SECTION 400531 - THERMOPLASTIC 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 plastic 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 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 piping 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:

PVC pipe.

PVC tube.

CPVC pipe.

Polyvinylidene fluoride (PVDF) pipe and tube.

Acrylonitrile-butadiene-styrene (ABS) pipe.

Polyethylene (PE) pipe and tube.

Fittings.

Accessories for plastic piping.

* + - * 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.

* + - 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 C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 12 In., for Water Transmission and Distribution.

AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. through 3 In., for Water Service.

AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. through 63 In., for Water Distribution and Transmission.

* + - * 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 B16.1 - 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 Metric/Inch Standard.

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.

* + - * 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 D1527 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80.

ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.

ASTM D2464 - Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.

ASTM D2657 - Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.

ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.

ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

ASTM D2737 - Standard Specification for Polyethylene (PE) Plastic Tubing.

ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.

ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.

ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.

ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

ASTM D3222 - Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.

ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

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

ASTM D3965 - Standard Classification System and Basis for Specifications for Rigid Acrylonitrile-Butadiene-Styrene (ABS) Materials for Pipe and Fittings.

ASTM F402 - Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.

ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

ASTMF438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.

ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

ASTM F441 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

ASTM F442 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).

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

ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.

ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

ASTM F1055 - Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing.

ASTM F1056 - Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings.

ASTM F1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings.

* + - * 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.

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

* + - * 1. Manufacturer: Company listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture each of the respective thermoplastic pipe systems.
        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. AMBIENT CONDITIONS
         1. Minimum and Maximum Temperatures: Do not install pipe when temperature is below 40 degrees F or above 90 degrees F if pipe is exposed to direct sunlight.
         2. UV Protection: Provide pipe installed above ground or outside with UV protection.
      2. EXISTING CONDITIONS
         1. Field Measurements:

Verify field measurements prior to fabrication.

Indicate field measurements on Shop Drawings.

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

Select one or more of following Paragraphs based on Project requirements.

* + - * 1. PVC Pipe and Fittings:

Pipe:

Comply with [**ASTM D1785**] <**\_\_\_\_\_\_\_\_**>.

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

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

Pipe:

Comply with [**ASTM D2241**] <**\_\_\_\_\_\_\_\_**>.

[**SDR-26 for 160-psig pressure rating, calculated according to ASTM D2837**] [**SDR-41 for 100-psig rating, calculated according to ASTM D2837**] [**SDR-21 for 200-psig rating, calculated according to ASTM D2837**].

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

Pipe: As indicated in piping schedule.

Fittings: ASTM [**D2466, Schedule 40**] [**D2467, Schedule 80**] [**; ASTM D2464, threaded**].

Consider specifying threaded or flanged end connections if later removal is required.

Joints: [**ASTM D2855, socket, solvent welded**] [**Flanged**] [**Threaded**]<**\_\_\_\_\_\_\_\_**>.

Materials:

Comply with ASTM D1784.

[**Minimum**] Cell Classification: [**12545-C**] <**\_\_\_\_\_\_\_\_**>.

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

* + - * 1. PVC Pipe and Fittings:

Pipe:

Comply with AWWA C900.

Class: [**165**] [**235**] <**\_\_\_\_\_\_\_\_**>.

Fittings:

Material: Cast iron.

Comply with AWWA C111.

Joints:

Type: Compression gasket ring.

Comply with ASTM D3139.

Materials:

Comply with ASTM D1784.

[**Minimum**] Cell Classification: [**12545-C**] <**\_\_\_\_\_\_\_\_**>.

* + - * 1. PVC Tube and Fittings:

Tube:

Type: [**Clear**] <**\_\_\_\_\_\_\_\_**>.

Size and Wall Thickness: [**As indicated in piping schedule**] <**\_\_\_\_\_\_\_\_**>.

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

Fittings:

Type: Compression.

Materials: Suitable for application.

Threads:

Type: Straight.

Comply with ASME B1.1.

* + - 1. CPVC PIPE AND FITTINGS

CPVC is considered to be stronger, more ductile, and more flexible than PVC. CPVC is also considered nontoxic, in that it does not leach toxins at elevated temperatures as PVC might do. CPVC is resistant to many chemicals (consult pipe supplier for listing) and resists scale buildup; for mixed waste systems, chemical analyses, and corrosion, testing may be necessary to properly select the piping system.

* + - * 1. Description:

Pipe:

Comply with ASTM F441.

Schedule: [**40**] [**80**].

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

Pipe:

Comply with ASTM F442.

SDR: <**\_\_\_\_\_\_\_\_**> [**As indicated**].

Fittings:

Flanged: Comply with ASME [**B16.1**] [**B16.5**]; Class [**125**] <**\_\_\_\_\_\_\_\_**>.

Socket Welded: Comply with ASTM [**F438, Schedule 40**] [**F439, Schedule 80**].

Threaded: Comply with ASTM F437 and ASME B1.20.1

Schedule: 80.

Consider specifying threaded or flanged end connections if later removal is required.

Joints: [**Socket welded**] [**Flanged**] [**Push on**] [**Threaded**].

Materials:

Comply with ASTM D1784.

[**Minimum**] Cell Classification: [**23447**] <**\_\_\_\_\_\_\_\_**>.

* + - 1. PVDF PIPE, TUBE, AND FITTINGS

PVDF is considered to provide superior chemical resistance to many solvents, acids, bases, and halogens. It is designed for extra tough applications where plastic may not have been considered. PVDF is able to maintain much of its strength and chemical resistance within a broad temperature range. Single- and double-wall configurations are available, as are molded drainage pattern fittings.

* + - * 1. Description:

Pipe:

Comply with ASTM D3222.

Schedule [**40**] [**80**].

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

SDR: <**\_\_\_\_\_\_\_\_**> [**As indicated**].

Butt and socket welding are the preferred methods for joining PVDF pipe. Threading is available for Schedule 80 piping only. A common recommendation for PVDF fittings is that butt welding be used for sizes 1/2 to 12 inches, and socket welding be used for sizes 3/8 to 4 inches.

Fittings:

Comply with ASTM D3222.

Type: Molded.

Consider specifying threaded or flanged end connections if later removal is required.

End Connections:

[**Butt**] [**Socket**] welded.

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

Flanged: Comply with ASME [**B16.1**] [**B16.5**]; Class [**125**] <**\_\_\_\_\_\_\_\_**>.

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

Threaded: Comply with ASME B1.1.

* + - * 1. PVDF Tube and Fittings:

Tube:

Size and Wall Thickness: [**As indicated in piping schedule.**]

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

Fittings:

Type: Compression.

Materials: Suitable for application.

* + - 1. ABS PIPE AND FITTINGS
         1. Pipe:

Comply with ASTM D1527.

Schedule: [**40**] [**80**].

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

SDR: <**\_\_\_\_\_\_\_\_**> [**As indicated in piping schedule**] [**As calculated according to ASTM D2837**].

* + - * 1. Fittings:

Comply with ASTM D2661.

Type: Molded.

Consider specifying threaded or flanged end connections if later removal is required.

End Connections:

Solvent welded.

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

Flanged: Comply with ASME [**B16.1**] [**B16.5**]; Class [**125**] <**\_\_\_\_\_\_\_\_**>.

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

Threaded: Comply with ASME B1.1.

* + - * 1. Materials:

Comply with ASTM D3965.

[**Minimum**] Cell Classification: [**42222**] <**\_\_\_\_\_\_\_\_**>.

* + - 1. PE PIPE, TUBE, AND FITTINGS

Select one or more of following Paragraphs based on Project requirements.

* + - * 1. PE Pipe and Fittings:

Pipe:

Comply with ASTM D2447.

Schedule: [**40**] [**80**].

SDR: <**\_\_\_\_\_\_\_\_**> [**As indicated in piping schedule**] [**As calculated according to ASTM D3035**] [**As calculated according to ASTM F714**].

Fittings:

Type: Molded.

[**ASTM D3261, butt welded**] [**ASTM D2683, socket welded**] [**ASTM F1056, socket welded**].

Consider specifying threaded or flanged end connections if later removal is required.

Joints: [**Socket heat fusion**] [**Butt fusion**] [**Flanged**] [**Threaded**].

Materials:

Comply with ASTM D3350.

[**Minimum**] Cell Classification: [**324433-C**] <**\_\_\_\_\_\_\_\_**>.

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

ASTM D3035 piping is available in different wall thicknesses ranging from DR 32.5, thinnest, to DR 7, thickest, with pressure ratings from 160 to 840 psig. Coordinate wall thickness and pressure rating with intended service conditions.

