SECTION 400524 - STEEL 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 steel pipe materials normally encountered in plant process piping systems and common to multiple Sections in this Division, and it includes 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.

For water and wastewater treatment projects, individual piping systems (such as sanitary, raw water, and drainage) are typically defined on Drawings via 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:

Steel pipe.

Steel tube.

Cement-mortar-lined steel pipe.

Plastic-lined steel pipe.

Glass-lined steel pipe.

Rubber-lined steel pipe.

Internally coated steel pipe.

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: 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 ferrous piping.

* + - 1. REFERENCE STANDARDS

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

* + - * 1. American Water Works Association:

AWWA C200 - Steel Water Pipe, 6 In. and Larger.

AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipe.

AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied.

AWWA C206 - Field Welding of Steel Water Pipe.

AWWA C207 - Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In.

AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.

AWWA C210 - Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings.

AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.

AWWA C222 - Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings.

AWWA C550 - Protective Epoxy Interior Coatings for Valves and Hydrants.

AWWA C606 - Grooved and Shouldered Joints.

AWWA M11 - Steel Water Pipe - A Guide for Design and Installation.

* + - * 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 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.

ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/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 B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

ASME B36.10M - Welded and Seamless Wrought Steel Pipe.

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

* + - * 1. ASTM International:

ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings.

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

ASTM A105 - Standard Specification for Carbon Steel Forgings for Piping Applications.

ASTM A106 - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.

ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.

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 A216 - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.

ASTM A334 - Standard Specification for Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service.

ASTM A423 - Standard Specification for Seamless and Electric-Welded Low-Alloy Steel Tubes.

ASTM A576 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.

ASTM A727 -Standard Specification for Carbon Steel Forgings for Piping Components with Inherent Notch Toughness.

ASTM A858 - Standard Specification for Heat-Treated Carbon Steel Fittings for Low-Temperature and Corrosive Service.

ASTM A865 - Standard Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints.

ASTM C33 - Standard Specification for Concrete Aggregates.

ASTM C150 - Standard Specification for Portland Cement.

ASTM C600 - Standard Test Method of Thermal Shock Test on Glass Pipe.

ASTM D1418 - Standard Practice for Rubber and Rubber Latices - Nomenclature.

ASTM D3308 - Standard Specification for PTFE Resin Skived Tape.

ASTM E438 - Standard Specification for Glasses in Laboratory Apparatus.

ASTM F336 - Standard Practice for Design and Construction of Nonmetallic Enveloped Gaskets for Corrosive Service.

ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

ASTM F1545 - Standard Specification for Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges.

* + - * 1. NSF International:

NSF 61 - Drinking Water System Components - Health Effects.

NSF 372 - Drinking Water System Components - Lead Content.

* + - * 1. SSPC - The Society for Protective Coatings:

SSPC-SP 6 - Commercial Blast Cleaning.

* + - 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 information regarding pipe and fittings.

USE PARAGRAPH BELOW WITH EPD REQUIREMENT WHEN PROJECT ESTIMATE IS $1M OR MORE.

* + - * 1. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel pipe within this specification section, if available. A statement of the contractor’s good faith effort to obtain the EPD shall be provided if not available.

Manufacturer-provided EPDs must be Product Specific Type III (Third-Party Reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services.*

* + - * 1. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, sizes, and material lists.
        2. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
        3. 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 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. 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. STEEL PIPE AND FITTINGS
          1. General Service Piping:

Comply with ASTM A53; Grade [**A**] [**B**].

Type: [**Welded**] [**Seamless**] [**Butt welded**] [**Electric welded**].

Schedule: [**40**] [**80**] [**As indicated on Drawings**] [**As indicated in piping schedule**].

Finish: Hot-dip galvanized.

* + - * 1. High-Temperature Service Piping:

Comply with ASTM A106; Grade [**A**] [**B**] [**C**].

Type: [**Hot finished**] [**Cold drawn**].

Schedule: [**40**] [**80**] [**As indicated on Drawings**] [**As indicated in piping schedule**].

Dimensions: [**Comply with ASME B36.10M**] [**As indicated in piping schedule**].

