0"
1-1/2"	3/8"	9'-0"
2"	3/8"	10'-0"
2-1/2"	1/2"	11'-0"

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3"	1/2"	12'-0"
3-1/2"	1/2"	13'-0"
4"	5/8"	14'-0"
5"	5/8"	16'-0"
6"	3/4"	17'-0"
8"	3/4"	19'-0"
10"	7/8"	22'-0"
12"	7/8"	23'-0"
14"	1"	25'-0"
16"	1"	27'-0"

C. Horizontal copper tubing shall be supported in accordance with MSS SP-69, Tables 3 and 4. The following is an excerpt from those tables:

Nominal Pipe Size	Rod Diameter	Maximum Spacing
1/4" – 3/4"	3/8"	5'-0"
1"	3/8"	6'-0"
1-1/4"	3/8"	7'-0"
1-1/2"	3/8"	8'-0"
2"	3/8"	8'-0"
2-1/2"	1/2"	9'-0"
3"	1/2"	10'-0"
3-1/2"	1/2"	11'-0"
4"	1/2"	12'-0"
5"	1/2"	13'-0"
6"	5/8"	14'-0"
8"	3/4"	16'-0"

D. Horizontal Schedule 40 PVC piping shall be supported in accordance with the following table:

Nominal Pipe Size	Rod Diameter	Maximum Spacing
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1/2"	3/8"	4'-0"
3/4"	3/8"	4'-0"
1"	3/8"	4'-6"
1-1/4" – 2"	3/8"	5'-0"
2-1/2" – 3"	1/2"	6'-0"
4"	1/2"	6'-6"
6"	5/8"	7'-6"
8"	3/4"	8'-0"
10"	3/4"	8'-6"
12"	3/4"	9'-6"

3.2 CONCRETE INSERTS

- A. Provide inserts for placement in formwork before concrete is poured.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Where concrete slabs from finished ceilings, provide inserts to be flush with slab surface.
- D. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

3.3 GENERAL

- A. Pipe shall be suspended from the building structure in a neat and workmanlike manner. Wherever possible, parallel runs of horizontal pipe shall be grouped on trapeze type hangers utilizing angle iron or uni-strut. Excess all thread rod shall not exceed 1 1/2" below pipe support.
- B. The use of wire or perforated metal strapping is not permitted.
- C. Hanging of pipe from other pipes, duct, etc is not permitted.
- D. Supports shall be designed and installed such that neither pipe nor supports will be subject to electrolytic action. Provide dielectric isolation between dissimilar metals of piping and supports (tape (electricians, duct, etc. is not acceptable).
- E. Provide anchors as required for proper anchorage including channels, plate etc.
- F. Insulation saddles shall be adhered to the insulation jacket with adhesive.
- G. Hangers for piping 2 1/2" and smaller utilizing teardrop hangers, hanger and pipe shall be insulated as an assembly. Piping 3" and above shall be supported by sections of cellular glass (foam glass) insulation placed in the insulation saddle to protect against damage to the insulation caused by excessive weight. Installation of just a metal pipe saddle is not sufficient.

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- H. Vertical piping shall be secured at sufficiently close intervals to keep the pipe in alignment and carry the weight of the pipe and contents. Cast-iron soil pipe shall be supported at not less than every story height and at its base. Screwed pipe shall be supported at not less than every other story height. Copper tubing shall be supported at each story for piping 3/4 inch and over and at not more than intervals of four feet for 5/8 inch and smaller.
- I. Cast iron soil pipe shall be supported at not more than intervals of five feet and at least once in each joint of pipe, refer to CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter 4 Installation for proper hanger spacing and piping support.
- J. No-hub piping shall have, especially in the smaller sizes, additional hangers. Hang no-hub piping with sufficient hangers so that piping is rigidly supported.
- K. Piping may be grouped together and supported from galvanized angle iron trapeze hangers. Provide insulation saddles to protect the pipe insulation.

END OF SECTION

SECTION 22-0523

GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to this Section.

1.2 SUMMARY

- A. Related Sections:
 - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
 - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
 - 3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.4 ACCEPTABLE MANUFACTURERS

- A. Apollo
- B. Circuit Solver
- C. Jomar Group
- D. Milwaukee
- E. Nibco
- F. Viega

1.5 REQUIREMENTS

- A. Provide clamp lock hand lever operators on valves less than 6 inches. Provide hand wheel and closed housing worm gear on valves 6 inches and larger unless indicated otherwise below. Provide chain operators for all equipment room and powerhouse valves 4 inch and larger which are located over 6 feet 6 inches above the finish floor. All valves shall be of the extended neck design to allow for the installation of full thickness insulation over flanges. Provide rubber end caps on all exposed valve stems under 7'-0" to prevent bump hazards. Valves shall be installed upright with no more than 45 degrees off center.

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- B. All plumbing work valves for domestic water piping systems shall comply with "Reduction of Lead in Drinking Water Act" effective January 1, 2014.
- C. All plumbing valves used in the potable domestic water system shall comply with NSF/ANSI 372, "Domestic Water System Components – Lead Content."
- D. Valves with nonmetallic stems will not be accepted.