* + - * 1. PE Pipe and Fittings:

Pipe: [**AWWA C901**] [**AWWA C906**] [**ASTM D3035, DR <\_\_\_\_\_\_\_\_> for <\_\_\_\_\_\_\_\_>-psig pressure rating**].

Fittings:

Comply with AWWA [**C901**] [**C906**].

Type: Molded [**or fabricated**].

Consider specifying threaded or flanged end connections if later removal is required.

Joints: [**Compression**] [**Butt fusion**] [**Flanged**] [**Threaded**].

Materials:

Comply with ASTM D3350.

[**Minimum**] Cell Classification: [**324433-C**] <**\_\_\_\_\_\_\_\_**>.

* + - * 1. PE Tube and Fittings:

Tube:

Comply with AWWA C901.

Size and Wall Thickness:

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

Comply with ASTM [**D2737**] [**F876**].

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

Fittings:

Type: Compression.

Materials: Suitable for application.

Threads:

Type: Straight.

Comply with ASME B1.1.

* + - 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. 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. FINISHES
         1. Coat machined faces of metallic flanges with temporary rust-inhibitive coating.
      2. ACCESSORIES
         1. PVC Piping:

Flange Bolting:

Hex-Head Bolts: Stainless steel; ASTM A193; Grade <**\_\_\_\_\_\_\_\_**>.

Hex-Head Nuts: Stainless steel; ASTM A194; Grade <**\_\_\_\_\_\_\_\_**>.

Flange Gaskets:

Type: Full faced.

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

Comply with ASME B16.21.

Solvent Cement:

Comply with ASTM D2564.

[**Primers: Comply with ASTM F656.**]

* + - * 1. CPVC Piping:

Flange Bolting:

Hex-Head Bolts: Stainless steel; ASTM A193; Grade <**\_\_\_\_\_\_\_\_**>.

Hex-Head Nuts: Stainless steel; ASTM A194; Grade <**\_\_\_\_\_\_\_\_**>.

Flange Gaskets:

Type: Full faced.

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

Comply with ASME B16.21.

Push-On Joint Seals:

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

Comply with ASTM F477.

Solvent Cement: Comply with ASTM F493.

* + - * 1. PVDF Piping:

Nonmetallic Gaskets:

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

Comply with ASME B16.21.

Metallic Ring Joint Gaskets:

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

Comply with ASME B16.20.

Flange Bolting:

Hex-Head Bolts: Stainless steel; ASTM A193; Grade <**\_\_\_\_\_\_\_\_**>.

Hex-Head Nuts: Stainless steel; ASTM A194; Grade <**\_\_\_\_\_\_\_\_**>.

Flange Gaskets:

Type: Full faced.

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

Comply with ASME B16.21.

* + - * 1. ABS Piping:

Flange Bolting:

Hex-Head Bolts: Stainless steel; ASTM A193; Grade <**\_\_\_\_\_\_\_\_**>.

Hex-Head Nuts: Stainless steel; ASTM A194; Grade <**\_\_\_\_\_\_\_\_**>.

Flange Gaskets:

Type: Full faced.

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

Comply with ASME B16.21.

Solvent Cement: Comply with ASTM D2235.

* + - * 1. PE Piping:

Insert Fittings: Comply with ASTM D2609.

Couplings: Comply with ASTM F1055.

Flange Bolting:

Hex-Head Bolts: Stainless steel; ASTM A193; Grade <**\_\_\_\_\_\_\_\_**>.

Hex-Head Nuts: Stainless steel; ASTM A194; Grade <**\_\_\_\_\_\_\_\_**>.

Flange Gaskets:

Type: Full faced.

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

Comply with ASME B16.21.

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

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**] [**tubes**] 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, remove burrs [**, and**] [**bevel plain-end pipe**].
          2. Thoroughly clean pipe and fittings before installation.
          3. 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. Joining:

Heat Joining: Comply with ASTM D2657.

Electrofusion: Comply with ASTM F1290.

Primers and Cleaners: Comply with ASTM F402.

PVC Solvent-Cemented Joints: Comply with ASTM D2855.

* + - * 1. Insulation: As indicated [**on Shop Drawings**] [**on 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 Subparagraph 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, shavings, and other debris after pipe installation.

END OF SECTION 400531