SECTION 400517 - COPPER PROCESS PIPE AND TUBING

Note that this section has only been edited for NYSOGS standardization and has not been technically edited. The designer shall make all technical edits specific to the project for this section.

This Section specifies copper pipe and tube materials normally encountered in plant process piping systems, and includes common fittings. Specialized fittings, joints, accessories, and other appurtenances are specified in detail in the appropriate piping Section based on service.

For water and wastewater treatment projects, individual piping systems (such as sanitary, raw water, and drainage) are typically defined on Drawings using a piping schedule, which describes piping components required for that system and may provide other relevant data such as pressure testing requirements and applicable valve types.

Piping for Site utilities is specified in applicable site utilities Sections in Division 33.

1. GENERAL
	* + 1. SUMMARY
				1. Section Includes:

Copper pipe and fittings.

Copper tube and fittings.

Accessories.

* + - * 1. Related Requirements:

List other Sections directly related to or affecting Work of this Section. Include Sections specifying information expected to be found in this Section as well as Sections required to describe complete system or assembly requirements.

Section 400506 - Couplings, Adapters, and Specials for Process Piping: Piping appurtenances.

Section 400551 - Common Requirements for Process Valves: Common product requirements for valves for placement by this Section.

* + - 1. REFERENCE STANDARDS

List reference standards included within text of this Section, with designations, numbers, and complete document titles.

* + - * 1. American Welding Society:

AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

* + - * 1. ASME International:

ASME B1.1 - Unified Inch Screw Threads, UN and UNR Thread Form.

ASME B1.20.1 - Pipe Threads, General Purpose, Inch.

ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Inch Standard.

ASME B16.15 - Cast Copper Alloy Threaded Fittings: Classes 125 and 250.

ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

ASME B16.20 - Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and Jacketed.

ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.

ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV.

ASME B16.24 - Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500.

ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.

ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

ASME B31.3 - Process Piping.

* + - * 1. ASTM International:

ASTM B88 - Standard Specification for Seamless Copper Water Tube.

ASTM B32 - Standard Specification for Solder Metal.

ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.

ASTM B61 - Standard Specification for Steam or Valve Bronze Castings.

ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

ASTM B75 - Standard Specification for Seamless Copper Tube.

ASTM B98 - Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes.

ASTM B124 - Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes.

ASTM B150 - Standard Specification for Aluminum Bronze Rod, Bar, and Shapes.

ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.

ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.

ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).

* + - * 1. Manufacturers Standardization Society:

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

* + - * 1. NSF International:

NSF 61 - Drinking Water System Components - Health Effects.

NSF 372 - Drinking Water System Components - Lead Content.

* + - 1. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals)
				4. Product Data: Submit manufacturer information regarding pipe, tube, and fittings.
				5. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, sizes, and materials list.
				6. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

Include separate Paragraphs for additional certifications.

Include following Paragraph when Contractor is responsible for designing products or assemblies. List affected products when Section specifies more than one product.

* + - * 1. Delegated Design Submittals: Submit signed and sealed Shop Drawings with piping layout and with design calculations and assumptions for pipe sizing methods.
				2. Source Quality-Control Submittals: Indicate results of [**shop**] [**factory**] tests and inspections.
				3. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
				4. Qualifications Statements:

Coordinate following Subparagraphs with requirements specified in QUALIFICATIONS Article.

Submit qualifications for manufacturer, installer, and licensed professional.

Submit manufacturer's approval of installer.

* + - 1. CLOSEOUT SUBMITTALS
				1. Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, and [**invert**] [**centerline**] elevations.
				2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
			2. QUALITY ASSURANCE

Include this Article to specify compliance with overall reference standards affecting products and installation included in this Section.

* + - * 1. Permanently mark each length of pipe with manufacturer's name or trademark and indicate conformance to standards.
				2. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

In following Paragraph insert "State of New York Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Perform Work according to <**\_\_\_\_\_\_\_\_**> standards.

Include following Paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain <**\_\_\_\_\_\_\_\_**> [**copy**] [**copies**] of each standard affecting Work of this Section on Site.
			1. QUALIFICATIONS

Coordinate following Paragraphs with requirements specified in SUBMITTALS Article.

* + - * 1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience.
				2. Installer: Company specializing in performing Work of this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience [**and approved by manufacturer**].
				3. Licensed Professional: [**Professional engineer**] <**\_\_\_\_\_\_\_\_**> experienced in design of specified Work and licensed in New York State.
			1. DELIVERY, STORAGE, AND HANDLING
				1. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
				2. Store materials according to manufacturer instructions.
				3. Protection:

Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

Protect piping and appurtenances by storing off ground.

Provide additional protection according to manufacturer instructions.

* + - 1. EXISTING CONDITIONS
				1. Field Measurements:

Verify field measurements prior to fabrication.

Indicate field measurements on Shop Drawings.

1. PRODUCTS
	* + 1. COPPER PIPE, TUBE, AND FITTINGS

Copper is generally corrosion resistant, although it is rapidly corroded by oxidizing acids such as chromic and nitric acids. Copper pipe with soldered joints is not recommended for transporting fuel oil or other flammable or toxic liquids. Copper tubing is not allowed for natural gas distribution according to U.S. code. Consult with piping manufacturer and select materials based on specific application.

Piping is available in various lengths depending on specific material. Copper tube comes in rigid, hard-tempered "joints" or soft-tempered (annealed) rolls.

Copper tubing "type" designations apply only to tubing furnished under ASTM B88. "Type" indicates wall thickness; Type K has the greatest wall thickness, and Type M the least wall thickness. Some plumbing codes may require use of ASTM B88 Type K or Type L pipe for water service applications and water distribution systems, but may not allow use of Type M.

Select from following options required for Project conditions based on service requirements.

* + - * 1. Pipe:

Material: Seamless copper.

Comply with ASTM [**B42**] [**B302**] [**B306**].

Temper: [**Annealed**] [**Hard drawn**].

Type: [**K**] [**L**] [**M**].

* + - * 1. Tube:

Material: Seamless copper alloy.

Comply with ASTM B88

Type: [**K**] [**L**] [**M**].

Temper: [**Drawn**] [**Annealed**].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Tube:

Material: Seamless copper alloy.

Comply with ASTM [**B75**] [**B251**].

Temper: [**Soft**] annealed.

* + - * 1. Fittings:

Material: Copper alloy.

Temper: Comply with ASTM [**B61**] [**B62**].

Solder-Joint Fittings: Comply with ASME [**B16.18**] [**B16.22**] [**B16.23**] [**B16.29**].

Flared Fittings: Comply with ASME B16.26.

Threaded Fittings:

Material: Cast bronze.

Comply with ASME B16.15.

Threads: Comply with ASME B1.20.1 .

Flanges and Flanged Fittings:

Comply with ASME B16.24.

Class [**150**] [**300**] <**\_\_\_\_\_\_\_\_**>.

Gaskets:

Material: [**Neoprene**] <**\_\_\_\_\_\_\_\_**>.

Comply with ASME B16.5 and ASME [**B16.20**] [**B16.21**].

Thickness: 1/16 inch .

Seals:

Material: [**EPDM**] <**\_\_\_\_\_\_\_\_**>.

[**Factory installed.**]

Tubing Compression Fittings:

Material: Forged brass alloy.

Comply with ASTM [**B124**] <**\_\_\_\_\_\_\_\_**>.

Threads: Comply with ASME B1.1.

Press Fittings:

Material: [**Copper**] [**Bronze**].

Comply with ASME [**B16.18**] [**B16.22**].

* + - * 1. Pipe Joints:

Type:

[**Threaded**] [**Soldered**] [**Brazed**].

Connections to Equipment: [**Flanged**] <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Tube Joints:

Type: [**Soldered**] [**Flared**] [**Press compression**] [**Compression**].

* + - 1. ACCESSORIES
				1. Bolting: Comply with ASTM [**B98**] [**B150**] <**\_\_\_\_\_\_\_\_**>.

Consider operating temperature and exposure to corrosivity when selecting a solder type.

* + - * 1. Solder:

Comply with ASTM B32 [**and AWS A5.8**].

Due to risk of galvanic corrosion, direct contact with steel and galvanized steel hangers should not be allowed.

* + - * 1. Piping Supports:

Material: [**Copper**] [**Brass**] [**Padded steel**].

Comply with MSS SP-58.

* + - 1. SOURCE QUALITY CONTROL
				1. Provide shop inspection and testing of completed assembly.

Include one or both of following Paragraphs to require Director's inspection or witnessing of test at factory.

* + - * 1. Director’s Inspection:

Make completed [**piping**] [**and**] [**tubing**] components available for inspection at manufacturer's factory prior to packaging for shipment.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspection is allowed.

* + - * 1. Director’s Witnessing:

Allow witnessing of factory inspections and test at manufacturer's test facility.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspections and tests are scheduled.

Include following Paragraph if reliance on manufacturer's approved quality-control program is sufficient for Project requirements.

* + - * 1. Certificate of Compliance:

If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

Specified shop tests are not required for Work performed by approved manufacturer.

1. EXECUTION
	* + 1. EXAMINATION
				1. Verify that field dimensions are as indicated on [**Shop**] Drawings.
				2. Inspect existing flanges for nonstandard bolt hole configurations or design, and verify that new pipe and flange mate properly.
			2. PREPARATION
				1. Thoroughly clean pipe and fittings before installation.
			3. INSTALLATION
				1. Comply with [**ASME B31.3**] <**\_\_\_\_\_\_\_\_**>.
				2. Run piping straight along alignment as indicated on [**Shop**] Drawings, with minimum number of joints.
				3. Fittings:

Clean gasket seats thoroughly, and wipe gaskets clean prior to installation.

Install fittings according to manufacturer instructions.

Bolts:

Tighten bolts progressively, drawing up bolts on opposite sides until bolts are uniformly tight.

Use torque wrench to tighten bolts to manufacturer instructions.

* + - * 1. Provide required upstream and downstream clearances from devices as indicated on [**Shop**] Drawings.
				2. Install piping with sufficient slopes for venting or draining liquids and condensate to low points.
				3. Provide expansion joints as specified in Section 400506 - Couplings, Adapters, and Specials for Process Piping to compensate for pipe expansion due to temperature differences.
				4. Dielectric Fittings: Provide between dissimilar metals.
				5. Field Cuts: According to pipe manufacturer instructions.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

In following Paragraph insert "State of New York Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Installation Standards: Install Work according to <**\_\_\_\_\_\_\_\_**> standards.
			1. TOLERANCES
				1. Laying Tolerance: [**5/8**] <**\_\_\_\_\_\_\_\_**> inch.
			2. FIELD QUALITY CONTROL
				1. Inspection:

Inspect for damage to pipe lining or coating and for other defects that may be detrimental as determined by Director’s Representative.

Repair damaged piping or provide new, undamaged pipe.

After installation, inspect for proper supports and interferences.

* + - * 1. Pressure Testing: As indicated on piping schedule.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Pressure Testing:

Test Pressure: Not less than 200 psig or 50 psi in excess of maximum static pressure, whichever is greater.

Conduct hydrostatic test for minimum [**two**] <**\_\_\_\_\_\_\_\_**> hours.

Filling:

Fill section to be tested with water slowly and expel air from piping at high points.

Install corporation cocks at high points.

Close air vents and corporation cocks after air is expelled.

Raise pressure to specified test pressure.

Observe joints, fittings, and valves under test.

Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage and retest.

Leakage:

Correct visible deficiencies and continue testing at same test pressure for additional [**two**] <**\_\_\_\_\_\_\_\_**> hours to determine leakage rate.

Maintain pressure within plus or minus 5 psi of test pressure.

Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.

Compute maximum allowable leakage by following formula:

L = SD x sqrt(P)/C.

L = testing allowance in gph.

S = length of pipe tested in feet.

D = nominal diameter of pipe in inches.

P = average test pressure during hydrostatic test in psig.

C = 148,000.

If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

If test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.

Correct visible leaks regardless of quantity of leakage.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

In following Paragraph insert "State of New York Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Pressure Testing: According to <**\_\_\_\_\_\_\_\_**> standards.
			1. CLEANING
				1. Keep pipe interior clean as installation progresses.
				2. After installation, clean pipe interior of soil, grit, and other debris.

END OF SECTION 400517