* + - * 1. Water Piping:

Comply with AWWA C200.

Type: [**Fabricated**] [**Mill**] pipe.

Minimum Wall Thickness:

Pipe Diameter 8 Inches and Smaller: 0.375 inch

Pipe Diameter Greater Than 8 Inches:0.500 inch

Fittings and Special Sections: Comply with AWWA C208.

Flanges:

Comply with AWWA C207[**; Class D**].

Type: Slip on.

Field Welding Materials: Comply with AWWA C206.

* + - * 1. Joints:

Description: [**Screwed ends; NPT**] [**Straight threaded**] [**Taper threaded**] [**Butt welded**] [**Socket welded**] [**Flanged**] [**Mechanical coupling**] [**Push on; harnessed for high-pressure service**].

* + - * 1. Fittings:

Type:

Piping 2 Inches and Smaller: Threaded.

Piping 2-1/2 Inches and Larger: Welded or flanged.

Dimensions: [**Comply with ASME B36.10M**] [**As indicated in piping schedule**].

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

Threaded Fittings:

Class: [**150**] [**300**].

Malleable Iron:

Comply with [**ASTM A47**] [**and**] [**ASME B16.3**].

Type: Black; banded.

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

Cast Iron:

Comply with ASME B16.3.

Pattern: Drainage.

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

Forged Steel:

Comply with [**ASTM A105**] [**ASTM A858**] [**and**] [**ASME B16.11**].

Threads: Comply with ASME B1.20.1

Rigid Steel Couplings: Comply with [**ASTM A865**] <**\_\_\_\_\_\_\_\_**>.

Butt-Welding Fittings:

Comply with [**ASTM A105**] [**ASTM A858**] [**and**] [**ASME B16.9**].

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

Socket-Welding Fittings:

Comply with [**ASTM A105**] [**ASTM A858**] [**and**] [**ASME B16.11**].

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

Flanged Fittings:

Forged Steel: Comply with [**ASTM A105**] [**ASTM A727**] <**\_\_\_\_\_\_\_\_**> [**, AWWA C207**] [**, and**] [**ASME B16.5**].

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

Cast Iron: Comply with ASME B16.1.

Class: [**125**] [**150**] [**300**] <**\_\_\_\_\_\_\_\_**>.

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

Facing and Drilling:

Comply with ASME B16.5.

Type: [**<\_\_\_\_\_\_\_\_>-inch raised face**] [**Flat face**] <**\_\_\_\_\_\_\_\_**>.

Backing Flanges:

Material: Cast steel.

Comply with ASTM A216; Grade [**WCA**] [**WCB**] [**WCC**].

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

Type: Van stone.

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

Fasteners:

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

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

Cast-Iron Mating Flange on Valves or Equipment:

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

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

Washers: Constructed of same material as bolts.

Mechanical Couplings: Comply with [**AWWA C606**] [**ASTM F1476**].

Unions:

Piping 2 Inches and Smaller: Threaded.

Piping 2-1/2 Inches and Larger: Threaded or flanged.

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

Material: Carbon steel.

Comply with ASTM A334; Grade <**\_\_\_\_\_\_\_\_**>.

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

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

Material: Low-alloy carbon steel.

Comply with ASTM A423; Grade <**\_\_\_\_\_\_\_\_**>.

Type: [**Seamless**] [**Electric welded**].

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

* + - * 1. Fittings:

Material: Steel.

Comply with ASTM [**A108**] [**A576**].

Type: Compression.

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

Threads:

Comply with ASME B1.1.

Type: Straight.

* + - 1. BURIED STEEL PIPE EXTERIOR LINING
         1. Description: Shop-applied prime coat and coal-tar enamel protective coating.
         2. Comply with AWWA C203.

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

* + - 1. BURIED STEEL PIPE EXTERIOR LINING
         1. Fusion-bonded epoxy coating.
         2. Comply with AWWA C213.
      2. CEMENT-MORTAR-LINED STEEL PIPE AND FITTINGS
         1. Comply with AWWA C205.
         2. Shop-apply lining after fabrication and before installation.
         3. Cement: Comply with ASTM C150.
         4. Aggregate:

Material: [**Silica sand**] <**\_\_\_\_\_\_\_\_**>.