1.6 SUBMITTALS

- A. All product data sheets shall be clearly labeled with identifying equipment number, fixture number, intended service, etc.
- B. All product data sheets shall be clearly labeled with the manufacturer's name.
- C. All pipe, fittings, and valve product data sheets shall clearly state country of manufacture. Foreign made pipe, fittings and appurtenances, manufactured outside the United States, will not be accepted. If this information is not provided on data sheets, the contractor shall provide a letter from the manufacturer stating country of manufacture.
- D. When information other than submitted item appears on a data sheet, the applicable information shall be clearly identified.
- E. Submittals that do not meet these requirements will not be considered and will be returned as REJECTED.

1.7 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GATE VALVES

- A. Provide gate valves per the following table:

<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL #</u>	<u>PRESSURE CLASS</u>
Hot & Cold Domestic Water	2" & smaller	T113-LF (threaded) / S113-LF (soldered)	125
Hot & Cold Domestic Water	2-1/2" & larger	F607-RWSB	125

2.2 BALL VALVES

- A. Provide ball valves per the following table:

<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL #</u>	<u>PRESSURE CLASS</u>
Hot & Cold Domestic Water	2" & smaller	T585-80-LF (threaded) / T/S585HP-66-LF (soldered)	150# CWP

- B. Where piping is insulated, ball valves shall be equipped with 2" extended handles of non-thermal conductive material. A protective sleeve shall be provided that allows operation of the valve without breaking the vapor seal or disturbing the insulation. Include fully adjustable memory stops for all ball valves.

2.3 BUTTERFLY VALVES

- A. Provide butterfly valves per the following table:

<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL #</u>	<u>PRESSURE CLASS</u>
Hot & Cold Domestic Water	2-1/2" to 12"	LD2000	200
Hot & Cold Domestic Water	14" & larger	LD2000-LD	200

- B. Valves 8" and larger shall have weatherproofed sealed gear operator consisting of fully enclosed worm, worm gear, and worm shaft with hand wheel to provide necessary torque for close-off and infinite throttling positions. Valves 6" and smaller to have 10 position lever lock handle suitable for on-off and manual throttling service. All operators to have valve position indicator and memory stop. All valves 6" and larger shall have threaded lugs for dead-end service.

2.4 CHECK VALVES

- A. Provide check valves per the following table:

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<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL #</u>	<u>PRESSURE CLASS</u>
Hot & Cold Domestic Water	2" & smaller	T-413-Y-LF (threaded) / S-413-Y-LF (solder)	125
Hot & Cold Domestic Water	2-1/2" & larger	Webstone 10550W G/W-920-W-LF	125

2.5 FLOW BALANCING VALVES

- A. For Renovation Projects with Recirculated Systems: Flow balancing valves shall be Lead Free Circuit Setter by Bell and Gossett, NIBCO, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION

- A. The installation of butterfly valves in water piping systems shall allow for ordinary maintenance work to be performed on the equipment these butterfly valves isolate, without having to drain the system beyond the butterfly valve. For instance, a check valve, of the type which would have to be removed from the line to replace the clapper or liner, should not be bolted onto a water type butterfly valve since removal of the check valve from the line would involve removing the butterfly valve also.
- B. Valves shall be located so as to be accessible by maintenance personnel. Valves 2 1/2 and larger shall have piping supported on each side of the valve.
- C. Valves shall be installed with stem no longer than horizontal position. Prior to installation valves shall be thoroughly cleaned to remove foreign material.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION

SECTION 22-0553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.
 - 6. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch, Stainless steel, 0.025-inch, Aluminum, 0.032-inch, or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately

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larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
 - 1. Stencil Material: Brass.
 - 2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches minimum.
 - 2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section " High-Performance Coatings."
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.
 1. Identification Paint: Use for contrasting background.
 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 25 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Pipe Label Color Schedule:
 1. Domestic Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.
 2. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: Orange.
 - b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Cold Water: 2 inches, square.
 - b. Hot Water: 1-1/2 inches, round.
 - 2. Valve-Tag Color:
 - a. Cold Water: Green.
 - b. Hot Water: Green.
 - 3. Letter Color:
 - a. Cold Water: White.
 - b. Hot Water: White.

3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 0700
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of piping insulation work as indicated on the drawings and by the requirements of this section.

1.2 QUALITY ASSURANCE

- A. Provide piping and duct insulation products produced by one or more of the following manufacturers for each type of insulation and temperature range required:
 - 1. Armacell LLC.
 - 2. CertainTeed Corp.
 - 3. Johns Manville
 - 4. Knauf Fiberglass
 - 5. Owens Corning
 - 6. Pittsburgh Corning Corp.
- B. Fire/Smoke Ratings: Provide composite pipe insulation (insulation, jackets, covering, sealers, mastics and adhesives) with flame-spread rating and smoke-developed rating as tested by ASTM E84 (NFPA 225) method. Composite rating shall not exceed the values shown with the physical properties for each type of insulation in this section.

