SECTION 400536 - FIBERGLASS-REINFORCED PLASTIC PROCESS PIPE

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 fiberglass-reinforced plastic (FRP) pipe materials normally encountered in plant process piping systems and common to more than one Section in this Division. This Section includes pipe, common fittings, and joints. Common piping components, including penetrations, restrained joints, flexible connections, and expansion joints and loops, are specified in Section 400506. Specialized fittings, joints, accessories, and other appurtenances are specified in detail in the appropriate piping Section based on service.

In process industries such as water and wastewater treatment, piping is typically specified by pipe material. Individual piping systems (for example, sanitary, raw water, and drainage) may be defined on the Drawings by way of a pipe schedule, which describes the piping components required for that system as well as provides other relevant data such as pressure-testing requirements and applicable valving requirements.

Piping for site utilities are specified in applicable site utilities Sections in Division 33 - Utilities.

1. GENERAL
	* + 1. SUMMARY
				1. Section Includes: Fiberglass-reinforced (thermosetting) plastic pipe and fittings.
				2. 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: 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.

* + - 1. DEFINITIONS

Limit list of definitions to terms unique to this Section and not provided elsewhere.

* + - * 1. Fiberglass-Reinforced (Thermosetting) Plastic (FRP) Pipe: Piping that contains glass-fiber reinforcement embedded in cured thermosetting resin. The glass-fiber reinforcement within the material system provides the mechanical strength and the thermosetting resin cures to an irreversible hard matrix designed to be compatible with the fluid medium.
			1. REFERENCE STANDARDS

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

LEED requires compliance with specific editions of referenced standards.

* + - * 1. American Water Works Association:

AWWA C950 - Fiberglass Pressure Pipe.

* + - * 1. ASME International:

ASME B31.3 - Process Piping.

* + - * 1. ASTM International:

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 D2310 - Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-factory Reinforced Thermosetting-Resin) Pipe.

ASTM D2992 - Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings.

ASTM D3754 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe.

ASTM D3892 - Standard Practice for Packaging/Packing of Plastics.

ASTM D4024 - Standard Specification for Machine Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Flanges.

ASTM D4161 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.

ASTM D5421 - Standard Specification for Contact Molded "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Flanges.

ASTM D5685 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe Fittings.

ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

* + - * 1. NSF International:

NSF 61 - Drinking Water System Components - Health Effects.

* + - 1. COORDINATION
				1. Coordinate Work of this Section with piping and equipment connections specified in other Sections [**and 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's catalog information regarding pipe 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.

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 design calculations and assumptions for pipe sizes and 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. SUSTAINABLE DESIGN SUBMITTALS
				1. Manufacturer's Certificate:

Certify that products meet or exceed specified sustainable design requirements.

Insert material certifications list below to suit products specified in this Section and Project sustainable design requirements. Specific certificate submittal and supporting data requirements are specified in Section 018113.

Materials Resources Certificates:

Certify source and origin for [**salvaged**] [**and**] [**reused**] products.

Certify recycled material content for recycled content products.

Certify source for regional materials and distance from Project Site.

* + - * 1. Product Cost Data:

Submit cost of products to verify compliance with Project sustainable design requirements.

Exclude cost of labor and equipment to install products.

Provide cost data for following products:

Edit list of material cost data below to suit products specified in this Section and Project sustainable design requirements. Specific cost data requirements are specified in Section 018113.

Salvaged, refurbished, and reused products.

Products with recycled material content.

Regional products.

<**\_\_\_\_\_\_\_\_**>.

* + - 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.

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.

Manufacturer's Packaging: Comply with ASTM D3892.

* + - * 1. Store materials according to manufacturer instructions.
				2. Protection:

Protect materials from puncture, abrasion, moisture, dust, and UV 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

If selecting FRP piping for corrosive fluids, consult piping manufacturer and select materials based on specific application and temperature.

* + - 1. FRP PIPE

Reference standards in following Paragraph include specific material and fabrication requirements. Ensure that other statements in this Section do not conflict with these requirements.

