

Division 22: PLUMBING

1. GENERAL INSTRUCTIONS

A. GENERAL REQUIREMENTS

All requirements under Division 01 and the general and supplementary conditions of these specifications apply to this section and division. Where the requirements of this section and division exceed those of Division 01, this section and division take precedence. Become thoroughly familiar with all its contents as to requirements that affect this division, section, or both. Work required under this division includes all material, equipment, appliances, transportation, services and labor required to complete the entire system as required by the drawings and specifications, or reasonably inferred to be necessary to facilitate the function of each system as implied by the design and equipment specified.

The specifications and drawings for the Project are complementary, and any portion of work described in one shall be provided as if described in both. In the event of discrepancies, notify the Engineer and request clarification prior to proceeding with the work involved.

Drawings are graphic representations of the work upon which the contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They convey the scope of work, indicating the intended general arrangement of the systems without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the drawings as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory, and properly operating system.

B. DEFINITIONS

Furnish: "to supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations."

Install: "to perform all operations at the project site including, but not limited to, the actual unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."

Provide: "to furnish and install, complete and ready for the intended use."

Furnished by Owner (or Owner-Furnished) or Furnished by Others: "an item furnished by the Owner or under other divisions or contracts, and installed under the requirements of this division, complete, and ready for the intended use, including all items and services incidental to the work necessary for proper installation and operation. Include the installation under the warranty required by this division."

Engineer: Where referenced in this division, "Engineer" is the Engineer of Record and the Design Professional for the work under this division, and is a consultant to, and an authorized representative of the Architect, as defined in the General and/or Supplementary Conditions. When used in this division, Engineer means increased involvement by and obligations to the Engineer, in addition to involvement by and obligations to the Architect.

AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the work.

NRTL: Nationally recognized testing laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA), and acceptable to the AHJ over this project. Nationally recognized testing laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ and standards that meet the specified criteria.

The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified." The term "approved" shall mean labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.

The term lead free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content of less than or equal to 0.25% per safe drinking water act as amended January 4, 2011 Section 1417.

C. PREBID SITE VISIT

Prior to submitting bid, visit the site of the proposed work and become fully informed as to the conditions under which the work is to be done. Failure to comply with this requirement shall not be considered sufficient justification to request or obtain extra compensation over and above the contract price.

D. MATERIAL AND WORKMANSHIP

Provide new material, equipment, and apparatus under this contract unless otherwise stated herein, of best quality normally used for the purpose in good commercial practice, and free from defects. Model numbers listed in specifications or shown on the drawings are not necessarily intended to designate the required trim, written descriptions of the trim govern model numbers.

Pipe, pipe fittings, pipe specialties and valves shall be manufactured in plants located in the United States or certified to meet the specified ASTM and ANSI standards.

Work performed under this contract shall provide a neat and "workmanlike" appearance when completed, to the satisfaction of the Architect and Engineer. Workmanship shall be the finest possible by experienced mechanics. Installations shall comply with applicable codes and laws.

The complete installation shall function as designed and intended with respect to efficiency, capacity, noise level, etc. Abnormal noise caused by rattling equipment, piping and squeaks in rotating components shall not be acceptable. Materials and equipment shall be of commercial specification grade in quality. Light duty and residential grade equipment shall not be accepted unless otherwise indicated.

Remove from the premises waste material present as a result of this work, including cartons, crating, paper, stickers, and/or excavation material not used in backfilling, etc. Clean equipment installed under this contract to present a neat and clean installation at the termination of the work.

Repair or replace public and private property damaged as a result of work performed under this contract to the satisfaction of authorities and regulations having jurisdiction. Provide all safety lights, guards, and warning signs required for the performance of the work and for the safety of the public.

E. MANUFACTURERS

In other articles where lists of manufacturers are introduced, subject to compliance with requirements, provide products by one of the manufacturers specified.

Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

Where manufacturers are not listed, provide products subject to compliance with requirements from manufacturers that have been actively involved in manufacturing the specified product for no less than 5 years.