1.3 SUBMITTALS

- A. Each data sheet shall be legibly marked with the intended service (cold water, hot water, hot water return, storm, etc).
- B. When information on more than one type of insulation appears on a data sheet, the applicable information shall be identified.
- C. The manufacturer's name shall appear legibly on each data sheet.
- D. Submittals not meeting these requirements will not be considered.

PART 2 - PRODUCTS

2.1 PIPE INSULATION

- A. Flexible Tubular Elastomeric:
 - 1. Provide fire-retardant closed-cell slip-on flexible type. Product must be guaranteed by manufacturer to have continuous operational temperature limit of not less than 220 degrees F and a minimum "R" value of 3.70. Product to be equivalent to Armacell LLC "Armaflex AP". Applicable products manufactured by Manville and Rubatex are acceptable. Provide insulation for the following services:
 - (a) Moisture condensate drains - 1/2" thick.
 - (b) Ice maker drain piping – 1/2" thick
- B. Fiberglass:
 - 1. Provide factory-formed factory-jacketed "system" type conforming strictly to

fire-resistive qualities herein before specified in "Quality Assurance" section. Jacket to be vapor-barrier type when used for systems operating below 60 degrees F. "System" density shall not less than 4 pounds per cubic foot. Product must be guaranteed by manufacturer to have continuous operational temperature limit of not less than 650 degrees F and a minimum "R" value of 4.00. Product to be equivalent to Manville "Micro-Lok 650" with type AP jacketing. Product to be manufactured by Owens Corning, Manville or Knauf. Jacket to be fiberglass reinforced kraft paper with aluminum foil and self-sealing lap joint.

2. Provide insulation of thickness for following services:
 - (a) Domestic cold water piping: 1/2" thick for 1-1/4" and smaller pipe, 1" thick for 1-1/2" and larger pipe.
 - (b) Domestic hot water piping: 1" thick for 1-1/4" and smaller pipe, 1-1/2" thick for 1-1/2" and larger pipe.
 - (c) Domestic hot water recirculation piping: 1" thick for 1-1/4" and smaller pipe, 1-1/2" thick for 1-1/2" and larger pipe.
 - (d) Ice Maker drain piping – 1/2" thick.
- C. Piping located in unconditioned mechanical rooms, attics, or exposed to the weather shall have the thickness listed above increased by 1/2".
- D. For any service when above grade exposed-to-the-weather outside building, cover straight pipe insulation with 0.016" thick aluminum jacket equivalent to Childers and cover valves and fittings with .024" thick aluminum factory formed covers equivalent to Childers Ell-Jacs.

PART 3 - EXECUTION

3.1 REQUIREMENTS

- A. Pipe saddles for protection of the insulation shall be provided by the insulation sub-contractor and installed at the time the insulation is applied. Saddles shall be secured to insulation with adhesive.
- B. Insulate all surfaces as indicated by drawings and specifications. Where more than one type of insulation is indicated for a particular application, selection shall be the contractors option.
- C. Install insulation products in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices.
- D. Surfaces shall be clean and dry prior to application of insulation. The piping system shall be tight with all testing and corrections complete.
- E. Install insulation materials with smooth and even surfaces. Insulate each continuous run of pipe with full-length units of insulation, with a single cut piece to complete each run. Do not use cut pieces or scraps abutting each other.
- F. Cover valves, flanges, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, pre-cut, or job fabricated units (at installers option), except where a specific form or type is indicated. In no case shall insulation cover gauges, plug cock indicators, or other items required for visual reference.
- G. Extend insulation without interruption through walls, floors and similar piping

penetrations, except where otherwise indicated.

- H. Install protective metal shields and insulated inserts wherever needed to prevent compression of insulation. Insulation shall not be installed over pipe hangers.
- I. All pipe insulation exposed to weather, except as otherwise described, shall be finished with .016 inch, (standard thickness) aluminum jacket and pre-formed aluminum fitting covers, by Childers or approved equal.
- J. Fiberglass Insulation on Cold Piping:
 - 1. Insulation on concealed piping shall be finished with white paintable, fire-retardant ASJ jacket.
 - 2. Butt all joints firmly together and smoothly secure all jacket laps and joint strips with lap adhesive. End of pipe insulation shall be sealed off with a vapor barrier coating at all fittings and valves and at each joint of insulation in addition to any other manufacture's recommendations.
 - 3. Insulate fittings and valves with molded fiberglass fittings, segments of pipe insulation, or with firmly compressed foil-faced fiberglass blanket with PVC covers. Secure in place with 20 gauge corrosion-resistant wire and apply a smoothing coat of insulating cement. Vapor seal by applying a layer of open-weave glass cloth fabric embedded between two coats of vapor-barrier mastic. Lap glass fabric 2" onto adjacent pipe. (In lieu of glass cloth embedded between coats of mastic, premolded fitting covers sealed at all edges with vapor barrier adhesive. Secure ends of covers with pressure-sensitive vinyl tape).
- K. Fiberglass Insulation on Hot Piping:
 - 1. Insulation on concealed piping shall be finished with white paintable, fire-retardant ASJ jacket.
 - 2. Butt all joints firmly together and smoothly secure all jacket laps and joint strips with lap adhesive. Flare type staples at 4 inch spacing may be used for concealed work.
 - 3. Insulate fittings and valves with molded fiberglass fittings, segments of pipe insulation, or with firmly compressed fiberglass blanket with PVC covers. Secure in place with 20 gauge wire and finish with a coat of insulating cement. Fittings for pipe sizes under 4" may be insulated with hydraulic setting insulating cement. All thickness' to be equal to that of adjoining pipe covering. Exposed fittings and valves shall be additionally finished with open-weave glass cloth fabric adhered between two floor coats of lagging adhesive. Lap glass fabric 2" onto adjacent pipe. (In lieu of glass cloth embedded between coats of adhesive premolded fitting covers may be used. The covers shall overlap the adjoining pipe insulation and shall be mechanically secured).

