SECTION 226600 - CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

Revise this Section by deleting and inserting text to meet Project specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section Includes:

Single-wall piping.

Double-containment piping.

Field-fabrication containment piping.

Piping specialties.

Neutralization tanks.

Neutralization systems.

Manholes - holding tanks.

Leak-detection systems.

* + - 1. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. FPM: Vinylidene fluoride (hexafluoropropylene copolymer rubber).
			1. SUBMITTALS
				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: For each type of product.
				5. Shop Drawings: For neutralization system and leak-detection system.

Include plans, elevations, sections, and attachment details.

Include details of neutralization-system assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Include details of leak-detection-system assemblies. Indicate required clearances, method of field assembly, components, and location and size of each field connection.

Include diagrams for power, signal, and control wiring.

Retain "Delegated-Design Submittal" paragraph below if design services have been delegated to Contractor.

* + - * 1. Delegated-Design Submittal: For seismic restraints of aboveground piping.

Include design calculations for selecting seismic restraints.

Retain "Profile Drawings for Outdoor Underground Piping" paragraph below if profiles are not indicated on Drawings.

* + - * 1. Profile Drawings for Outdoor Underground Piping: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate underground structures and pipes. Show types, sizes, materials, and elevations of other utilities crossing system piping.

Retain "Coordination Drawings" paragraph below for situations where limited space necessitates maximum utilization for efficient installation of different components or if coordination is required for installation of products and materials by separate installers. Coordinate paragraph with other Sections specifying products listed below. Preparation of coordination drawings requires the participation of each trade involved in installations within the limited space.

* + - * 1. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

Pipe sizes, locations, and elevations.

Other piping in same trench and clearances from sewerage system piping.

Interface and spatial relationship between piping and proximate structures.

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For chemical-waste specialties and [**neutralization tanks**] [**neutralization systems**] [**and**] [**leak-detection systems**] to include in emergency, operation, and maintenance manuals.
			2. MAINTENANCE MATERIAL SUBMITTALS
				1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Neutralization-Tank Limestone: Equal to [**200**] <**Insert number**> percent of amount required for each tank sump initial charge. Furnish limestone in 50-lb bags.

Neutralization-System Limestone and Chemicals: For each neutralization system.

Limestone: Equal to [**500**] <**Insert number**> percent of amount required for tank sump initial charge. Furnish limestone in 50-lb bags.

Chemicals: Equal to [**500**] [**1000**] <**Insert number**> percent of neutralizing chemicals required for filling tanks.

* + - 1. DELIVERY, STORAGE, AND HANDLING
				1. Deliver and store piping and specialties with sealing plugs in ends or with end protection.
				2. Do not store plastic pipe or fittings in direct sunlight.
				3. Protect pipe, fittings, and seals from dirt and damage.
			2. FIELD CONDITIONS

Retain this article if interruption of existing chemical-waste service is required.

* + - * 1. Interruption of Existing Chemical-Waste Service: Do not interrupt chemical-waste service to facilities occupied by Director’s Representative or others unless permitted under the following conditions and then only after arranging to provide temporary chemical-waste service in accordance with requirements indicated:

Notify Director’s Representative no fewer than [**two**] <**Insert number**> days in advance of proposed interruption of chemical-waste service.

Do not proceed with interruption of chemical-waste service without Director’s Representative's written permission.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

* + - 1. SYSTEM DESCRIPTION

Retain this article for neutralization systems or leak-detection systems.

* + - * 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 “Standard for Electrical Safety in the Workplace”, by an NRTL, and marked for intended location and application.
				2. NFPA Compliance: Comply with NFPA 70 “Standard for Electrical Safety in the Workplace”.
			1. PERFORMANCE REQUIREMENTS

In "Single-Wall Piping Pressure Rating" and "Double-Containment Piping Pressure Rating" paragraphs below, verify acceptable tests for retained piping types. Air pressure test for plastic piping types may not be recommended.