F. COORDINATION

Coordinate work with that of other trades so that the various components of the systems are installed in proper relation to fit the available space, and will allow proper service access to those items requiring maintenance. Components which are installed without regard to the above shall be relocated at no additional cost to the Owner.

Unless otherwise indicated, General Contractor shall provide chases and openings in building construction required for installation of the systems specified herein. Contractor shall furnish the General Contractor with information on chases and openings when required. Contractor shall keep informed as to the work of other trades engaged in the construction of the project and shall execute his work in such a manner as not to interfere with or delay the work of other trades.

Figured dimensions shall be taken in preference to scaled drawings. Contractor shall take his own measurements at the building, as variations may occur. Contractor shall be held responsible for errors which could have been avoided by proper checking and verification.

Provide materials with trim that is properly finished to match ceiling walls, finishes actually installed. Model numbers listed in the specifications or shown on the drawings are not intended to designate the required trim.

G. ORDINANCES AND CODES

Work performed under this contract shall, in all instances, be in conformance with applicable national, state and local codes having jurisdiction. Equipment furnished and associated installation work performed under this contract shall be in strict compliance with applicable codes as amended by the local AHJ, including any amendments and standards as set forth by the following:

- 1. National Fire Protection Association (NFPA)
- 2. Underwriters Laboratories (UL)
- 3. Occupational Safety and Health Administration (OSHA)
- 4. American Society of Mechanical Engineers (ASME)
- 5. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
- 6. American National Standards Institute (ANSI)
- 7. American Society of Testing Materials (ASTM)
- 8. Other national standards and codes where applicable.

Where the contract documents exceed the requirements of the referenced codes, standards, etc., the contract documents shall take precedence. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent.

Promptly bring all conflicts observed between codes, ordinances, rules, regulations, referenced standards, and these documents to the attention of the Architect and Engineer for final resolution. Contractor will be held responsible for any violation of the law.

Procure and pay for permits and licenses required for the accomplishment of the work herein described. Where required, obtain, pay for, and furnish certificates of inspection to Owner.

H. PROTECTION OF EQUIPMENT AND MATERIAL

Store and protect from damage equipment and material after delivery to job site. For materials and equipment susceptible to changing weather conditions, dampness, or temperature variations, store inside in conditioned spaces. For materials and equipment not susceptible to these conditions, cover with waterproof, tear-resistant, heavy tarp or polyethylene plastic as required to protect from plaster, dirt, paint, water, or physical damage. Equipment and material damaged by construction activities shall be rejected and Contractor shall furnish new equipment and material of a like kind at his own expense.

Keep premises broom clean of foreign material created during work performed under this contract. Piping, equipment, etc. shall have a neat and clean appearance at the termination of the work.

Plug or cap open ends of piping systems while stored and installed during construction when not in use to prevent the entrance of debris into the systems.

Keep the manufacturer-provided protective coverings on floor drains, floor sinks and trench drains during construction. Remove coverings at the termination of the work and polish exposed surfaces.

I. SUBSTITUTIONS

The base bid shall include only the products from manufacturers specifically named in the drawings and specifications. No substitution will be considered prior to receipt of bids unless written request for approval to bid has been received by the Engineer at least ten (10) calendar days prior to the date for receipt of bids. Each such request shall include the name of the material or equipment for which substitution is requested and a complete description of the proposed substitution including drawings, cuts, performance and test data, and other information necessary for an evaluation. Include a statement setting forth changes in other materials, equipment or other work that incorporation of the substitute would require. The burden of proof of the merit of the proposed substitute is upon the proposer. The Engineer's decision of approval or disapproval of a bid of a proposed substitution shall be final.

Coordinate and verify with other trades whether or not the substituted equipment can be installed as shown on the construction drawings without modification to associated systems or architectural or engineering design. Include additional costs for architectural and engineering design fees in bid if drawing modifications are required because of substituted equipment.

If the proposed substitution is approved prior to receipt of bids, such approval will be stated in an addendum. Bidders shall not rely upon approval made by any other party. Verbal approval will not be given. No substitutions will be considered after the contract is awarded unless specifically provided in the contract documents.