END OF SECTION

SECTION 22-1100
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings and water meters.
- B. Water Samples: Specified in Part 3 "Cleaning" Article.
- C. Field quality-control test reports.
- D. Provide product data sheets for each type of pipe, fitting and joining method used to include flux and solder. Each data sheet shall be legibly marked with the intended service (cold water, hot water, hot water return, above ground, below ground, etc). When information on more than one type of pipe appears on a data sheet, the applicable information shall be identified. The manufacturer's name shall appear legibly on each data sheet. Submittals not meeting these requirements will not be considered.
- E. Pipe pressure test reports (test reports shall have a witness signature from a representative of the facility maintenance department).

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.
- C. Comply with NSF/ANSI 372, "Drinking Water System Components – Lead Content," for potable domestic water piping and components.
- D. All pipe, tubing, fittings, valves and related components shall be of domestic manufacture. "Foreign pipe", that which is manufactured outside the United States, shall not be permitted. This includes pipe, tubing, fittings, valves and related components. If "foreign pipe" is found to have been installed, all "foreign pipe" shall be removed and reinstalled with domestic pipe at the installing contractor's expense. Additional allocation of time and money to remove and replace "foreign pipe" shall not be made. Where "foreign pipe" has been insulated, removed insulation shall not be reused.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.

- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
 - 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - 2. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body, with ball-and-socket, metal-to-metal, bronze seating surface and female threaded ends.
 - 3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 - 4. Cast-Iron Flanges: ASME B16.1, Class 125.
 - 5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
 - 6. Steel-Piping, Expansion Joints: Compound, galvanized steel fitting with telescoping body and slip-pipe section. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.
 - 7. Steel-Piping, Double Expansion Joints: Compound, galvanized steel fitting with telescoping body and two slip-pipe sections. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.

2.3 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. Hard Copper Tube: ASTM B 88, Types K and L, water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Copper Press Fittings: ASME B 16.18 or ASME B16.22 and performance criteria of IAPMO PS 117, copper and cast-copper alloy press fittings with EPDM O-rings.
 - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 - 5. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
 - a. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

- C. Provide copper press fitting with EPDM O-rings. Install per manufacturer's recommendations. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press end shall have SC (Smart Connect) feature design (leakage path). In ProPress ½" to 4" dimensions the Smart Connect Feature assures leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. This provides the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.

2.4 VALVES

- A. Drain valves are specified in Division 22 Section "Plumbing Specialties."
- B. Balancing valves are specified in Division 22 Section "General Duty Valves for Plumbing Systems".

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Grooved joints may be used on aboveground grooved-end piping.
- D. Aboveground Domestic Water Piping, NPS 3 and smaller shall be any of the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought copper solder-joint fittings; and soldered joints.
 - 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
- E. Press connections: Copper press fitting joints shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

3.3 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use bronze ball for piping NPS 2 and smaller. Use cast-iron butterfly with flanged ends for piping NPS 2-1/2 and larger.
 - 2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
 - 3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
 - 4. Drain Duty: Hose-end drain valves.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
 - 1. Install hose-end drain valves at low points in water mains, risers, and branches.
 - 2. Install stop-and-waste drain valves where indicated.
- D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Calibrated balancing valves are specified in Division 22 Section "General Duty Valves for Plumbing Piping".

3.4 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gauge, and test tee with valve, inside the building at each domestic water service entrance. Pressure gauges are specified in Division 22 Section "Meters and Gauges," and drain valves and strainers are specified in Division 22 Section "Plumbing Specialties."
- F. Install water-pressure regulators downstream from shutoff valves. Water-pressure regulators are specified in Division 22 Section "Plumbing Specialties."
- G. Install domestic water piping level without pitch and plumb.