* + - * 1. Single-Wall Piping Pressure Rating: [**5-psig**] <Insert value> [air test pressure] [**10 feet head**of water for 30 minutes] <Insert value and time>.
				2. Double-Containment Piping Pressure Rating:

Carrier Piping: [**5-psig**] <Insert value> [air test pressure] [**10 feet head** of water for 30 minutes] <Insert value and time>.

Containment Piping: [**5-psig**] <Insert value> [air test pressure] <Insert test method>.

* + - * 1. Field-Fabrication Containment-Piping Pressure Rating: [**5-psig**] <**Insert value**> [**air test pressure**] <**Insert test method**>.

Retain "Delegated Design" paragraph below if Contractor is required to assume responsibility for design.

* + - * 1. Delegated Design: Engage a qualified Director’s Representative, as defined in Section 014000 "Quality Requirements," to design seismic restraints for aboveground piping.
			1. SINGLE-WALL PIPE AND FITTINGS

Revise "Piping Schedule" Article to indicate where each type of piping material described in this article shall be installed.

* + - * 1. PP Drainage Pipe and Fittings: ASTM F1412 “Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems”, extruded pipe and drainage-pattern fittings molded, with Schedule 40 dimensions and with fire-retardant additive complying with ASTM D4101 “Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials”; with [**fusion-**] [**and**] [**mechanical-**]joint ends.

Exception: Pipe and fittings made from PP resin without fire-retardant additive may be used for underground installation.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2933) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[IPEX USA LLC](http://www.specagent.com/Lookup?uid=123457150523).

[Orion Fittings; A Watts Water Technologies Company](http://www.specagent.com/Lookup?uid=123457150527).

[Zurn Industries, LLC](http://www.specagent.com/Lookup?uid=123457150528).

Or equal.

Source Limitations: Obtain pipe and fittings from single source from single manufacturer.

* + - * 1. CPVC Drainage Pipe and Fittings: ASTM F2618 “Standard Specification for Chlorinated Poly Pipe and Fittings for Chemical Waste Drainage Systems”, pipe and drainage-pattern fittings.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=12652) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Charlotte Pipe and Foundry Company](http://www.specagent.com/Lookup?uid=123457150589).

[Spears Manufacturing Company](http://www.specagent.com/Lookup?uid=123457150588).

Or equal.

Source Limitations: Obtain pipe and fittings from single source from single manufacturer.

* + - * 1. PVDF Drainage Pipe and Fittings: ASTM F1673 “Standard Specification for Polyvinylidene Fluoride Corrosive Waste Drainage Systems”, Schedule 40, pipe and drainage-pattern fittings. Include fittings with [**fusion-**] [**and**] [**mechanical-**]joint ends.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2934) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[IPEX USA LLC](http://www.specagent.com/Lookup?uid=123457150516).

[Orion Fittings; A Watts Water Technologies Company](http://www.specagent.com/Lookup?uid=123457150513).

[Zurn Industries, LLC](http://www.specagent.com/Lookup?uid=123457150514).

Or equal.

Source Limitations: Obtain pipe and fittings from single source from single manufacturer.

* + - * 1. Fiberglass Pipe and Fittings, Centrifugally Cast: ASTM D2997 “Standard Specification for Centrifugally Cast "Fiberglass" Pipe”, Type II, [**Grade 1**] [**Grade 2**] <**Insert grade**>, [**Class A**] [**Class B**] [**Class C**], RTRP pipe; with ASTM D5685 “Standard Specification for "Fiberglass" Pressure Pipe and Fittings”, Type 4, fiberglass thermosetting resin fittings matching pipe; and [**adhesive-bonding**] [**and**] [**butt-and-wrap-joint**] materials. Include wall thickness that will provide [**160-psig**] <**Insert value**> minimum, sustained water test pressure rating.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2936) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Smith Fiberglass; a National Oilwell Varco brand](http://www.specagent.com/Lookup?uid=123457150598).

Or equal

Source Limitations: Obtain pipe and fittings from single source from single manufacturer.