The terms "approved", "approved equal", or "equal", refer to approval by the Engineer as an acceptable alternate bid. No substitutions will be considered that are not bid as an alternate. No material substitutions shall be considered for approval prior to award of contract.

J. SUBMITTALS

Assemble and submit for review shop drawings, material lists, manufacturer product literature for equipment to be furnished, and items requiring coordination between contractors under this contract. Provide submittals in sufficient detail so as to demonstrate compliance with these Contract Documents and the design concept. Prior to transmitting submittals, verify that the equipment submitted is mutually compatible and suitable for the intended use, will fit the available space, and maintain manufacturer recommended service clearances. If the size of equipment furnished makes necessary any change in location or configuration, submit a shop drawing showing the proposed layout.

Transmit submittals as early as required to support the project schedule. Allow for two weeks Engineer review time, plus 10/10m mailing time via the Architect, plus a duplication of this time for resubmittal, if required. Only resubmit those sections requested for resubmittal.

Submittals shall contain the project name, applicable specification section, submittal date, equipment identification acronym as used on the drawings, and the Contractor's stamp. The stamp shall certify that the submittal has been checked by the Contractor, complies with the drawings and specifications, and is coordinated with other trades. Manufacturer product literature shall include shop drawings, product data, performance sheets, samples and other submittals required by this division. Highlight, mark, list, or indicate the materials, performance criteria, and accessories that are being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.

Submittals and shop drawings shall not contain the firm name, logo, seal, or signature of the Engineer. They shall not be copies of the work product of the Engineer. If the Contractor desires to use elements of such product, refer to paragraph "Electronic Drawings Files" for procedures to be used.

Separate submittals according to individual specification sections. Illegible submittals will be rejected and returned without review. Catalog data shall be properly bound, identified, indexed and tabbed in a 3-ring binder. Each item or model number shall be clearly marked and accessories indicated. Label the catalog data with the equipment identification acronym or model number used on the drawings and include performance curves, capacities, sizes, weights, materials, finishes, wiring diagrams, dimensions, requirements and dimensions from specific manufacturer form and to specify shipping method and drawing format. In addition to payment, submittals shall be accompanied by a release agreement form from the Engineer must be received before electronic drawing submittals will be sent.

Provide the quantity of submittals required by Division 01. If not indicated and hard-copy sets are provided, submit a minimum of (6) copies. Refer to Division 01 for acceptance of electronic submittals for this project. For electronic submittals, Contractor shall submit the documents in accordance with the procedures specified in Division 01. Contractor shall notify the Architect and Engineer that the submittals have been posted. If electronic submittal procedure is used, not defined in Division 01, Contractor shall include the website, user name, and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall provide the designated representatives of the Architect and Engineer. Contractor shall allow for the Engineer review time as specified above in the construction schedule. Contractor shall submit only the documents required. Purchase the materials and/or equipment in the electronic submittal.

The checking and subsequent acceptance of submittals by the Engineer and/or Architect shall not relieve the Contractor of responsibility for deviations from the drawings and specifications, errors in dimensioning, details, size of members, or quantities, omissions of components or fittings; coordination of electrical equipment; and not providing items with actual building conditions and adjacent work. Proceed with the procurement and installation of equipment only after receiving approved shop drawings relative to each item.

K. ELECTRONIC DRAWINGS

In preparation of shop drawings or record drawings, Contractor may, at his option, create electronic drawing files in AutoCAD or DXF format on CD-ROM or DVD disc, flash drive, or direct download from the Internet. Contractor shall provide a shipping and handling fee of \$200 for shipping set of drawings, and \$15 per sheet for each additional sheet. Contact the Architect for written authorization and Engineer's approval. Contractor shall provide a payment form and to specify shipping method and drawing format. In addition to payment, submittals shall be accompanied by a release agreement form from the Engineer must be received before electronic drawing submittals will be sent.

L. RECORD DRAWINGS (AS-BUILT DRAWINGS)

During progress of the work in this division, Contractor shall maintain an accurate record of all changes made during the installation of the system. Upon completion of the work, accurately transfer all record information to three identical sets of the approved shop drawings. Insert one set into each copy of the manual described below.

See Division 01 and General Conditions for additional information.