3.5 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- C. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support devices are specified in Division 22 Section "Hangers and Supports." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 3. NPS 2: 10 feet with 3/8-inch rod.
 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 7. NPS 6: 12 feet with 3/4-inch rod.
 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- F. Install supports for vertical steel piping every 22 feet.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 6. NPS 6: 10 feet with 5/8-inch rod.
 7. NPS 8: 10 feet with 3/4-inch rod.
- H. Install supports for vertical copper tubing every 10 feet.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to water-service piping with shutoff valve, and extend and connect to the following:
1. Plumbing Fixtures: Cold and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
 2. Equipment: Cold and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Test in accordance with Specification 220100 Section 3.7
2. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
3. Prepare reports for tests and required corrective action.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below whichever is more stringent:
 - a. It is recommended that disinfection of the domestic water piping system is accomplished by a professionally trained treatment crew, experienced in disinfecting domestic water systems in 'healthcare' facilities, because the effectiveness of disinfection is entirely dependent upon maintain clean

- pipes and avoiding major contamination during, and throughout, the construction phase.
- b. The domestic piping installation crews shall be made aware of the critical necessity of maintaining clean pipes and avoiding any contamination during the domestic water system installation and instructed that the primary means for ensuring the sanitary condition of the domestic water piping are the sanitary handling of materials, the cautionary procedures exercised during construction, and the continual inspection of the ongoing work.
 - c. Since heavy particulates generally contain bacteria and can prevent even very high chlorine concentrations from contacting and killing these organisms, the disinfection procedures must be carefully implemented to ensure that a water main and its appurtenances have been thoroughly cleaned for the final disinfection by chlorination.
 - d. Any connection of new water main to the existing and active distribution system prior to the receipt of satisfactory bacteriological samples may constitute a cross-connection. Therefore, the new domestic water mains must be isolated until bacteriological tests are satisfactorily completed.
 - e. The interiors of pipes, fittings, and valves shall be protected from contamination by being kept clean and dry at all times.
 - f. Opening in the pipeline shall be closed with watertight plugs when pipe installation is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. Rodent-proof plugs may be used when watertight plugs are not practicable and when thorough cleaning will be performed by flushing or other means.
 - g. Delays in the installation of delivered pipe shall be absolutely minimized since it increases the risk of contamination. The more closely the rate of delivery is correlated to the rate of pipe laying, the lower the risk of contamination.
 - h. No contaminated material or any material capable of supporting growth of microorganisms shall be used for sealing joints. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water and shall not contribute odors. It shall be delivered to the job in closed containers and shall be kept clean and applied with dedicated, clean applicator brushes.
 - i. If dirt enters the pipe, it shall be removed and the interior pipe surface cleaned and swabbed with a 1 to 5 percent hypochlorite disinfecting solution. If, in the opinion of the EOR, the dirt remaining in the pipe will not be removed during the flushing operation, then the interior of the pipe shall be cleaned using mechanical means, such as a hydraulically propelled and suitable device acceptable to the EOR, in conjunction with the application of a 1 percent hypochlorite disinfecting solution. The cleaning method used shall not force mud or debris into the interior pipe-joint spaces and shall be acceptable to the EOR.
 - j. Final flushing should occur immediately after the applicable retention period, so that the disinfecting solution does not remain in prolonged contact with pipe, especially if heavily chlorinated water has been utilized. This is necessary to help prevent damage to the pipe lining or to prevent corrosion damage to the pipe itself. The flushing should continue through all main fittings, valves, and branches until residual chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system or that is acceptable for domestic use.

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- k. If final water sample results from the lab indicate a measured HPC greater than 500 colony-forming units (cfu) per mL, flushing should be resumed and another coliform and HPC set of samples should be taken until no coliforms are present and the HPC is less than 500 cfu/mL.
 - l. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

SECTION 22-1316
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.
 - 3. Encasement for underground metal piping.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. LLDPE: Linear, low-density polyethylene plastic.
- D. NBR: Acrylonitrile-butadiene rubber.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
- B. Seismic Performance: If in a seismic design category C or D, soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings:
 - 1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
- C. Provide product data sheets for each type of pipe, fitting and joining method used to include flux and solder. Each data sheet shall be legibly marked with the intended service (sanitary, storm, vent, above ground, below ground, etc). When information on more than one type of pipe appears on a data sheet, the applicable information shall be identified. The manufacturer's name shall appear legibly on each data sheet. Submittals not meeting these requirements will not be considered.

- D. Pipe pressure test reports (test reports shall have a witness signature from a representative of the facility maintenance department).

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.
- C. All pipe, tubing, fittings, valves and related components shall be of domestic manufacture. "Foreign pipe" that which is manufactured outside the United States, shall not be permitted. This includes tubing, fittings, valves and related components. If "foreign pipe" is found to have been installed, all "foreign pipe" shall be removed and reinstalled with domestic pipe at the installing contractor's expense. Additional allocation of time and money to remove and replace "foreign pipe" shall not be made. Where "foreign pipe" has been insulated, removed insulation shall not be reused.
- D. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 and CISPI 301.
- B. Standard Shielded Couplings: CISPI 310 or ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Heavy-duty Shielded, Type 304 Stainless-Steel Couplings: ASTM C 1540 with Type 304 AISI stainless-steel shield with a minimum shield thickness of 0.15", with 4 or 6 Type 304 stainless-steel bands and tightening devices, and ASTM C 564 neoprene gasket.
 - a. Basis of Design: Husky SD 4000
 - 1) Acceptable Manufacturers:
 - a) Husky SD4000
 - b) Clamp All 125
 - c) MG Coupling
 - 2. Mid-duty, Shielded, Type 304 Stainless-Steel Couplings: With Type 304 AISI stainless-steel shield, with 4 Type 304 stainless-steel bands and tightening devices, and ASTM C 564, neoprene sleeve.
 - a. Basis of Design: Husky SD2000
 - 1) Acceptable Manufacturers:

- a) Husky HD2000
- b) Clamp All 80
- c) Ideal Tridon
- d) Mission Heavyweight

2.3 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.
- B. Drainage Fittings: ASME B16.12, threaded, cast-iron drainage pattern.
- C. Pressure Fittings:
 - 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - 2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
 - 3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125 standard pattern.
 - 4. Cast-Iron Flanges: ASME B16.1, Class 125.
 - 5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125.

