This master should be used by designers working on Port of Portland construction projects and by designers working for PDX tenants (“Tenants”). Usage notes highlight a few specific editing choices, however the entire section should be evaluated and edited to fit specific project needs.

SECTION 221100 - PLUMBING PIPING

1. GENERAL
	* + 1. DESCRIPTION
				1. This section describes piping, pipe fittings, and incidental related items as required for complete piping systems.
			2. RELATED WORK SPECIFIED ELSEWHERE
				1. Section 015713, Temporary Erosion, Sediment, and Pollution Control
				2. Section 220500, Common Work Results for Plumbing
				3. Section 220529, Hangers and Supports for Plumbing Piping and Equipment
				4. Section 220545, Seismic Restraints for Plumbing Piping and Equipment
				5. Section 220548, Vibration and Seismic Control for Plumbing Piping and Equipment
				6. Section 220553, Identification for Plumbing Piping and Equipment
				7. Section 220590, Pressure Testing of Plumbing Systems
				8. Section 312000, Site Clearing and Earthwork
				9. Section 312300, Trenching, Backfilling, and Compacting
				10. Section 312319, Dewatering
			3. REFERENCES
				1. ANSI: American National Standards Institute

ANSI 61: Drinking Water System Components - Health Effects

ANSI B16.1: Gray Iron Pipe Fittings and Flanged Fittings: Classes 25, 125, and 250

* + - * 1. ASME: American Society of Mechanical Engineers

ASME A112.3.1: Stainless Steel Drainage Systems for Sanitary DWV, Storm, and Vacuum Applications, Above- and Below Ground

* + - * 1. ASTM: American Society for Testing and Materials

ASTM A36: Standard Specification for Carbon Structural Steel

ASTM A47: Standard Specification for Ferritic Malleable Iron Castings

ASTM A53 or A120: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A74: Standard Specification for Cast Iron Soil Pipe and Fittings

ASTM A183: Standard Specification for Carbon Steel Track Bolts and Nuts

ASTM A234: Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

ASTM A307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

ASTM A351: Standard Specification for Castings, Austenitic, for Pressure-Containing Parts

ASTM A403: Standard Specification for Wrought Austenitic Stainless-Steel Piping Fittings

ASTM A536: Standard Specification for Ductile Iron Castings

ASTM A666: Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar

ASTM A743: Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application

ASTM A744: Standard Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service

ASTM B75: Standard Specification for Seamless Copper Tube

ASTM B88: Standard Specification for Seamless Copper Water Tube

ASTM B584: Standard Specification for Copper Alloy Sand Castings for General Applications

ASTM C564: Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

ASTM D2000: Standard Classification System for Rubber Products in Automotive Applications

ASTM D2513: Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings

ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM F1673: Standard Specification for Polyvinylidene Fluoride (PVDF) Corrosive Waste Drainage Systems

* + - * 1. AWWA: American Water Works Association

AWWA C110: Ductile-Iron and Gray-Iron Fittings

AWWA C151: Ductile Iron Pipe, Centrifugally Cast, for Water

AWWA C209: Cold-Applied Tape Coatings for Steel Water Pipe and Fittings

AWWA C214: Tape Coating Systems for the Exterior of Steel Water Pipelines

AWWA C220: Stainless-Steel Pipe, 1/2 Inch and Larger

* + - * 1. CDA: Copper Development Association

CDA Copper Tube Handbook

* + - * 1. CISPI: Cast Iron Soil Pipe Institute

CISPI Standard 301: Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

* + - * 1. IAPMO: The International Association of Plumbing and Mechanical Officials

IAPMO IGC 304:  Flexible Expansion Joints for DWV and Sewer Piping Systems

* + - * 1. ISO: International Organization for Standardization

ISO 9001: Quality management systems - Requirements

* + - * 1. OSPC: Oregon Specialty Plumbing Code
				2. UL: Underwriters Laboratories

UL 723: Standard for Test for Surface Burning Characteristics of Building Materials

* + - 1. SUBMITTALS
				1. Product Data: For all products specified herein. Submit a schedule of services and a list of related plumbing materials and fittings.
				2. Shop Drawings: For plumbing systems layout. Coordinate with the work of other divisions and existing facilities, systems, equipment, and components.
				3. Test Reports and Certificates:

Certificates of inspections and pipe tests.