M. OPERATION AND MAINTENANCE INSTRUCTIONS

During the course of construction, collect and compile a complete brochure of equipment furnished and installed on this project. Include operational and maintenance instructions, manufacturer's catalog sheets, wiring diagrams, parts lists, approved submittals and shop drawings, warranties, and descriptive literature as furnished by the equipment manufacturer. Include an inside cover sheet that lists the project name, date, Owner, Architect, Engineer, General Contractor, Sub-Contractor, and an index of contents.

Submit three copies of literature bound in approved binders with index and tabs separating equipment types to the Architect, for Engineer's review, at the termination of the work. Paper clips, staples, rubber bands, loose-leaf binding, and mailing envelopes are not considered approved binders. Final approval of systems installed under this contract shall be withheld until this equipment brochure is received and deemed complete by the Architect and Engineer. Instruct workmen to save required literature shipped with the equipment itself for inclusion in this brochure.

Include record drawings as described above.

Refer to Division 01 for acceptance of electronic manuals for this project. For electronic manuals, refer to paragraph "Submittals" for requirements.

N. SPARE PARTS

Furnish to Owner, with receipt, the spare parts for faucet washers and O-rings, flushometer repair kits, and water closet tank repair kits for the fixtures furnished for this project.

O. TRAINING

At a time mutually agreed upon between the Owner and Contractor, provide the services of a factory trained and authorized representative to train Owner's designated personnel on the operation and maintenance of the equipment provided for this project. Provide training to include, but not be limited to, an overview of the system and/or equipment as it relates to the facility as a whole; operation and maintenance procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive

maintenance and appropriate operator intervention, and review of data included in the operation and maintenance manuals.

Submit a certification letter to the Architect stating that the Owner's designated representative has been trained as specified herein. Letter shall include date, time, attendees and subject of training. The Contractor and the Owner's representative shall sign the certification letter indicating agreement that the training has been provided.

Schedule training with Owner with at least 7 days advance notice.

P. WARRANTIES

Warrant each system and each element thereof against all defects due to faulty workmanship, design, or material for a period of 12 months from date of Substantial Completion, unless specific items are noted to carry a longer warranty in the construction documents or manufacturer's standard warranty exceeds 12 months. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 01.

Warranty shall include a guarantee of free circulation of liquids throughout the system as intended without leaks, excessive noise, or water hammer.

Warranties shall include labor and material, including travel expenses. Make repairs or replacements without any additional costs to the Owner, and to the satisfaction of the Owner, Architect, and Engineer.

Perform the remedial work promptly, upon written notice from the Engineer or Owner.

At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period and any other warranties. Maintain warranty status. Each warranty instrument shall be addressed to the Owner and state the commencement date and term.

2. GENERAL MATERIALS AND INSTALLATION

A. BUILDING OPERATION

Comply with the schedule of operations as outlined in the architectural portions of this specification. Building shall be in operation during normal workday hours. Accomplish work requiring interruption of building operation at a time when the building is not in operation and only with written approval of building Owner and/or tenant. Coordinate interruption of building operation with the Owner and/or tenant a minimum of seven (7) days in advance of work.

B. EXISTING EQUIPMENT REUSE AND REMOVAL

Provide items of plumbing systems modification required because of building remodeling, as noted on the drawings, in necessary. Match existing materials and construction techniques when modifying existing systems. Coordinate requirements with general contractor and architect.

New floor drains shall be connected to the existing sanitary drainage system as shown on the drawings or as required. Saw-cut existing concrete floor as required to install new underfloor lines, and patch to match existing sub-floor. Refer to architectural specifications for finish floor patching requirements.

Patch holes weather-tight in existing roofs caused by removal of plumbing items during piping.

Make connection of new pipe to similar existing waste, water and gas pipe using standard fittings and joining practices.

C. EXCAVATION AND BACKFILLING

Perform excavation and backfill required for installation of underground work under this contract. Excavation shall be of sufficient width, Crib or brace trenches to prevent cave-in or ground movement. Do not excavate trenches close to columns or walls of new building without prior consultation with the Architect. Use pumping equipment if required to keep trenches free of water. Backfill trenches in maximum 6 inch layers of well-lamped dry earth in a manner consistent with local building codes.