2.4 STAINLESS-STEEL PIPE AND FITTINGS

- A. Pipe and Fittings: ASME A112.3.1, drainage pattern with socket and spigot ends.
- B. Gaskets: Lip seals shaped to fit socket groove, with plastic backup ring.
 - 1. Material: EPDM, unless NBR is indicated.

2.5 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 - 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 2. Gaskets: AWWA C111, rubber.
- C. Flanges: ASME 16.1, Class 125, cast iron.

2.6 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- B. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

C. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2.7 PVC PIPE AND FITTINGS

A. Solid-Wall Schedule 40 PVC Pipe: ASTM D 2665, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

2.8 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Sleeve Materials:

- a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
- b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
- c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

C. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.

1. Center-Sleeve Material: Manufacturer's standard.
2. Gasket Material: Natural or synthetic rubber.
3. Metal Component Finish: Corrosion-resistant coating or material.

E. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.

F. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

- G. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
- H. Tubular Fittings: ASTM F 409, ABS and PVC drainage-pattern tube and tubular fittings with ends as required for application.

2.9 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Description: ASTM A 674 or AWWA C105, high-density, cross laminated PE film of 0.004-inch] or LLDPE film of 0.008-inch minimum thickness.
- B. Form: Sheet or tube.
- C. Color: Black or natural.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
 - 1. Hubless cast-iron soil pipe and fittings; mid-duty shielded, stainless-steel couplings; and hubless-coupling joints equal to Husky SD4000.
 - 2. Steel pipe, drainage fittings, and threaded joints.
 - 3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
 - 4. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.**
 - 6. Dissimilar Pipe-Material Couplings: Flexible, Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
 - 1. Hubless cast-iron soil pipe and fittings; mid-duty, shielded, stainless-steel couplings; and hubless-coupling joints.
 - 2. Steel pipe, drainage fittings, and threaded joints.
 - 3. Stainless-steel pipe and fittings gaskets, and gasketed joints.
 - 4. Copper DWV tube, copper drainage fittings, and soldered joints.
 - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
 - 5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.**
 - 6. Dissimilar Pipe-Material Couplings: Flexible, Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- D. Aboveground, vent piping NPS 5 and larger shall be any of the following:
 - 1. Hubless cast-iron soil pipe and fittings; mid-duty, shielded, stainless-steel couplings; and hubless-coupling joints.
 - 2. Steel pipe, drainage fittings, and threaded joints.

3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

4. Dissimilar Pipe-Material Couplings: Flexible, Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

E. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.

3.3 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 2 Section "Sanitary Sewerage."

B. Basic piping installation requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."

C. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Mechanical Vibration and Seismic Controls."

D. Install cleanout at the upstream end of all horizontal drains, at a spacing not to exceed 50', changes in direction greater than 45 degrees and at the base of stacks unless required otherwise by local jurisdiction.

E. Install cleanout at grade where the building drains connects to the building sewers. Cleanouts shall be two-way type.

F. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

G. Install underground, ductile-iron, special pipe fittings according to AWWA C600.

1. Install encasement on piping according to ASTM A 674 or AWWA C105.

H. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Basic Mechanical Materials and Methods."

I. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

J. 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."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- L. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- M. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 1/4"/ft downward in direction of flow for piping NPS 2 1/2 and smaller; 1/8"/ft downward in direction of flow for piping NPS 3 and larger.
 - 2. Vent Piping: 1/8"/ft down toward vertical fixture vent or toward vent stack.
- N. Install engineered soil and waste drainage and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 - 2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- O. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- P. Install underground ABS and PVC soil and waste drainage piping according to ASTM D 2321.
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- R. The transition from PVC underground piping to above ground cast-iron piping shall happen underground so that no PVC is exposed aboveground.
- S. **When tying into an existing underground sanitary drainage system, the existing building drains under concrete slabs shall be verified to have the correct slope as well as verify the piping is not broken or obstructed. Contractor shall video tape all piping to document this and ensure no blockages exist or any piping has been crushed.**

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- E. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Mechanical Vibration Controls and Seismic Restraints."

- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Install individual, straight, horizontal piping runs according to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 4: 60 inches with 3/8-inch rod.
 - 2. NPS 6 and larger: 60 inches with 1/2-inch rod.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 5. NPS 6: 10 feet with 5/8-inch rod.
 - 6. NPS 8: 10 feet with 3/4-inch rod.
- K. Install supports for vertical copper tubing every 10 feet.
- L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

- A. **After underground piping is complete before slab is poured the plumbing contractor shall document (through digital photographs) the routing of piping throughout the area of construction and update the as-built documents accordingly. Contractor shall video tape all piping to ensure no blockages exist or any piping has been crushed.**
- B. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
- C. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- E. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they

leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PROTECTION

- A. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION

SECTION 22-4300
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes plumbing fixtures and related components.
- B. Related Sections include the following:
 - 1. Division 22 Section "Plumbing Specialties" for backflow preventers and specialty fixtures not in this Section.