Submit bacteriological samples to a certified laboratory to test that the water is suitable for drinking. The laboratory’s certificate stating purity of water shall be submitted to the Port.

* + - * 1. Other: Certified welders’ certificates.
			1. QUALITY ASSURANCE
				1. Regulatory Requirements:

Piping material and installation shall meet requirements of the local plumbing, fire, and building codes and serving utility requirements.

Provide chlorination of domestic cold and hot water piping in accordance with county and state health requirements.

* + - * 1. Pipe Cleaning: Should any pipe be plugged or should foaming of water systems occur, disconnect piping, reclean, and reconnect with no additional cost to the Port.
				2. Correct any damage to the building or systems resulting from failure to properly clean the system with no additional cost to the Port.
1. PRODUCTS
	* + 1. CAST IRON SOIL PIPE, SERVICE WEIGHT
				1. General: A code-approved hubless system in accordance with Cast Iron Soil Pipe Institute Standard 301.
				2. Pipe and Fittings: Service weight hubless cast iron in accordance with ASTM A74. AB&I, True Spun, Tyler, or equal.
				3. Gaskets: Compression type in accordance with ASTM C564.
				4. Couplings:

Above Grade: Band type coupling consisting of stainless steel clamp and corrugated shield assemblies, with a neoprene sealing sleeve and fittings in accordance with AWWA C110.

Buried: Clamp-All 125 or Husky 24-gauge 304 stainless steel hubless type clamp and shield assemblies with neoprene sealing gaskets (ASTM C564).

* + - * 1. Service:

Sanitary soil and waste to 5 feet outside building line (excluding kitchen sanitary and grease waste).

Vent piping 2 inches and above.

Storm and overflow drain to 5 feet outside building line.

* + - 1. DUCTILE IRON WATER PIPE
				1. Pipe: Cement-lined ductile iron pipe, in accordance with AWWA C151.
				2. Fittings:

Below Grade: Class 150 Megalug or equal mechanical joint type complete with gaskets, bolts, and nuts; or Tyton or equal for joints employing a single gasket for the joint seal with bell-and-spigot pipe.

Above Grade: Mechanical couplings and fittings as specified herein.

* + - * 1. Service:

Below grade, incoming domestic water main, 4 inches and over.

Above grade, domestic water piping, 6 inches and over.

Below grade, storm drain, 12 inches and over.

Above grade, storm drain force mains.

* + - 1. BLACK STEEL PIPE, SCHEDULE 40
				1. Pipe: Schedule 40, in accordance with ASTM A120 or A53.
				2. Fittings: 150-pound screwed malleable iron on 2 inches and below, Schedule 40 welded fittings in accordance with ASTM A234 for 2 1/2 inches and above or mechanical couplings on select piping as herein specified. Fittings below grade shall be welding fittings.
				3. Service:

Natural gas piping and vent lines above grade.

* + - 1. GALVANIZED STEEL PIPE
				1. Pipe: Schedule 40 in accordance with ASTM A120.
				2. Fittings: 150-pound screwed galvanized malleable iron on 2 inches and below. Mechanical couplings as herein specified on 2 1/2 inches and above.
				3. Service:

Miscellaneous indirect waste piping.

At the Contractor’s option, waste and vent piping 1 1/2 inches and under, above grade.

Pumped waste (above grade).

Liquid grease waste piping (threaded sealant shall withstand 400°F).

Safety and relief valve discharge.

* + - 1. STAINLESS STEEL PIPE AND FITTINGS
				1. Stainless Steel Roll Grooved Pipe: Water pressures up to 350 psi gauge (3/4-inch threaded) stainless steel pipe, Schedule 10, conforming to AWWA C220 requirements.

Fittings: Type 316/316L Schedule 10s fittings conforming to ASTM A403.

Couplings: Type 316 stainless steel coupling conforming to ASTM A351 or ASTM A743.