Excavation as specified herein shall be defined as any excavation. Common excavation shall comprise the satisfactory removal and disposal of material of various types and in quantities as described in the description encountered, including rock, if any, within the limits of work as specified and shown on drawings. Excavation shall be performed to the lines and grades indicated on the drawings. Purpose of excavated materials that are not used for backfilling shall be removed from the site. Backfill to the satisfaction of the Architect and Engineer. Backfill to be used for backfilling to the satisfaction of the Architect and Engineer shall be approved by the Architect and Engineer.

D. UNDERGROUND CONNECTIONS

Provide underground piping as indicated and shown on the drawings. Install interior and exterior connections to "mains" and existing utility lines in compliance with the requirements of the codes having jurisdiction and the serving utility. Verify the exact location of utility mains, service lines, and connection points requiring connection in the field prior to installation. In conjunction with the utility involved in the installation of services, verify that installation will tie into the existing utility mains, service lines, and connection points at the indicated invert elevation point prior to installation. If the installation will not tie into the indicated invert elevation point while maintaining proper fall, notify the Architect and the Engineer so that an alternative may be determined.

Provide service piping and accessories required to complete utility connections that are not furnished by the serving utility. Coordinate with the serving utility company regarding items furnished, work performed, and permits and inspections required. Pay associated fees or charges.

Coordinate with the local gas service company to provide a new gas service, including gas meter, shut-off valves, and regulator as indicated on the drawings. Installation shall be in complete conformance with the requirements of the local gas service company.

E. COINCIDENTAL DAMAGE

Repair streets, sidewalks, drives, paving, walls, finishes, and other facilities damaged in the course of the work. Repair materials shall match existing construction. Repair work shall meet all requirements of the Owner, local authorities having jurisdiction, and meet the satisfaction of the Architect. Conform to requirements of Division 02 of this specification.

F. CUTTING AND PATCHING

Conform to the requirements in Division 01. Cut walls, floors, ceilings, and other portions of the facility as required to install work under this division. Obtain permission from the Architect prior to cutting. Do not disturb structural members without prior approval from the Architect. Cut holes as small as possible. Patch walls, floors, and other portions of the facility as required by work under this division. Patching shall match original material and construction including fire ratings, if applicable. Repair and refinish areas disturbed by work to the condition of adjoining surfaces in a manner satisfactory to the Architect.

G. ROUGH-IN

Coordinate without delay all roughing-in with other divisions. Conceal piping, conduit, and rough-in except in unfinished areas and where otherwise shown.

H. SUPPORT SYSTEMS

Structural steel used for pipe supports, equipment supports, etc., shall be new and clean, and shall conform to ASTM designation A-36.

Support plumbing equipment and piping from the building structure. Do not support plumbing equipment and piping from ceilings, other mechanical or electrical components, and other non-structural elements.

I. ACCESS DOORS

Provide access doors for all concealed equipment where indicated or as required, except where above lay-in ceilings. Access doors shall be adequately sized for the devices served with a minimum size of 18 inches x 18 inches. Access doors must be of the proper construction for type of construction in which it is installed. Obtain Architect's approval of type, size, location, and color before ordering. Provide factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation, concealed hinges, flush-swing-operated cam lock, and anchor straps. Provide access doors manufactured by Milcor, Tillus, Zurn, or equal.

J. PENETRATIONS

Seal elevated floor, exterior wall and roof penetrations watertight and weathertight with non-shrink, non-hardening commercial sealant. Pack with mineral wool and seal both ends with minimum of 1/2 inch of sealant.

Extend pipe insulation for insulated pipe through floor, wall and roof penetrations, including fire rated walls and floors. The vapor barrier shall be maintained. Size sleeve for a minimum of 1/2 inch annular clear space between inside of sleeve and outside of insulation.

Provide sleeves for horizontal pipe passing through or under foundation. Sleeves shall be cast iron soil pipe two nominal pipe sizes larger than the pipe served.