1.3 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- C. Cooled Water: Cooled potable water produced by water cooler.
- D. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
- E. PVC: Polyvinyl chloride plastic.
- F. Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid-solution supply.
- G. Tepid: Approximately 85 deg F temperature.
 - 1. Allowable Variation: Plus or minus 5 deg F.

1.4 SUBMITTALS

- A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

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1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. All plumbing fixtures for domestic water piping systems shall comply with "Reduction of Lead in Drinking Water Act" effective January 1, 2014.
- D. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.
- E. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.
- F. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- G. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- H. NSF/ANSI Standard: Comply with NSF/ANSI 372, "Drinking Water System Components – Lead Content," for fixture materials that will be in contact with potable water.
- I. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- J. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 1. Hand Sinks: NSF 2 construction.
 2. Plastic Laundry Trays: ANSI Z124.6.
 3. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
 4. Vitreous-China Fixtures: ASME A112.19.2M.
 5. Water-Closet, Tank Trim: ASME A112.19.5.
 6. Emergency Eyewash and Shower Equipment: ANSI Z358.1
- K. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
 2. All public lavatories shall be provided with a mixing valve compliant with ASSE 1070
 3. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 4. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 5. Faucet Hose: ASTM D 3901.
 6. Faucets: ASME A112.18.1M.
 7. Hose-Connection Vacuum Breakers: ASSE 1011.
 8. Hose-Coupling Threads: ASME B1.20.7.

9. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 10. NSF Materials: NSF 61.
 11. NSF/ANSI Materials: NSF/ANSI 372.
 12. Pipe Threads: ASME B1.20.1.
 13. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 14. Supply and Drain Fittings: ASME A112.18.1M.
- L. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
1. Atmospheric Vacuum Breakers: ASSE 1001.
 2. Brass and Copper Supplies: ASME A112.18.1M.
 3. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.
- M. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Floor Drains: ASME A112.21.1M.
 2. Grab Bars: ASTM F 446.
 3. Hose-Coupling Threads: ASME B1.20.7.
 4. Off-Floor Fixture Supports: ASME A112.6.1M.
 5. Pipe Threads: ASME B1.20.1.
 6. Plastic Toilet Seats: ANSI Z124.5.
 7. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 COORDINATION

- A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.
- B. Reinforcement: 2-by-4-inch fire-retardant-treated-wood blocking between studs. Fire-retardant-treated-wood blocking is specified in Division 6 Section "Rough Carpentry."

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
 3. Faucet, Laminar-Flow Fittings: Equal to 10 percent of amount of each type and size installed, but not less than 2 of each type and size.
 4. Faucet, Flow-Control Fittings: Equal to 10 percent of amount of each type and size installed.
 5. Supply, Flow-Control Fittings: Equal to 5 percent of amount of each type and size installed.
 6. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but not less than 12 of each type.
 7. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
 8. Water-Closet Tank, Repair Kits: Equal to 5 percent of amount of each type installed.
 9. Toilet Seats: Equal to 5 percent of amount of each type installed.

10. Operating Key Handles: Equal to 100 percent of amount installed for each key-operated hose bibb and hydrant installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following requirements apply for product selection:
 1. Products: Subject to compliance with requirements, provide one of the products specified in other Part 2 articles.
 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified in other Part 2 articles.
 3. No manufacturer substitutions shall be allowed without prior written approval from the engineer (5) days before bidding.

2.2 MANUFACTURERS

- A. Bathtubs and Showers:
 1. Manufacturers:
 - a. American Standard, Inc.
 - b. Aqua Bath Co., Inc.
 - c. Aqua Glass Corp.
 - d. Comfort Designs
 - e. Kohler Co.
 - f. U.S. Industries, Eljer Plumbingware Div.
- B. Carriers, Hose Bibbs and Hydrants, and Water Hammer Arrestors:
 1. Manufacturers:
 - a. Josam Co.
 - b. Leonard Valve Company.
 - c. NIBCO Inc.
 - d. Sioux Chief Manufacturing Co., Inc.
 - e. Smith, Jay R. Mfg. Co.
 - f. Wade
 - g. Watts
 - h. Woodford Manufacturing Co.
 - i. Zurn Industries, Inc.
- C. Emergency Equipment:
 1. Manufacturers:
 - a. Bradley
 - b. Encon
 - c. Guardian
 - d. Stingray
- D. Faucets:
 1. Manufacturers:
 - a. American Standard, Inc.
 - b. Kohler
 - c. Chicago Faucet