Comply with ASTM C33.

* + - * 1. Water: Clean with no organic matter or strong alkalis.
        2. Liner Thickness: Comply with [**AWWA C205**] <**\_\_\_\_\_\_\_\_**>.
      1. PLASTIC-LINED STEEL PIPE AND FITTINGS

Polypropylene (PP)-lined pipe is relatively economical and offers good resistance to various acids and alkalis, although it is not recommended for solvents and is brittle at low temperatures. Potential applications are hydrochloric acid (less than 30 percent concentration), sulfuric acid (less than 90 percent concentration), sea water or brine, sodium hydroxide, and ultrapure water. Consult with piping manufacturer and select materials based on specific application.

Operating temperature limitations may be encountered depending upon specific chemical environments.

* + - * 1. Polypropylene (PP)-Lined Steel Pipe and Fittings:

Liner:

Comply with ASTM F1545.

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

Maximum Design Pressure: <**\_\_\_\_\_\_\_\_**> psig at <**\_\_\_\_\_\_\_\_**> degrees F

Maximum Operating Temperature: [**225**] <**\_\_\_\_\_\_\_\_**> degrees F

Minimum Liner Thickness: <**\_\_\_\_\_\_\_\_**> mils

Lock liner to shell.

Gaskets: [**Rubber**] [**As indicated in piping schedule**] <**\_\_\_\_\_\_\_\_**>.

Polyvinylidene fluoride (PVDF)-lined pipe is abrasion resistant and also offers excellent resistance to halogens and high-strength acids and alkalis. This liner material has a relatively high thermal expansion coefficient. Potential applications are hydrochloric acid (less than 35 percent concentration), sulfuric acid (less than 98 percent concentration), chlorine, and bromine. Consult with piping manufacturer and select materials based on specific application.

Operating temperature limitations may be encountered depending upon specific chemical environments.

* + - * 1. Polyvinylidene Fluoride (PVDF)-Lined Steel Pipe and Fittings:

Liner:

Comply with ASTM F1545.

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

Maximum Design Pressure: <**\_\_\_\_\_\_\_\_**> psig at <**\_\_\_\_\_\_\_\_**> degrees F.

Maximum Operating Temperature: [**275**] <**\_\_\_\_\_\_\_\_**> degrees F

Minimum Liner Thickness: <**\_\_\_\_\_\_\_\_**> mils.

Lock liner to shell.

Gaskets: [**Rubber**] [**As indicated in piping schedule**] <**\_\_\_\_\_\_\_\_**>.

PTFE-lined pipe offers a relatively high maximum operating temperature. This liner material is virtually inert. Potential applications are nitric acid and other chemical processing materials. Consult with piping manufacturer and select materials based on specific application.

Operating temperature limitations may be encountered depending upon specific chemical environments.

* + - * 1. PTFE-Lined Steel Pipe and Fittings:

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

Maximum Design Pressure: <**\_\_\_\_\_\_\_\_**> psig at <**\_\_\_\_\_\_\_\_**> degrees F

Maximum Operating Temperature: [**450**] <**\_\_\_\_\_\_\_\_**> degrees F

Minimum Liner Thickness: <**\_\_\_\_\_\_\_\_**> mils

Lock liner to shell.

Gaskets: [**Rubber**] [**As indicated in piping schedule**] <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Flanges:

Pipes 1 Inch through 8 Inches:

Material: Forged steel.

Comply with ASTM A105 and ASME [**B16.1**] [**B16.5**] [**B16.42**].

Class: [**150**] [**300**].

Pipes 10 Inches through 12 Inches:

Type: Flared steel, lap jointed.

Comply with ASTM A105 and ASME [**B16.1**] [**B16.5**] [**B16.42**].

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

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

* + - * 1. Flanges:

Pipes 4 Inches and Larger:

Type: Flat face.

Comply with AWWA C207.

Class: D.