Provide Schedule 40 PVC pipe sleeves for vertical pressure pipe passing through concrete slab on grade. Sleeves shall be one nominal pipe size larger than the pipe served and two pipe sizes larger than pipe served for ductile iron pipes with restraining rods. Seal water-tight with silicone caulk.

Provide 1/2 inch thick cellular foam insulation around perimeter of non-pressure pipe passing thru concrete slab on grade. Insulation shall extend to 2 inches above and below the concrete slab.

K. ELECTRICAL WIRING

Line voltage wiring shall be provided by Division 16. Line voltage control and interlock wiring for plumbing systems shall also be provided by Division 16. Low voltage control wiring shall be provided by Division 15. Furnish wiring diagrams to Division 16 as required for proper equipment hookup. Coordinate with Division 16 the actual wire sizing amps for plumbing equipment (from the equipment nameplate) to ensure proper installation.

L. EQUIPMENT FURNISHED BY OTHERS

Provide necessary equipment and accessories that are not provided by the equipment supplier or Owner to complete installation of equipment furnished by others in locations as indicated on the drawings, specified herein, or both. Furnish and install rough-in drains, vents and water services. Provide final connection to kitchen equipment, furnished by others, in locations as indicated on the drawings. Provide accessory items that are required but not furnished with the equipment including traps, stop valves, PTVs, indirect drain from equipment to floor drains, and accessory items indicated or required for the proper operation of the complete system or termination of the work.

Contractor shall be responsible for correct rough-in dimensions and shall verify same with Architect and/or equipment supplier to service installations.

M. SYSTEM TESTING AND ADJUSTING

Upon completion of each phase of the installation, test each system in conformance with local code requirements and as noted below. Furnish labor and equipment required to test each system installed under this contract. Assume all costs associated with the tests and repairing and/or replacing any damages resulting therefrom.

Notify the Architect and the AHJ, three (3) working days prior to making plumbing system tests. Leave covered work uncovered until the required tests have been completed, but if necessary the construction procedure, tests on portions of the work may be made, and when satisfactory, the work may be concealed. Testing shall be completed before final connection is installed and before backfill. Pipes, joints, flanges, valve stems, etc., shall be leak tight. Repair or replace defective joints. Caulking of defective joints, cracks or holes will not be permitted. Repeat tests after repairs have been made. Final tests shall be made in the presence of the administrative authority and/or the Owner's authorized representative.

Upon completion of the systems installed, and prior to acceptance by the Architect and Engineer, make general operating tests to demonstrate equipment and systems are ready for work. Specific functioning in conformance with the intent of the drawings and specifications. As a part of these tests, open every shut-off to ensure complete system flushing, remove and clean four aerators or air trainers, light pilot lights, and operate every piece of equipment furnished under this contract to demonstrate proper function.

Test the drainage and vent system by plugging openings with test plugs, except those at the top of the stacks. Fill the system with water. Test results will be satisfactory if the water level remains stationary for not less than one (1) hour. Subject the drainage and vent system to a pressure test (at least 100) test of water. If leaks develop, repair them and repeat the test.

Test the domestic water system by filling it with water and then isolating the system from its source. Keep the system closed for a period of one hour before testing. Test for leaks. The pressure differential for this test period shall not exceed 10 psi. Test water piping with 1/2" PSI hydrostatic pressure.

PLUMBING PIPING

A. PIPING MATERIALS

Materials specified or noted on the drawings are subject to the approval of local code authorities. Verify approval before installing any material or joining method.

Domestic Water (Cold, Hot, and Hot Water Recirculation): Domestic water piping installed above the floor slab inside the building shall be "Type L" hard temper copper tube with wrought copper fittings and soldered connections made up with 95/5 solder. Brazed mechanically formed tee connections (T-DRI) may be used in copper lines where approved by code; connection shall be made with brazed silver solder (Sil-Fos) joints in conformance with manufacturer's instructions.

Interior Waste And Vent Below Slab: Waste and vent pipe below slab inside building shall be service weight cast iron soil pipe with hub and spigot fittings with neoprene gasket joints, meeting ASTM A74, manufactured by AB & I Foundry, Charlotte or Tyler pipe and bearing the trademark of the CISPI and NSF. Hubless waste and vent pipe is not permitted below base slab.

Interior Waste and Vent Above Slab: Waste and vent pipe above slab inside building shall be hubless cast iron soil pipe and fittings, meeting ASTM A888 and CISPI 301, manufactured by AB & I Foundry, Charlotte or Tyler pipe and bearing the trademark of the CISPI and NSF. (Note: PVC piping is not allowed in ceiling return air plenums)

Natural Gas Above Slab: Gas piping above ground shall be Schedule 40 black steel with malleable iron screwed fittings for 2" and smaller and Class 150 welded fittings for 2-1/2" and larger.

Connections to Plumbing Fixtures and Equipment: 1-1/4 inch and larger waste connections from fixture traps to cast iron pipe shall be "DWV" copper with wrought copper drainage pattern fittings with copper sweat or compression joints at fixture trap connections and threaded joints at connections to cast iron pipe.

Indirect And Condensate Drain Outside Building: Indirect and condensate drain pipe installed outside the building above ground shall be Schedule 40 PVC pipe and fittings with solvent weld joints where allowed by code. Type "M" for 1 inch and smaller and "DWV" for 1-1/4 inches and larger hard temper copper tube with wrought copper drainage pattern fittings and soldered connections made with 95/5 solder. Terminate at nearest roof drain, gutter or other location as shown drawings. Install cleanouts at elbows greater than 45 degrees.

B. PIPING AND EQUIPMENT INSULATION

Provide domestic cold water, hot water, and hot water recirculation, indirect and condensate drain pipe (within building) with one-piece fiberglass insulation with all-service jacket with self-sealing lap to provide a continuous vapor barrier by Containeed, Owens-Corning or Armstrong. Provide insulation thickness as follows:

1" thick for cold piping

1" thick for condensate and auxiliary condensate piping

1" thick for hot water and hot water return piping 6" and smaller

Provide 1 inch fiberglass insulation on vent piping within six feet of vent through the roof.

Provide fiberglass insulation on domestic cold and hot water pipes installed in walls and chases. Provide fiberglass insulation on domestic cold and hot water pipes installed in walls and chases.

Insulate water heaters, storage tanks, hot water pumps, etc. that are not factory insulated.

For hot piping, provide pipe hangers and riser clamps sized for the outside diameter of piping. Butt insulation to hanger or riser clamp for vertical pipes. Seal exposed insulation with insulation sealer. Exception for Vertical Piping: Provide clamps sized for the outside diameter of the vertical pipe and extend clamp through insulation. Seal penetrations of insulation and vapor barrier with wet coat of vapor barrier lap cement. For 2-1/2" and larger cold piping at hangers, provide 8 inch long sections of high density, high temperature calcium silicate by Johns-Manville, Fiberglass by Knurr or flexible urethane piping insulation meeting ASTM C 534-01A, Type I with integral high density pipe supports and enclosed in steel insulation shield by Cooper B-line, Armacon, or approved equal. Insulation shall be continuous along the pipe surface, except at valves, unions, and where piping is exposed at fixtures. For pipes 2 inch and smaller using fiberglass or flexible elastomeric insulation without pre-insulated supports, provide insulation protection shields installed between hanger and pipe which meets the following minimum length requirements:

Pipe Size (NPS)	Insulation Thickness (inches)	Minimum Shield Length, (ft)
Less than 1"	1	3 5 6 7 8 9 10
	1.5	3 5 5 5 5 5 5 5 5 5
	2	5 5 5 5 5 5 5 5 5 5
	2.5	5 5 5 5 5 5 5 5 5 5
	3	5 5 5 5 5 5 5 5 5 5

1-1/4" to 2" and Less

Cover fittings with Zeston, Knurr, or equal one-piece PVC pre-molded insulating covers. Fitting covers, jackets and adhesives shall not exceed flame spread rating of 25 and smoke development rating of 50 per ASTM E84. Fill voids between covers and piping with fiberglass insulation and tape joints at all elbows and tees. Install pipe insulation in compliance with manufacturer's recommendations. Where pre-molded insulating fittings are not approved by the local AHJ, miter insulation at fittings.



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