Revise grade or class in "Fiberglass Pipe and Fittings, Filament Wound" paragraph below if a specific grade or class is not required. Fiberglass piping is typically not used as frequently for labs and healthcare and is more typically used for industrial applications such as refineries and chemical plants.

* + - * 1. Fiberglass Pipe and Fittings, Filament Wound: ASTM D2996 “Standard Specification for Filament-Wound "Fiberglass" Pipe”, Type I, [**Grade 1**] [**Grade 2**] <**Insert grade**>, [**Class A**] [**Class B**] [**Class C**] [**Class E**] [**Class F**] <**Insert class**>, RTRP pipe; ASTM D5685 “Standard Specification for "Fiberglass" Pressure Pipe and Fittings”, Type 1, reinforced thermosetting resin fittings matching pipe; and [**adhesive-bonding**] [**and**] [**butt-and-wrap-joint**] materials. Include wall thickness that will provide [**160-psig**] <**Insert value**> minimum, sustained water test pressure rating.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2937) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Ameron International](http://www.specagent.com/Lookup?uid=123457150601).

[Smith Fiberglass; a National Oilwell Varco brand](http://www.specagent.com/Lookup?uid=123457150600).

Or equal.

Source Limitations: Obtain pipe and fittings from single source from single manufacturer.

* + - * 1. Stainless Steel Drainage Pipe and Fittings: ASME A112.3.1 “Stainless Steel Drainage Systems for Sanitary DMV, Storm, and Vacuum Applications Above & Below Ground”, ASTM A666 “Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar”, Type 316L, stainless steel pipe and drainage-pattern fittings; with socket-and-spigot ends for gasket joints; and having piping manufacturer's FPM lip-seal rubber gaskets shaped to fit socket groove, with plastic backup ring.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2941) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Josam Company](http://www.specagent.com/Lookup?uid=123457150592).

Or equal.

Source Limitations: Obtain pipe and fittings from single source from single manufacturer.

* + - * 1. Borosilicate Glass Pipe and Fittings: ASTM C1053 “Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent Applications”, pipe and drainage-pattern fittings; with manufacturer's standard couplings.

Covering: Factory-applied polystyrene for pipe installed underground.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2943) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Schott North America, Inc](http://www.specagent.com/Lookup?uid=123457150530).

Or equal.

Source Limitations: Obtain pipe and fittings from single source from single manufacturer.

* + - * 1. Adapters and Transition Fittings: Assemblies with combinations of clamps, couplings, adapters, and gaskets; compatible with piping and system liquid; made for joining different piping materials.
			1. DOUBLE-CONTAINMENT PIPE AND FITTINGS

Revise "Piping Schedule" Article to indicate where each type of piping material described in this article shall be installed.

Double-containment piping can be made of almost any single pipe and fitting material or of two different pipe and fitting materials. Piping systems in this article are typical combinations. Leak-detection system may be added if required.

* + - * 1. Description: Factory-fabricated, double-wall pipe and fittings. Sizes indicate carrier-pipe size; with carrier (inner) pipe and fittings; annular-space, carrier-pipe supports; containment (outer) pipe and fittings; and joining materials and fasteners.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=2945) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Flo Safe, Inc](http://www.specagent.com/Lookup?uid=123457150535).

[IPEX USA LLC](http://www.specagent.com/Lookup?uid=123457150536).

[Orion Fittings; A Watts Water Technologies Company](http://www.specagent.com/Lookup?uid=123457150542).

Or equal.

* + - * 1. Source Limitations: Obtain pipe and fittings from single source from single manufacturer.
				2. Piping Materials:

Materials in "PP Double-Containment Drainage Pipe and Fittings" and "PVDF Double-Containment Drainage Pipe and Fittings" subparagraphs below are common for gravity-flow (nonpressure) drainage piping systems. Other materials may be acceptable to authorities having jurisdiction.

PP Double-Containment Drainage Pipe and Fittings: Made of ASTM D4101 “Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials” PP resin.

Carrier and Containment Pipes: ASTM F1412 “Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems”, Schedule 40.