* + - * 1. Stainless Steel Water Tube and Fittings: Use for piping 3-inch and larger, Grade H, ASTM A268, roll-grooved joint.

Fittings: Schedule 10S Type 304L stainless steel fittings, ISO 9001, ASTM A403.

Couplings: Anvil or Gruvlok grooved system, IPS stainless steel grooved coupling with EPDM gasket, stainless steel nuts and bolts, ASTM A351, A743 and A744, ISO 9001.

* + - * 1. Service: Domestic water system 3 inches through 8 inches
			1. STAINLESS STEEL PUSH-FIT PIPE AND FITTINGS
				1. Stainless Steel Push-Fit Pipe: ASME A112.3.1, ASTM A666. Type 316L, stainless steel pipe with socket and spigot ends for gasket joints and piping manufacturer’s, Viton or equal, lip-seal rubber gaskets to fit socket groove, with plastic backup ring. Piping shall be Blucher stainless steel or equal.
				2. Fittings: AISI type 316L stainless steel DWV fitting system and push-fit socket connections rated for vacuum service with EPDM sealing ring and retaining clamp. Treated with pickling and passivation finish process. Fittings shall be Blucher stainless steel or equal, DWV pattern fittings.
				3. Service: Vacuum Grease Removal System
				4. Provide a new, unused hand operated cutting/chamfer tool(s) for pipe sizes 1 1/2-inch thru 6-inch. Tool(s) to remain property of the Port after final completion of the work.
			2. COPPER PIPE
				1. Pipe: Hard drawn copper tubing, Class L or K, ASTM B88.
				2. Fittings: Wrought copper, 150 psi, solder joint type, Chase, Revere, Mueller, or equal. At the Contractor’s option, a system using mechanically extracted collars in main with branch line inserted to not obstruct flow may be used on domestic water piping above ground, similar to T‑drill.
				3. Service:

Domestic hot and cold water piping below ground (Type K, hard drawn) on piping 3 inches and smaller.

Domestic hot and cold water piping above ground (Type L, hard drawn) on piping 4 inches and smaller.

Trap priming lines above ground (Type L, hard drawn).

Industrial cold water, non-potable cold and hot water above grade (Type L) on piping 4 inches and smaller.

Pumped waste (Type K fittings per OSPC). Below ground fittings shall be brazed.

Miscellaneous drains and overflows.

Natural gas regulator vents (Type L, hard drawn).

* + - 1. COPPER GROOVED PIPING SYSTEM (OPTIONAL)
				1. Acceptable Manufacturers: Victaulic, Gruvlok, or pre-bid approved equal.
				2. Pipe: Copper tube, in accordance with ASTM B88, Type L roll grooved in accordance with Victaulic current listed standards. No flaring of grooved copper tube or fittings to IPS size is allowed.
				3. Mechanical Couplings:

Victaulic Style 606, zero flex, rigid couplings with angled bolt pad design for copper consisting of a ductile iron cast housing, a synthetic rubber gasket of a central cavity pressure-response design with plated nuts and bolts to secure the unit together.

Coupling housings shall be cast ductile iron in accordance with ASTM A36.

* + - * 1. Gaskets: Flushed configuration, in accordance with ASTM B88, molded synthetic rubber of elastomers having properties as designated in ASTM D2000.
				2. Flange Adapters: Victaulic Style 641, ductile iron in accordance with ASTM A536, engaging directly into roll grooved copper tube and fittings and directly to ANSI Class 125 cast iron and Class 150 steel flanged components.
				3. Fittings:

Victaulic full flow copper fittings with grooves designed to accept Victaulic grooved end couplings.

Copper in accordance with ASTM B75 alloy C12200 or bronze sand castings in accordance with ASTM B584 copper alloy CDA 844.

Victaulic Style 47 dielectric waterway when connecting dissimilar metals.