* + - * 1. FRP Pressure Pipe and Fittings:

Materials:

Comply with ASTM [**D2310**] [**D3754**].

Type: [**1**] [**2**] [**3**] [**4**].

Liner: <**\_\_\_\_\_\_\_\_**>.

Pressure Rating:

Pressure Class: <**\_\_\_\_\_\_\_\_**>.

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

[**<\_\_\_\_\_\_\_\_> psig.**]

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

As indicated in pipe schedule.

Comply with ASTM [**D2310**] [**and**] [**D2992**].

Fittings:

Non-Flanged: Comply with ASTM D5685.

Flanged: Comply with ASTM D5421.

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

Flanged: Comply with ASTM D4024; Type [**A**] [**B**]; Grade <**\_\_\_\_\_\_\_\_**>; Class [**I**] [**II**].

Joints: [**Bell and spigot, ASTM D3754**] [**Bell and spigot, ASTM D4161**] [**Butt, ASTM D3754**] [**Flanged, ASTM D4024**] <**\_\_\_\_\_\_\_\_**>.

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

* + - * 1. FRP Pressure Pipe and Fittings:

Comply with [**AWWA C950**] <**\_\_\_\_\_\_\_\_**>.

Type: [**1**] [**2**].

Grade: [**1**] [**2**] [**3**] [**4**].

Liner: <**\_\_\_\_\_\_\_\_**>.

Pressure Rating: [**<\_\_\_\_\_\_\_\_> psig**] [**As indicated in pipe schedule**] <**\_\_\_\_\_\_\_\_**>.

* + - 1. SUSTAINABILITY CHARACTERISTICS

Insert sustainable design characteristics in this Article to suit content of this Section and Project sustainable design requirements as specified in Section 018113.

* + - * 1. Section 018113 – LEED Documentation Requirements: Requirements for sustainable design compliance.
				2. Material and Resource Characteristics:

Recycled Content Materials: Furnish materials with maximum available recycled content [**including:**] [**.**]

Insert list of materials specified in this Section required to have recycled content.

<**\_\_\_\_\_\_\_\_**>.

Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site [**including:**] [**.**]

Insert list of materials specified in this Section required to be regional materials.

<**\_\_\_\_\_\_\_\_**>.

* + - 1. ACCESSORIES
				1. Flange Bolting:

Material: Stainless steel.

Comply with ASTM A193.

Fasteners:

Hex-Head Bolts: Grade <**\_\_\_\_\_\_\_\_**>; comply with ASTM A193.

Hex-Head Nuts: Grade <**\_\_\_\_\_\_\_\_**>; comply with ASTM A194.

* + - * 1. Flange Gaskets:

Type: Full faced.

Material: [**Ethylene propylene rubber**] [**PTFE**] <**\_\_\_\_\_\_\_\_**>.

* + - * 1. FRP Gaskets:

Material: Elastomeric.

Comply with ASTM F477.

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

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

* + - * 1. Director’s Inspection:

Make completed pipe sections 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.
				2. Cleaning: Clean surfaces to remove foreign substances.
			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:

According to manufacturer instructions.

Gaskets:

Clean seats thoroughly.

Wipe gaskets clean prior to installation.

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.
				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, Adapters, and Specials for Process Piping to compensate for pipe expansion due to temperature differences.
				4. Field Cuts: According to pipe manufacturer instructions.
				5. Insulation: As indicated [**on Drawings**] [**on Shop Drawings**] [**in piping schedule**].

\*\*\*\*\*\* [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. Inspection:

Inspect for piping defects that may be detrimental as determined by the Director’s Representative.

Repair damaged piping, or provide new, undamaged pipe.

After installation, inspect for proper supports and interferences.

* + - * 1. Pressure Testing:

As indicated in 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

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.

Perform pressure test on piping according to <**\_\_\_\_\_\_\_\_**> standards.

* + - 1. CLEANING
				1. Keep pipe interior clean as installation progresses.
				2. Clean pipe interior of soil, grit, and other debris after pipe installation.

END OF SECTION 400536