SECTION 400523 - STAINLESS STEEL 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 steel pipe materials normally encountered in plant process piping systems and common to more than one Section in this Division, and includes common fittings and joints. Common piping components, including penetrations, restrained joints, flexible connections, expansion joints, and loops, are specified in Section 400506. Specialized fittings, joints, accessories, and other appurtenances are specified and detailed in the appropriate piping Section based on service.

For water and wastewater treatment projects, individual piping systems (for example, sanitary, raw water, and drainage) are typically defined on Drawings by providing a piping schedule, which describes the 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 are specified in applicable site utilities Sections in Division 33.

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

Stainless-steel pipe and fittings.

Stainless-steel 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, Adaptors, and Specials for Process Piping: Pipe penetrations, restrained joints, flexible connections, expansion joints and loops, and sleeve-type couplings.

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

Section 404642 - Cathodic Process Corrosion Protection: Passive cathodic protection for buried metallic piping.

* + - 1. REFERENCE STANDARDS

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

* + - * 1. American Welding Society:

AWS D1.1 - Structural Welding Code - Steel.

* + - * 1. ASME International:

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

ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Classes 25, 125, 250 and 800.

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

ASME B16.9 - Factory-Made Wrought Buttwelding Fittings.

ASME B16.11 - Forged Fittings, Socket-Welding and Threaded.

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

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

ASME B31.3 - Process Piping.

ASME Boiler and Pressure Vessel Code (BPVC), Section IX - Welding and Brazing Qualifications.

* + - * 1. ASTM International:

ASTM A182 - Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.

ASTM A194 - Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

ASTM A312 - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

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

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

ASTM A479 - Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.

ASTM A632 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small Diameter) for General Service.

ASTM A789 - Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service.

ASTM A813 - Standard Specification for Single- or Double-Welded Austenitic Stainless Steel Pipe.

ASTM A814 - Standard Specification for Cold-Worked Welded Austenitic Stainless Steel Pipe.

ASTM D3308 - Standard Specification for PTFE Resin Skived Tape.

* + - * 1. NSF International:

NSF 61 - Drinking Water System Components - Health Effects.

NSF 372 - Drinking Water System Components - Lead Content.

* + - 1. COORDINATION
				1. Coordinate Work of this Section with piping and equipment connections as specified in other Sections [**and as indicated on Drawings**].
			2. PREINSTALLATION MEETINGS
				1. Convene minimum [**one week**] <**\_\_\_\_\_\_\_\_**> [**weeks**] prior to commencing Work of this Section.
			3. 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 on pipe materials, tube materials, and fittings.
				5. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, sizes, and materials lists.
				6. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
				7. Welder Certificates: Submit welders' certification of compliance with [**ASME BPVC, Section IX**] [**AWS D1.1**] <**\_\_\_\_\_\_\_\_**>, verifying qualification within previous 12 months.

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, 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 valves, fittings, and appurtenances.
			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 compliance with 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. Welders: [**AWS**] [**ASME**] qualified within previous 12 months for employed weld types.
				4. 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. AMBIENT CONDITIONS
				1. Minimum Conditions: Do not store or handle uninstalled lined pipes or fittings at temperatures below zero degrees F.
			2. EXISTING CONDITIONS
				1. Field Measurements:

Verify field measurements prior to fabrication.

Indicate field measurements on Shop Drawings.

1. PRODUCTS
	* + 1. STAINLESS-STEEL PIPE AND FITTINGS
				1. General Service Piping:

Type:

[**Welded**] [**Seamless**]; comply with ASTM A813.

Class: [**SW**] [**DW**]; comply with [**ASTM A814**] <**\_\_\_\_\_\_\_\_**>.

Schedule: [**40S**] [**80S**] <**\_\_\_\_\_\_\_\_**>.

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

Schedule: As indicated [**on Drawings**] [**in piping schedule**].

Select grade based on service requirements. Generally, Type 316 stainless steel offers greater corrosion resistance and higher yield strength than Type 304. Types 304L and 316L (low-carbon grades) may be preferred when welding is to be performed, as welding heat may cause chromium carbide precipitation. Consult pipe manufacturer to ensure correct application for required service and installation conditions.

Grade: Type [**304**] [**304L**] [**316**] [**316L**] <**\_\_\_\_\_\_\_\_**>.

Dimensions: [**Comply with ASTM A312**] [**As indicated in piping schedule**].

* + - * 1. Fittings:

Type:

Piping 2 Inches and Smaller: Socket welding.

Piping 2-1/2 Inches and Larger: Butt welding.

Dimensions: [**Comply with ASTM A312**] [**As indicated in piping schedule**].

Threaded Fittings:

Comply with ASME B16.11 and ASTM A182.

Grade: Type [**304**] [**304L**] [**316**] [**316L**] <**\_\_\_\_\_\_\_\_**>.

Threads: Comply with ASME B1.20.1.

Butt-Welding Fittings:

Comply with ASTM A403.

Grade: Type [**304**] [**304L**] [**316**] [**316L**] <**\_\_\_\_\_\_\_\_**>.

Class: [**CR**] <**\_\_\_\_\_\_\_\_**>; comply with ASME B16.9.

Socket-Welding Fittings:

Comply with ASTM A403.

Grade: Type [**304**] [**304L**] [**316**] [**316L**] <**\_\_\_\_\_\_\_\_**>.

Class: [**WP-S**] [**WP-W**] [**WP-WX**] [**WP-WU**]; comply with ASME B16.11.

Flanged Fittings:

Type: [**Welding neck**] [**Slip on**] [**Socket welding**] [**Lapped**] [**Threaded**].

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

Comply with ASTM A182.

Grade: Type [**304**] [**304L**] [**316**] [**316L**] <**\_\_\_\_\_\_\_\_**>.

Facing and Drilling: Comply with ASME B16.5, with [**<\_\_\_\_\_\_\_\_>-inch raised face**] [**flat face**] <**\_\_\_\_\_\_\_\_**>.

Backing Flanges:

Material: Stainless steel.

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

Comply with ASTM A351.

Grade: Type <**\_\_\_\_\_\_\_\_**>.

Type: Van stone.

Drilling: Comply with ASME [**B16.1**] [**B16.5**].

Flanged Connections: As [**required to connect stainless-steel piping to fittings and equipment**] [**indicated on Drawings**] [**indicated in piping schedule**].

* + - 1. STAINLESS-STEEL TUBE AND FITTINGS
				1. Tube:

Type: [**Seamless**] [**Welded**].

Comply with ASTM [**A269**] [**A632**] [**A789**].

Select grade based on service requirements. Generally, Type 316 stainless steel offers greater corrosion resistance and higher yield strength than Type 304. Types 304L and 316L (low-carbon grades) may be preferred when welding is to be performed, as welding heat may cause chromium carbide precipitation. Consult pipe manufacturer to ensure correct application for required service and installation conditions.

Grade: Type [**304**] [**304L**] [**316**] [**316L**] <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Fittings:

Threaded:

Comply with ASTM A182 and ASME B16.11.

Grade: Type [**304**] [**304L**] [**316**] [**316L**] <**\_\_\_\_\_\_\_\_**>.

Threads: Comply with ASME B1.20.1.

Butt-Welding Fittings:

Comply with ASTM A403.

Grade: Type [**304**] [**304L**] [**316**] [**316L**] <**\_\_\_\_\_\_\_\_**>.

Class: [**CR**] <**\_\_\_\_\_\_\_\_**>.

Socket-Welding Fittings:

Comply with ASTM A403.

Grade: Type [**304**] [**304L**] [**316**] [**316L**] <**\_\_\_\_\_\_\_\_**>.

Class: [**WP-S**] [**WP-W**] [**WP-WX**] [**WP-WU**].

Flanged Fittings:

Type: [**Welding neck**] [**Slip on**] [**Socket welding**] [**Lapped**] [**Threaded**].

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

Comply with ASTM A182.

Grade: Type [**304**] [**304L**] [**316**] [**316L**] <**\_\_\_\_\_\_\_\_**>.

Facing and Drilling: Comply with ASME B16.5, with [**<\_\_\_\_\_\_\_\_>-inch raised face**] [**flat face**] <**\_\_\_\_\_\_\_\_**>.

Backing Flanges:

Material: Stainless steel.

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

Comply with ASTM A351.

Grade: Type <**\_\_\_\_\_\_\_\_**>.

Type: Van stone.

Drilling: Comply with ASME [**B16.1**] [**B16.5**].

Bolting:

Bolts: Comply with ASTM A193, Grade [**B5**] [**B7**] <**\_\_\_\_\_\_\_\_**>; hex head.

Nuts: ASTM A194, Grade <**\_\_\_\_\_\_\_\_**>; hex head.

Cast-Iron Mating Flange on Valves or Equipment:

Bolts: Comply with ASTM A193, Grade <**\_\_\_\_\_\_\_\_**>; hex head.

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

Bolts: Comply with ASTM A194, Grade <**\_\_\_\_\_\_\_\_**>; heavy hex head nuts.

Washers: Same material as bolts.

Crimp Fittings:

Material: Cold-drawn stainless steel.

Grade: Type [**304**] [**304L**] [**316**] [**316L**] <**\_\_\_\_\_\_\_\_**>.

Compression Fittings:

Material: Stainless steel.

Comply with ASTM A479.

Grade: Type 316.

Pressure Rating: As indicated [**on Drawings**] [**in piping schedule**].

* + - 1. ACCESSORIES
				1. Pipe-Thread Tape:

Material: PTFE.

Comply with ASTM D3308.

* + - * 1. O-Ring Seals: [**Rubber**] [**EPDM**] [**Fluoro-elastomeric**] <**\_\_\_\_\_\_\_\_**>.
				2. Flange Gaskets:

Comply with ASME B16.5.

Nonmetallic Gaskets:

Material: [**Chloroprene rubber**] <**\_\_\_\_\_\_\_\_**>.

Comply with ASME B16.21.

Metallic Ring Joint Gaskets:

Material: <**\_\_\_\_\_\_\_\_**>.

Comply with ASME B16.20.

Type:

Raised-Face Flanges: Flat ring.

Flat-Face Flanges: Full face.

* + - 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. Ream [**pipe**] [**and**] [**tube**] ends and remove burrs.
				2. [**Bevel plain-end pipe.**]
				3. 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 according to manufacturer instructions.

Bolting:

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 drainage of liquids and condensate to low points.
				3. Provide expansion joints as specified in Section 400506 - Couplings, Adaptors, 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.
				6. Field welding of stainless steel is [**not**] permitted.
				7. Provide cathodic protection [**where indicated on Drawings**] for buried ferrous piping systems, as specified in Section [**404642 - Cathodic Process Corrosion Protection**] <**\_\_\_\_\_\_\_\_\_\_\_\_**>.

\*\*\*\*\*\* [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. Piping Laying Tolerance: [**5/8**] <**\_\_\_\_\_\_\_\_**> inch.
				2. Inspection:

Inspect for damage to piping or tubing that may be detrimental as determined by the Director’s Representative.

Repair damaged piping, or provide new, undamaged pipe.

After installation, inspect for required supports and anchoring, interferences, and damage to pipe, tube, or fittings.

* + - * 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 gallons per hour.

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.

When 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.
				2. [**Repair**] [**Replace**] pipe or fittings with mortar cracks wider than 1/16 inch.
			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 400523