* + - * 1. Furnish a new copper roll grooving tool upon substantial completion of the work. The tool shall be able to direct roll groove 3-inch through 8-inch copper, and shall not flair ends of copper to IPS size. The tool shall be capable of roll grooving K, L, M, and DWV copper tube, and able to be operated with a standard 3/8-inch socket drive. Victaulic VE226C roll groover.
				2. Service: Domestic water system 3 inches through 8 inches.
			1. POLYETHYLENE PIPE
				1. Pipe: Polyethylene pipe and tube PE 3406 in accordance with ASTM D2513.
				2. Fittings: Provide copper alloy, PE 3306, PE 3406, stainless steel or other listed materials. Mechanical connectors for PE pipe and tubing and for transition fittings shall be approved compression type couplings or other special listed joints.
				3. Storage: Do not store unprotected pipe in direct sunlight. Store in a way to protect it from mechanical damage.
				4. Service: Buried natural gas piping.
			2. CROSSLINKED POLYETHYLENE PIPE
				1. Pipe: Crosslinked polyethylene pressure pipe for water service. Upinor ProPEX or equal.
				2. Fittings: Lead-free brass fittings and adapters, F1960 with reinforcing cold expansion rings. Expandable ProPex Ring with Stop, or equal.
				3. Storage: Do not store unprotected pipe in direct sunlight. Store in a way to protect it from mechanical damage.
				4. Service: Underground trap primer lines only.
			3. ACID-RESISTANT PIPING (PVDF)
				1. Pipe: Schedule 40 flame retardant FR-PVDF conforming to ASTM F1673, with a limiting oxygen index (LOI) of 60, resin having vertical burn rating of 94 V-O. Resin based on testing to ASTM E84 (UL 723) shall have surface burning characteristics greater than or equal to a flame spread 5 and smoke development 35. IPEX Plenum line flame-retardant PVDF, DWV pattern fittings (or Orion PVDF), or pre-bid approved equal.
				2. Fittings: Flame retardant PVDF, third-party certified to ASTM F1673 and ASTM E84, all of plastic construction. Tapered elastic retaining ring shall be designed to lock into a machined groove on the mating piping.

Underground Fittings: Rionfuse Joints or equal.

Above Ground Fittings: IPEX Plenumline, Orion No Hub Joints, or equal.

* + - * 1. Service: Kitchen sanitary and grease waste piping.
			1. ACID-RESISTANT PIPING (CPVC)
				1. Acceptable Manufacturers: Spears Labwaste CPVC, or pre-bid approved equal.
				2. Pipe: Schedule 40 CPVC pipe and fittings, conforming to ASTM F2618 with DWV joints, solvent-welded in accordance with manufacturer’s instructions. Materials testing to ASTM E84 (UL 723) shall have surface burning characteristics less than or equal to a flame spread 25 and smoke development 50 in accordance with mechanical code for return air plenums.
				3. Service: Kitchen sanitary and grease waste piping.
			2. BEVERAGE LINE CONDUIT SYSTEM
				1. General: Liquid tight piping system intended as a carrying pipe for beverage lines.
				2. Acceptable Manufacturers: Kelly Bevway, Colombo, Bevstream, or equal.
				3. Pipe: Aluminum or Steel Pipe. Sizes shall be 4", 6", and 8" diameters, as shown on the drawings, in 10-foot or 20-foot sections. Provide manufacturer’s standard end fittings and termination of piping to avoid sharp edges.
				4. Bends and Offsets: Provide manufacturer’s standard long radius bends and offset fittings. Custom fittings from the manufacturer is acceptable where standard fittings will not fit the application.
				5. Fittings: Provide manufacturer’s liquid tight couplings and match to the piping system.
				6. Pull Boxes: Provide manufacturer’s pull boxes and pull sleeves. Provide with appropriate end connections for connecting to the piping in the field.
				7. Service: Use for all beverage line systems where storage of beverage is remote from beverage dispensing including soda, beer, coffee, and wine and associated CO2, Nitrogen, and glycol systems.
			3. FLANGED JOINTS
				1. Flanges shall be cast iron or steel for screwed piping and forged steel welding neck for welded line sizes. Pressure rating and drilling shall match the apparatus, valve or fitting to which they are attached. Flanges shall be in accordance with ANSI B16.1; 150‑pound for system pressures to 150 psig; 300-pound for system pressures 150 psig to 400 psig. Gaskets shall be 1/16-inchthick, non-asbestos ring type, coated with graphite and oil to facilitate making a tight joint. Make joint using American Standard hexagon head bolts, lock washers and nuts (in accordance with ASTM A307 GR.B) for service pressures to 150 psig; alloy steel stud bolts, lock washer and American Standard hexagon head nuts (in accordance with ASTM A307 GR.B) for service pressures 150 psig to 400 psig. Use length of bolt required for full nut engagement. Provide electro-cad plated bolts and nuts on cold and chilled water lines.
			4. UNIONS
				1. Unions shall be 150 psi malleable iron or brass, brass to iron seat, ground joint, black or galvanized to match pipe. 200 psi WOG bronze, ground joint, solder type for copper tubing. Use of dielectric unions is not permitted.
			5. DIELECTRIC NIPPLE
				1. Iron body with zinc plated external coating, 150 psi, plastic dielectric coating on inside of nipple, and NPT x NPT connections. Grooved ends are not permitted.
			6. DIELECTRIC FLANGE
				1. Iron body with zinc plated coating and bronze body, 175 psi, Buna-N gasket for cold water, optional EPDM gasket for hot water and any system with water above 150°F, bolted flange with bolt insulation gaskets and metal washers, and NPT iron pipe by soldered copper connections. Use Watts series 3100 or equal.
			7. MECHANICAL PIPE COUPLINGS AND FITTINGS
				1. Acceptable Manufacturers: Gruvlok, Victaulic, or pre-bid approved equal.
				2. Flexible Couplings and Fittings:

Coupling housing shall be zero flex rigid type coupling with angled bolt pad design. Similar to Victaulic Type 07. Use only when expansion contraction, deflection, or noise and vibration is to be dampened. Flexible coupling shall be similar to Victaulic Type 77. Coupling gasket shall be similar to Victaulic’s Grade E molded synthetic rubber, Grade No. R615BZ. Flushseal gasket configuration on all applications. Coupling bolts shall be oval neck track head type with hexagonal heavy nuts in accordance with ASTM A183.

Fittings used with pipe couplings shall be fabricated of malleable iron castings in accordance with ASTM A47. Where malleable fitting pattern is not available, fittings fabricated from Schedule 40 steel pipe or standard wall seamless welding fittings with grooved ends may be used. Elbows on pumped systems shall be long radius type.

* + - * 1. Service:

Domestic water with ductile iron pipe, 6 inches and over, above grade.

Galvanized steel indirect waste, waste and vent, and pumped sewage, above grade.

* + - 1. MECHANICAL JOINT RESTRAINTS
				1. Acceptable Manufacturers: EBAA Iron Inc., Megalug Series 1100, or pre-bid approved equal.
				2. Incorporate mechanical restraint into the joint follower gland, consisting of individually actuated wedges that increase their resistance to pullout as pressure increases. Use twist-off nuts, 350 psi working pressure. Restraints shall be UL listed and FM Global approved.
				3. Service:

Domestic cold water, below grade, 4 inches and over.

Storm drain, below grade, 12 inches and over.

* + - 1. SOLDER AND BRAZE ROD
				1. Copper Piping and Joints: Dyna-Flow by J.W. Harris Co. Inc., Westinghouse Phos-Copper, or equal.
				2. Valves, Cast Fittings, or Bronze Fittings: Harris Stay-Silv-15, Handy & Harmon Sil-Fos, or equal.
				3. Water Piping: All-State 430 with Duzall Flux, Engelhard Silvabrite with Engelhard General Purpose Flux, J.W. Harris Co. Stay-Safe 50 with Stay-Clean Flux or equal, on 3 inches and smaller. On larger pipe, use Type “A” solder.
			2. UTILITY MARKERS
				1. Provide plastic utility warning tape and locate wire over all buried piping in accordance with Section 312300.
			3. PIPE WRAPPING
				1. For all below ground steel piping and fittings, provide complete covering of Scotchrap No. 51 or equal, 20 mil thickness, protective tape applied over Scotchrap pipe primer applied at 1 gallon per 800 square feet of pipe surface.
				2. Under some circumstances the Port may approve pipe furnished with factory applied jacket of “X‑tru-coat” with Scotchrap as previously specified for field joints.
			4. FLEXIBLE CONNECTORS
				1. Expansion Joint/Seismic Connector for Gas Service: AGA certified, T304 stainless steel hose and braid, Schedule 40 radius elbows and 180-degree bend, weld end Schedule 40 fittings. Metraflex Metraloop, or pre-bid approved equal.
				2. Expansion Joint for Stormwater Piping: Tech Specialties Series T, corrugated neoprene flexible expansion joint coupling, UPC labeled or equal.
				3. Expansion Joint for Domestic Water Piping: Metraflex Metraloop, or equal, UL classified for use in drinking water classifications in accordance with ANSI/National Sanitary Foundation 61 standard, bronze hose and braid with copper sweat ends.
				4. Expansion Joint for Sanitary Waste Piping: Metraflex Pooploop no hub connection, or equal, UL classified for use in sanitary waste classifications in accordance with IAPMO IGC 304 standard, stainless steel hose and braid with stub ends.
				5. Expansion Joint for Vacuum Waste Piping: Mason Industries Model VFLC or equal, stainless steel braided hose with stainless steel flanges and clean out. Allows 4 inches of seismic movement in all directions.
			5. PIPING, HANGERS, SUPPORTS, ANCHORAGE, AND SEISMIC RESTRAINTS
				1. Conform to the requirements of Section 220529, Section 220545, and Section 220548.
1. EXECUTION
	* + 1. PREPARATION
				1. Measurements, Lines, and Levels:

Check dimensions at the building site and establish lines and levels for the work specified in this section.

Establish all inverts, slopes and manhole elevations by instrument, working from an established datum point. Provide elevation markers for use in determining slopes and elevations in accordance with the drawings and specifications.

Use established grid and area lines for locating trenches in relation to buildings and boundaries.

* + - 1. EXCAVATION AND BACKFILL
				1. Perform all necessary excavation and backfill required for the installation of mechanical work in accordance with Section 312000 and Section 312300. Repair pipelines or other work damaged during excavation and backfilling. Provide dewatering and temporary erosion control in accordance with Section 312319 and Section 015713.
				2. All cast iron, steel, and copper piping shall be full bedded on sand. Place a minimum 4‑inch‑deep layer on the leveled trench bottom for this purpose. Remove the sand to the necessary depth for piping bells and couplings to maintain contact of the pipe on the sand for its entire length. Lay all other piping on a smooth level trench bottom, so that contact shall be made for its entire length.
			2. PIPING INSTALLATION
				1. Install unions in all non-flanged piping connections to apparatus and adjacent to all screwed valves, traps, and appurtenances requiring removal for servicing, located so that piping may be disconnected without disturbing the general system.
				2. Mechanical Couplings:

On systems using galvanized pipe and fittings, fittings shall be galvanized at factory.

Before assembly of couplings, lightly coat pipe ends and outside of gaskets with Port-approved lubricant.

Pipe grooving shall be in accordance with manufacturer’s specifications contained in latest published literature.

* + - * 1. Install all piping to vent and drain.
				2. Support all piping independently so that its weight is not carried by the equipment.
				3. Run piping clear of tube cleaning or removal/replacement access area on coils, etc.
				4. Install utility warning tape and locate wire over the entire length of the underground piping utilities in accordance with Section 312300.
				5. Underground Water Systems: Provide mechanical joint restraints or concrete thrust blocks, prior to testing pipe, at changes in direction. Block size as required for types of fittings involved.
				6. Dielectric Fittings: Provide dielectric couplings, unions or flanges between dissimilar metals. Fittings shall be suitable for the pressure and temperature to be encountered.
				7. Vent Through Roof: Mop in sheet lead flashing to 2 inches beyond roof penetration to terminate, apply sheet to top of vent and turn down into vent.
				8. Copper Grooved Piping System: Install in accordance with the manufacturer’s latest published literature.
				9. Expansion Joints/Seismic Connectors: Install where piping crosses building expansion joints and where indicated on drawings. Install in accordance with the manufacturer’s instructions.
				10. No-Hub Couplings: Install in accordance with the manufacturer’s instructions.
				11. Acid Resistant Waste and Vent Pipe: Follow manufacturer’s recommendations and instructions for producing joint fusion.
				12. Stainless Steel Push-Fit Pipe: Follow manufacturer’s recommendations and instructions. All joints shall be installed with the use of retainer clamp. See Section 221319 for additional requirements.
				13. See Section 220500 if work is above baggage conveyor or catwalk.
			1. PIPING JOINTS
				1. Join pipe and fittings using methods and materials recommended by the manufacturer, in accordance with standard practice and applicable codes. Cleaning, cutting, reaming, grooving, etc., shall be done with proper tools and equipment. Hacksaw pipe cutting is prohibited. Peening of welds to stop leaks is not permitted.
				2. Copper Piping:

Soldered Joints: Cut pipe evenly with cutter, ream to full inside diameter; end of pipe and inside of fitting thoroughly cleaned and polished. Joint shall be uniformly heated, and capillary space completely filled with solder, leaving full bead around entire circumference.

Brazed Joints: All joints using mechanically extracted collars shall be brazed in accordance with the Copper Development Association’s Copper Tube Handbook using B-cup series filler metal. Soft solder joints will not be accepted.

* + - * 1. Do not install couplings in floor, wall, or grade beam sleeves.
				2. Steel Piping:

Screwed Joints: Cut pipes evenly with pipe cutter, and ream to full inside diameter, with all burrs and cuttings removed. Joints shall be made up with suitable lubricant or Teflon tape, applied to male threads only, leaving two threads bare. Tighten joints so not more than two threads are left showing. Make junctions between galvanized steel waste pipe and bell of cast iron pipe with tapped spigot or half coupling on steel pipe to form spigot end, and caulk.

Flanged Joints: Pressure rating of flanges shall match valve or fitting joined. Coat joint gaskets with graphite and oil.

* + - * 1. Welded Joints:

Preparation for Welding: Bevel piping on both ends before welding.

Use following weld spacing on all buttwelds:

|  |  |  |
| --- | --- | --- |
| Nominal Pipe Wall Thickness | Spacing | Bevel |
| 1/4" or less | 1/8" | 37 1/2° |
| Over 1/4", less than 3/4" | 3/16" | 27 1/2° |

Before welding, remove all corrosion products and foreign material from surfaces.

Welded Joints: Joints shall be made by the arc-welding process using ASME certified welders. Port openings of fittings shall match the inside diameter of the pipe to which they are welded. Use full radius welding elbows for all turns; use welding tees for all tees. Use Reducing fittings for size reduction. Weldolets may be used for branches up through one-half the pipe size of the main to which they are attached. Nipples will not be allowed.

Welding Operation:

After deposition, clean each layer of weld metal to remove slag and scale by wire brushing or grinding. Chip where necessary to prepare for proper deposition of next layer.

Weld reinforcement no less than 1/16 inch nor more than 1/8 inch above normal surface of jointed sections. Reinforcement shall be crowned at center and tapered on each side to surfaces being joined. Exposed surface of weld shall be free of depressions below surface of jointed members.

Do not weld when temperature of base metal is lower than 0ºF. Material to be welded during freezing temperatures shall be made warm and dry before welding is started. Metal shall be warm to the hand or approximately 60ºF.

* + - * 1. Screwed Joints: Use Teflon tape or Teflon liquid dope applied to male threads only.
				2. Ductile Iron Pipe:

Below Grade: Make joints using mechanical joint restraints as specified herein.

Above Grade: Use mechanical pipe couplings and fittings.

* + - 1. INSTALLATION, PIPE WRAP
				1. Install in accordance with AWWA C209 and C214.
				2. Apply in accordance with the manufacturer’s instructions.
				3. Apply wrapping to fittings in field after installation.
			2. ADJUSTING AND CLEANING
				1. General:

Clean interior of all piping before installation.

Flush sediment out of all piping systems with a minimum velocity of 5 to 6 FPS.

Prepare system for adjusting and balancing. If any system components, including control valves, balancing valves, automatic flow control valves, strainers, or other valves and specialties have sediment present, remove, clean and replace damaged or worn components.

* + - * 1. Domestic Water Chlorination:

Chlorination of domestic cold and hot water piping shall be in accordance with county and state health requirements.

Upon completion of all tests and necessary replacements, disinfect all domestic water piping. Chlorination shall be accomplished by personnel of firm licensed to do this type of work.

The system shall be charged with a chlorine solution of at least 50 PPM residual chlorine. Evenly distribute the solution throughout the system. The strong chlorine solution shall remain in the system for a minimum of 24 hours. The strength of the solution shall be confirmed at over 10 PPM at the end of the 24 hour period.

* + - 1. BEVERAGE LINE CONDUIT SYSTEM INSTALLATION
				1. Install per manufacturer’s recommendations. Coordinate additional requirements with beverage system provider.
				2. Pipe Routing: Beverage line routing shown on the drawings is indicated as a straight run between two points. Coordinate routing with other utilities, required clearances, and other field conditions. Pipe systems shall be installed level and shall run with building structure. Show routing and location of all pull boxes in shop drawings. Coordinate final routing with the Port.
				3. Pull Boxes: Install per manufacturer’s recommendations. Install additional pull boxes as needed to facilitate installation of the beverage line systems.
				4. Supports and Seismic Restraint: Install per manufacturer’s recommendations and in accordance with other Division 22 specification sections. Provide supports on both sides of bull boxes and pull sleeves. For purposes of determining system weight, assume beverage conduit system is filled with water.
				5. Terminations and Penetrations:

Where beverage conduit penetrates floors, extend a minimum 6 inches above finished floor elevation to allow conduit support and adequate space for fire stopping.

Install manufacturer’s conduit end fitting to prevent sharp edges.

Where beverage conduit terminates inside a cooler, counter, or casework, coordinate penetration or termination with those trades.

Fill beverage conduit voids at open ends with caulking or fire caulking as appropriate for the condition.

* + - 1. INSTALLATION, NATURAL GAS PIPING
				1. Black Steel Pipe:

All natural gas piping joints shall be welded or screwed. Do not use mechanical couplings in natural gas piping.

Welded joints shall be arc-welded by certified welders as outlined above.

On piping below grade, install protective pipe wrap after testing and prior to backfilling in accordance with the manufacturer’s recommendations. Overlap one-half spiral lap for double thickness.

Piping installed under building floor slabs shall be in vented sleeve in accordance with code.

* + - * 1. Buried Polyethylene Pipe:

Thermal Expansion:

Snaking: The pipe and tubing shall be snaked in the trench bottom with enough slack to provide for thermal expansion and contraction before stabilizing. The normal slack created by residual coiling is generally sufficient for this purpose. If however, the pipe has been allowed to straighten before it is placed in the trench, 6 inches per 100 feet of pipe length shall be allowed for this purpose.

Stabilizing:

Stabilize pipe and tubing temperature by backfilling except leave all joints exposed so they can be examined during the pressure test.

Allow to stand overnight.

Joints:

Heat Fused Joints: Make heat fused joints as recommended by the manufacturer.

Mechanical Joints: Make mechanical joints in an approved manner with tools recommended by the joint manufacturer. Make mechanical joints with listed compression type couplings, or other listed special fittings.

Joints to Other Materials: Listed plastic to steel transition fittings shall be installed on each end of the plastic piping system. Transition fittings shall be installed outside of building walls with metallic piping extending into the building a sufficient distance to permit the use of backup wrenches.

Threaded joints or joints made with adhesives or solvent are prohibited.

Stabilize pipe temperatures before testing.

Pipe and tubing shall be installed only outside the foundation of any building or structure or parts thereof.

Provide 18-gauge bare copper tracer wire over entire length of pipe.

Installation shall be acceptable to the serving gas supplier.

END OF SECTION 221100