- d. Delta
 - e. Symmons
 - f. T&S Brass
 - g. Zurn
- E. Stops/Supplies:
- a. McGuire Manufacturing
 - b. Brasscraft
 - c. Watts
 - d. Zurn
- F. Fixtures:
- 1. Manufacturers:
 - a. American Standard, Inc.
 - b. Kohler
 - c. TOTO USA, Inc.
 - d. Zurn
- G. Flushometer Valves:
- 1. Manufacturers
 - a. American Standard, Inc.
 - b. Sloan Valve Company
 - c. Zurn
- H. Floor Drains, Floor Sinks, and Trench Drains:
- 1. Manufacturers:
 - a. ABT, Inc.
 - b. Josam Co.
 - c. MIFAB Manufacturing, Inc.
 - d. Smith, Jay R. Mfg. Co.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Industries, Inc.
 - g. Zurn Industries, Inc.
- I. Laundry Trays:
- 1. Manufacturers:
 - a. Fiat
 - b. Mustee, E. L. & Sons, Inc.
- J. Outlet Boxes:
- 1. Manufacturers:
 - a. Acorn Engineering Company.
 - b. Gray, Guy Manufacturing Co., Inc.
 - c. Oatey.
 - d. Symmons Industries, Inc.
 - e. Zurn
- K. Stainless Steel Sinks:

1. Manufacturers:
 - a. American Standard, Inc.
 - b. Elkay Manufacturing Co.
 - c. Just Manufacturing Co.
 - d. Kohler Co.

L. Service Basins and Service Sinks:

1. Manufacturers:
 - a. Creative Industries
 - b. Fiat
 - c. Kohler Co.
 - d. Stern-Williams Co., Inc.
 - e. Terrazzo Ware

M. Toilet Seats:

1. Manufacturers:
 - a. Bemis
 - b. Beneke
 - c. Centoco
 - d. Church
 - e. Olsonite

N. Trap Seal Primer Valves:

1. Manufacturers:
 - a. Precision Plumbing Products, Inc.
 - b. Smith, Jay R. Mfg. Co.
 - c. Tyler Pipe; Wade Div.
 - d. Watts Industries, Inc.
 - e. Zurn Industries, Inc.

O. Water Coolers:

1. Manufacturers:
 - a. Halsey Taylor
 - b. Haws
 - c. Oasis
 - d. Sunroc

2.3 PLUMBING FIXTURES

- A. Refer to Plumbing Legends/Schedules and Notes for Plumbing Fixture Specifications.
- B. Provide drain, drain body, and tailpiece for plumbing fixtures integral to solid surface countertops.

2.4 SOURCE QUALITY CONTROL

- A. Certify performance of plumbed emergency plumbing fixtures by independent testing agency acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.
- B. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE INSTALLATION

- A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-hanging fixtures with tubular waste piping attached to supports.
- F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
- G. Install counter-mounting fixtures in and attached to casework.
- H. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.
- I. Install water-supply piping with 1/4 turn commercial stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- J. Install drain, drain body, and tailpiece on drain outlet of each fixture that is integral to solid surface countertops to be directly connected to sanitary drainage system.
- K. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- L. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

- M. Install flushometer valves and all flush activation devices for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- N. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- O. Install toilet seats on water closets.
- P. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- Q. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
- R. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- S. Install shower, flow-control fittings with specified maximum flow rates in shower arms.
- T. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- U. Install disposer in outlet of sinks indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- V. Install hot-water dispensers in back top surface of sink or in counter with spout over sink.
- W. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings.
- X. Set bathtubs, shower receptors, and service basins in leveling bed of cement grout.
- Y. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.
- Z. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- AA. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
 1. Install roof-drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 2. Position roof drains for easy access and maintenance.
- BB. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- CC. Install draining-type ground and ground post hydrants with 1 cu. yd. of crushed gravel around drain hole.
 1. Set ground hydrants with box flush with grade.
 2. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect water supplies from water distribution piping to fixtures.
- C. Connect drain piping from fixtures to drainage piping.
- D. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment.
- E. Connect hot- and cold-water-supply piping to hot- and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.
- F. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary drainage and vent piping.
- G. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, drains, drain bodies, tailpieces and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.
 1. For plumbing fixture faucets, shower valves, and tub valves requiring both a hot-water and a cold water supply connection:
 - a. Hot water shall be connected on the left side of the faucet, shower valve, or tub valve such that when the left control is operated hot water shall be dispensed.
 - b. Cold water shall be connected on the right side of the faucet, shower valve, or tub valve such that when the right control is operated cold water shall be dispensed.
 - c. For faucets, shower valves, or tub valves that utilize a single lever to dispense water, the hot water shall connect to the left side of the valve and cold water shall connect to the right side of the valve.
- H. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste

piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

- I. Ground equipment.
 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Verify that installed fixtures are categories and types specified for locations where installed.
- B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.
- F. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.
 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 FIELD QUALITY CONTROL FOR EMERGENCY FIXTURES

- A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities and temperatures.
- B. Electrical-Component Testing: After electrical circuitry has been energized, test for compliance with requirements.
 1. Test and adjust controls and safeties.
- C. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.
- D. Report test results in writing.

3.6 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers, hot-water dispensers, and controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

E. For Emergency Fixtures:

1. Adjust or replace fixture flow regulators for proper flow.
2. Adjust equipment temperature settings.

3.7 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

3.8 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION