SECTION 401649 - SULFUR DIOXIDE GAS PIPING

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 includes requirements for aboveground process piping systems for dry sulfur dioxide applications in a water or wastewater treatment plant.

In the water and wastewater industry, sulfur dioxide may be used for dechlorination. Sulfur dioxide may also be used to remove dissolved oxygen or hydrogen sulfide and to treat chromium wastes.

Piping for Site utilities is specified in Division 33, plumbing piping and appurtenances are specified in Division 22, and process piping and valves are specified in Division 40.

In process industries such as water and wastewater treatment, piping is typically specified by pipe material. Individual piping systems (such as sanitary, raw water, and drainage) may be defined on Drawings via a pipe schedule, which describes piping components required for that system and provides other relevant data such as pressure testing requirements and applicable valve types (refer to Section 400506).

Piping, as well as fittings, joints, accessories, and other appurtenances, should be indicated on pipe schedule and specified by pipe material in Division 40 - Process Integration.

Valving, including appurtenances and accessories, should be indicated on valve schedule and specified by valve type in Division 40. Common items applicable to process valving are specified in Section 400551.

Consult piping manufacturer and select materials based on specific application.

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

Pipes and tubes for conveying dry sulfur dioxide.

Valves for conveying dry sulfur dioxide.

* + - * 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 055000 - Metal Fabrications: Miscellaneous metalwork and fasteners as required by this Section.

Section 400506 - Couplings, Adapters, and Specials for Process Piping: Components common to process piping systems.

Section 400517 - Copper Process Pipe and Tubing: Requirements as specified by this Section.

Section 400523 - Stainless Steel Process Pipe and Tubing: Requirements as specified by this Section.

Section 400524 - Steel Process Pipe: Requirements as specified by this Section.

Section 400531 - Thermoplastic Process Pipe: Requirements for PVC and CPVC piping [**and tubing**] as specified by this Section.

Section 400551 - Common Requirements for Process Valves: Basic materials and methods related to valves as specified in this Section.

Section 400561 - Gate Valves: Requirements as specified by this Section.

Section 400563 - Ball Valves: Requirements as specified by this Section.

Section 400564 - Butterfly Valves: Requirements as specified by this Section.

Section 400567 - Specialized Pressure and Flow-Control Valves: Pressure-reducing valves to prevent over-pressurization.

* + - 1. REFERENCE STANDARDS

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

* + - * 1. ASME International:

ASME B31.3 - Process Piping.

ASME B31.9 - Building Services Piping.

* + - * 1. ASTM International:

ASTM B163 - Standard Specification for Seamless Nickel and Nickel Alloy Condenser and Heat-Exchanger Tubes.

ASTM B165 - Standard Specification for Nickel-Copper Alloy (UNS N04400) Seamless Pipe and Tube.

ASTM B366 - Standard Specification for Factory-Made Wrought Nickel and Nickel Alloy Fittings.

ASTM B725 - Standard Specification for Welded Nickel (UNS N02200/UNS N02201) and Nickel Copper Alloy (UNS N04400) Pipe.

ASTM F2389 - Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems.

1. PRODUCTS

Following piping materials are as recommended by manufacturers for dry sulfur dioxide at room temperature. Confirm selection with piping manufacturer, especially under different Project conditions.

* + - 1. PIPES AND TUBES FOR CONVEYING DRY SULFUR DIOXIDE
				1. Steel Piping:

Pipe and Fittings: [**As specified in Section 400524 - Steel Process Pipe**] [**and**] [**as indicated on pipe schedule**].

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

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

Pipe and Fittings: Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

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

* + - * 1. Stainless-Steel Piping and Tubing:

Pipe, Tube, and Fittings:

[**As specified in Section 400523 - Stainless Steel Process Pipe and Tubing**] [**and**] [**as indicated on pipe schedule**].

Type: [**303**] [**or**] [**316**].

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

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

Pipe, Tube, and Fittings: Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

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

* + - * 1. Copper Piping and Tubing:

Pipe, Tube, and Fittings: [**As specified in Section 400517 - Copper Process Pipe and Tubing**] [**and**] [**as indicated on pipe schedule**].

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

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

Pipe, Tube, and Fittings: Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

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

* + - * 1. PVC Piping:

Pipe and Fittings: [**As specified in Section 400531 - Thermoplastic Process Pipe**] [**and**] [**as indicated on pipe schedule**].

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

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

Pipe and Fittings: Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

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

* + - * 1. CPVC Piping:

Pipe and Fittings: [**As specified in Section 400531 - Thermoplastic Process Pipe**] [**and**] [**as indicated on pipe schedule**].

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

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

Pipe and Fittings: Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

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

* + - * 1. Polypropylene (PP) Piping:

Pipe:

Comply with ASTM F2389.

Wall Thickness: Schedule [**80**] <**\_\_\_\_\_\_\_\_**>.

Fittings: [**Threaded**] <**\_\_\_\_\_\_\_\_**>.

Joints: Electrical-resistance fusion.

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

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

Pipe and Fittings: Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

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

High-alloy nickel (or Monel, a registered trademark of the Special Metals Corporation) is composed primarily of nickel and copper with lesser amounts of iron, manganese, carbon, and silicon, and may be fabricated by machining and welding.

* + - * 1. High-Alloy Nickel Piping and Tubing:

Pipe:

Type: [**Welded, ASTM B725**] [**or**] [**seamless, ASTM B165**].

Condition: Annealed.

Tensile Strength: 70 to 85 ksi

Tube:

Comply with ASTM [**B163**] [**B165**].

Type: Seamless.

Condition: Annealed.

Tensile Strength: 70 to 85 ksi

Fittings:

Material: High-alloy nickel.

Comply with ASTM B366.

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

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

Pipe, Tube, and Fittings: Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

* + - 1. VALVES FOR CONVEYING DRY SULFUR DIOXIDE
				1. Materials in Contact with Sulfur Dioxide: [**Carbon steel**] [**Stainless steel**] [**Copper**] [**PVC**] [**CPVC**] [**PP**] [**High-alloy nickel**] <**\_\_\_\_\_\_\_\_**>.
				2. Gate Valves:

[Manufacturers:](http://www.specagent.com/LookUp/?ulid=12735&mf=04&src=wd)

designer to provide two manufacturers and approved equivalent for all listed products.

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

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

Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

2 Inches and Smaller:

Comply with MSS SP 80.

Class: [**125**] [**150**] <**\_\_\_\_\_\_\_\_**>.

Bonnet: [**Threaded**] [**Union**].

Stem: [**Rising**] [**Nonrising**] [**; lock-shield**].

Operation: Handwheel.

Furnish inside screw [**with back-seating stem**], [**solid**] [**split**]-wedge disc [**, and alloy seat rings**].

End Connections: <**\_\_\_\_\_\_\_\_**>.

2-1/2 Inches and Larger:

Comply with MSS SP 70.

Class: [**125**] <**\_\_\_\_\_\_\_\_**>.

Bonnet: Bolted.

Stem: [**Rising**] [**Nonrising**].

Operation:

Handwheel, and outside screw and yoke.

Furnish chainwheel operators for valves 6 inches and larger mounted 7 feet and greater above operating floor.

Disc: Solid wedge.

Seat Rings: [**Viton**] [**PTFE**] <**\_\_\_\_\_\_\_\_**>.

End Connections: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Ball Valves:

[Manufacturers:](http://www.specagent.com/LookUp/?ulid=12736&mf=04&src=wd)

designer to provide two manufacturers and approved equivalent for all listed products.

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

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

Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

2 Inches and Smaller:

Comply with MSS SP 110.

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

Body: Two-piece.

Port: [**Full**] <**\_\_\_\_\_\_\_\_**>.

Seats: PTFE.

Stem: Blowout-proof.

Operation: [**Lever**] [**Wing or tee**] [**Locking lever**] [**Extended lever**] [**Round**] [**Oval**] handle [**with balancing stops**].

End Connections: <**\_\_\_\_\_\_\_\_**> [**, with union**].

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

Following Subparagraph specifies a three-piece, repairable ball valve.

2 Inches and Smaller:

Comply with MSS SP 110.

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

Body: Three-piece.

Port: [**Full**] <**\_\_\_\_\_\_\_\_**>.

Seats: PTFE.

Stem: Blowout-proof.

Operation: [**Lever**] [**Wing or tee**] [**Locking lever**] [**Extended lever**] [**Round**] [**Oval**] handle [**with balancing stops**].

End Connections: <**\_\_\_\_\_\_\_\_**>.

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

2 Inches and Smaller:

Comply with MSS SP 110.

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

Body: [**Two**] [**Three**]-piece.

Ball: Type [**303**] [**or**] [**316**] stainless steel.

Seats and Stuffing Box Ring: [**Reinforced**] PTFE.

Operation: [**Lever**] [**Wing or tee**] [**Locking lever**] [**Extended lever**] [**Round**] [**Oval**] handle [**with balancing stops**].

End Connections: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Butterfly Valves:

[Manufacturers:](http://www.specagent.com/LookUp/?ulid=12737&mf=04&src=wd)

designer to provide two manufacturers and approved equivalent for all listed products.

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

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

Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

2-1/2 Inches and Larger:

Comply with MSS SP 67.

Class: [**150**] [**200**] [**250**] <**\_\_\_\_\_\_\_\_**>.

Neck: Extended.

Disc: [**Nickel-plated ductile iron**] [**, Type 303 stainless steel**] [**, or**] [**Type <\_\_\_\_\_\_\_\_> stainless steel**].

Seat: Resilient, replaceable [**Viton**] [**PTFE**] <**\_\_\_\_\_\_\_\_**>.