* + - 1. GLASS-LINED STEEL PIPE AND FITTINGS
         1. Liner:

Material: [**Chemically resistant, low-expansion, borosilicate glass**] [**Porcelain enamel**] <**\_\_\_\_\_\_\_\_**>.

Comply with ASTM E438.

* + - * 1. Operating Temperature Range: [**Minus 20**] <**\_\_\_\_\_\_\_\_**> degrees F to [**plus 200**] <**\_\_\_\_\_\_\_\_**> degrees F.
        2. Working Pressure: 150 psig [**and full vacuum**].
        3. Minimum Liner Thickness: <**\_\_\_\_\_\_\_\_**> mils.
        4. Lock liner to shell.
        5. Gaskets:

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

Comply with ASTM F336.

* + - 1. RUBBER-LINED STEEL PIPE AND FITTINGS
         1. Liner:

Material: Elastomeric.

Comply with ASTM D1418.

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

Hardness: Brinell <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Terminate lining inside bolt holes and fill remaining space to flange edge with <**\_\_\_\_\_\_\_\_**>-inch [**PTFE**] [**PVDF**] [**PP**] <**\_\_\_\_\_\_\_\_**>.
        2. Lock liner to shell.
        3. Gaskets:

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

Maximum Thickness: [**1/8**] <**\_\_\_\_\_\_\_\_**> inch.

* + - 1. INTERNALLY COATED STEEL PIPE AND FITTINGS
         1. Polyurethane Liner:

Description: Self-priming, plural component, 100 percent solids, and non-extended polyurethane.

Comply with AWWA C222.

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

Dry Film Thickness: 30 mils.

* + - * 1. Spray-Applied Liquid Epoxy Liner:

Description: Thermosetting, fusion-bonded, 100 percent solids, and dry powder epoxy resin.

Comply with AWWA C210 and AWWA C550.

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

* + - 1. FINISHES
         1. Coat machined faces of flanges with temporary rust-inhibitive coating.
      2. ACCESSORIES
         1. Pipe-Thread Tape:

Material: PTFE.

Comply with ASTM D3308.

* + - * 1. Flange Gaskets:

Comply with [**ASME B16.5**] [**AWWA C207**].

Nonmetallic Gaskets:

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

Comply with ASME B16.21.

Metallic Ring Joint Gaskets:

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

Comply with ASME B16.20.

Type:

Raised Face: Flat ring.

Flat Face: Full face.

* + - 1. SOURCE QUALITY CONTROL
         1. Testing:

Provide shop inspection and testing of completed pipe sections.

Conduct 15,000-V minimum electrostatic spark test on each plastic-lined pipe to ensure integrity of plastic liner.

Test thermal shock resistance of glass-lined pipe according to ASTM C600.

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. Ream ends of threaded pipes and file smooth.
          2. Thoroughly clean pipe and fittings before installation.
          3. Surface Preparation:

Solvent-clean surfaces that are not shop primed.

Clean surfaces to remove loose rust, mill scale, and other foreign substances by [**power wire brushing**] [**commercial sand blasting; SSPC-SP 6**].

* + - 1. INSTALLATION
         1. According to [**ASME B31.3**] [**AWWA M11**] <**\_\_\_\_\_\_\_\_**>.
         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. Install cement-lined fabricated fittings with flexible pipe couplings.
        2. Welding of Cement-Lined Steel Pipe: Permitted only with approval of Director’s Representative
        3. Provide required upstream and downstream clearances from devices as indicated on [**Shop**] Drawings.
        4. Install piping with sufficient slopes for venting or draining liquids and condensate to low points.
        5. Provide expansion joints as specified in Section 400506 - Couplings, Adapters, and Specials for Process Piping to compensate for pipe expansion due to temperature differences.
        6. Dielectric Fittings: Provide between dissimilar metals.
        7. Field Cuts: According to manufacturer instructions.
        8. Provide cathodic protection [**as 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. Install pipe within tolerance of [**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 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:

Slowly fill with water section to be tested 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.

* + - * 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, loose mortar, and other debris.

END OF SECTION 400524