Operation:

[**Ten-position lever handle**] [**Infinite-position lever handle with memory stop**] [**Handwheel and gear drive**].

Furnish gear operators for valves 8 inches and larger, and chainwheel operators for valves mounted 7 feet and greater above operating floor.

End Connections: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Pressure Relief Valves:

[Manufacturers:](http://www.specagent.com/LookUp/?ulid=12738&mf=04&src=wd)

designer to provide two manufacturers and approved equivalent for all listed products.

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

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

Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

Description:

Body: Bronze.

Seat: PTFE.

Stem and Springs: Type [**303**] [**or**] [**316**] stainless steel.

Actuated Capacities: Automatic; direct pressure.

ASME certified and labeled according to BPVC.

* + - * 1. Pressure-Reducing Valves:

Description: [**As specified in Section 400567 - Specialized Pressure and Flow-Control Valves**] [**and**] [**as indicated on pipe schedule**].

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

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

Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

* + - * 1. Pressure Regulators:

[Manufacturers:](http://www.specagent.com/LookUp/?ulid=12739&mf=04&src=wd)

designer to provide two manufacturers and approved equivalent for all listed products.

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

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

Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

Description:

Operation: [**Diaphragm**] [**Pilot**].

Type: Direct acting, spring loaded.

Pressure Setting Adjustment: Manual.

Inlet Pressure Rating: 250 psig

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

Description:

Operation: Diaphragm.

Type: Direct acting, spring loaded.

Body: [**PVC**] [**CPVC**] <**\_\_\_\_\_\_\_\_**>.

Pressure Setting Adjustment: Manual.

Inlet Pressure Rating: 250 psig

* + - 1. ACCESSORIES
				1. Flange Gaskets: [**Viton**] [**PTFE**] <**\_\_\_\_\_\_\_\_**>.
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 flanges mate properly.
				3. Verify that openings are ready to receive sleeves [**and firestopping**].
				4. Verify that pipe plain ends to receive sleeve-type couplings are smooth and round for 12 inches from pipe ends and that pipe outside diameter conforms to sleeve manufacturer's requirements.
			2. PREPARATION
				1. Thoroughly clean end connections before installation.
				2. Close pipe and equipment openings with caps or plugs during installation.
				3. Cleaning: Clean surfaces to remove foreign substances.
			3. INSTALLATION
				1. According to [**ASME B31.3**] [**ASME B31.9**] <**\_\_\_\_\_\_\_\_**>.
				2. Piping and Appurtenances:

As indicated on [**Shop**] Drawings.

Use minimum number of joints.

According to manufacturer instructions and ASME B31.3.

* + - * 1. In locations where pipe expansion joints are indicated, install pipe alignment guides adjacent to and within [**four**] <**\_\_\_\_\_\_\_\_**> pipe diameters of joint.
				2. Field Fabrication: Fabricate fittings according to manufacturer instructions.
				3. Provide thrust restraints as required.
				4. Provide flexible couplings and expansion joints at connections to equipment and where indicated on [**Shop**] Drawings.
				5. Install couplings, service saddles, and anchors according to manufacturer instructions.
				6. Provide dielectric fittings between dissimilar metals.
				7. Provide upstream and downstream clearances [**as indicated on Drawings**] [**according to manufacturer instructions**].
				8. Local Indicators:

Install direct-reading indicator devices, such as thermometers and pressure gages, to be read at floor level and accessible for maintenance and service.

Install according to manufacturer instructions.

* + - * 1. Orientate valves to permit operation and maintenance access to valve operator and to avoid interferences with other equipment.

\*\*\*\*\*\* [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. FIELD QUALITY CONTROL
				1. Inspect for proper supports and interferences.
				2. Pressure Testing:

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

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

Test Pressure: As indicated on pipe schedule.

Conduct hydrostatic test for at least two hours.

Slowly fill section to be tested with water; expel air from piping at high points.

Raise pressure to specified test pressure and maintain within plus or minus 5 psi of test pressure.

Remove and renew cracked pipes, joints, fittings, and valves showing visible leakage, and retest at same test pressure for additional two hours to determine leakage; leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.

Compute maximum allowable leakage using following formula:

L = SD x sqrt(P)/C.

L = testing allowance, gph

S = length of pipe tested, feet

D = nominal diameter of pipe, inches

P = average test pressure during hydrostatic test, psig

C = 148,000

When pipe being tested contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

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

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

* + - * 1. Perform pressure test on piping according to <**\_\_\_\_\_\_\_\_**> standards.
				2. After installation, inspect for proper supports and interferences.
				3. Repair damaged coatings with material equal to original coating.
			1. ADJUSTING
				1. Field-calibrate local indicators at time of piping installation.
			2. CLEANING
				1. Purge system with dry inert gas before sulfur dioxide is introduced.

END OF SECTION 401649