Fittings: ASTM F1412 “Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems”, Schedule 40 drainage pattern complying with ASTM D3311 “Standard Specification for Drain, Waste, and Vent Plastic Fittings Patterns”.

PVDF Double-Containment Drainage Pipe and Fittings: Made of ASTM D3222 “Standard Specification for Unmodified Poly Molding Extrusion and Coating Materials” PVDF resin.

Carrier and Containment Pipes: ASTM F1673 “Standard Specification for Polyvinylidene Fluoride Corrosive Waste Drainage Systems”, Schedule 40.

Fittings: ASTM F1673 “Standard Specification for Polyvinylidene Fluoride Corrosive Waste Drainage Systems”, Schedule 40 drainage pattern complying with ASTM D3311 “Standard Specification for Drain, Waste, and Vent Plastic Fittings Patterns”.

Retain paragraph below if double-containment piping will have a cable leak-detection system installed in annular space.

* + - * 1. Include design and fabrication of double-containment pipe and fitting assemblies with provision for field installation of cable leak-detection system in annular space between carrier and containment piping.
			1. FIELD-FABRICATION CONTAINMENT PIPING

Revise "Piping Schedule" Article to indicate where each type of piping material described in this article shall be installed.

Piping in this article is used only for outer-containment piping over a carrier pipe. Monitoring may be added if required.

* + - * 1. Description: Containment split pipe and split fittings with carrier-pipe centralizers. Include manufacturer's fastening devices and materials.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=2946) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Flo Safe, Inc](http://www.specagent.com/Lookup?uid=123457150593).

[GF Piping Systems: Georg Fischer LLC](http://www.specagent.com/Lookup?uid=123457150594).

Or equal.

* + - * 1. Source Limitations: Obtain containment piping from single source from single manufacturer.

Piping in "Material" paragraph below is made by Flo Safe in NPS 4 and NPS 6 (DN 100 and DN 150).

* + - * 1. Material: [**HDPE**] [**PP**] pipe and fittings.
				2. Fastening System: FPM gaskets, clamps, and pins.
			1. JOINING MATERIALS
				1. Couplings: Assemblies with combinations of clamps, gaskets, sleeves, and threaded or flanged parts; compatible with piping and system liquid; and made by piping manufacturer for joining system piping.
				2. Adapters and Transition Fittings: Assemblies with combinations of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with piping and system liquid; and made for joining different piping materials.
				3. Flanges: Assemblies of companion flanges and gaskets complying with ASME B16.21 “Nonmetallic Flat Gaskets for Pipe Flanges” and compatible with system liquid, and bolts and nuts.
				4. Solvent Cement for Joining CPVC Piping: ASTM F493 “Standard Specification for Solvent Cements for Chlorinated Poly Plastic Pipe and Fittings”. Include primer in accordance with ASTM F656 “Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) Plastic Pipe and Fittings”.
				5. Fiberglass-Pipe Adhesive: As furnished or recommended by pipe manufacturer.
			2. PIPING SPECIALTIES
				1. Plastic Dilution Traps:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2947) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[IPEX USA LLC](http://www.specagent.com/Lookup?uid=123457150547).

[Orion Fittings; A Watts Water Technologies Company](http://www.specagent.com/Lookup?uid=123457150550).

[Zurn Industries, LLC](http://www.specagent.com/Lookup?uid=123457150552).

Or equal.

Source Limitations: Obtain traps from single source from single manufacturer.

Material: Corrosion-resistant PP, with removable base.

End Connections: Mechanical joint.

Dilution Tanks: 1-gal. capacity, with clear base unless colored base is indicated; with two 1-1/2 inch top inlets and one 1-1/2 inch side outlet.

Small Dilution Jars: 1-pint capacity, with clear base unless colored base is indicated; with 1-1/2 inch top inlet and 1-1/2 inch side outlet.

Large Dilution Jars: 1-quart capacity; with 1-1/2 inch top inlet and 1-1/2 inch side outlet.

* + - * 1. Glass, Drain-Line, Interceptor Traps:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2950) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Schott North America, Inc](http://www.specagent.com/Lookup?uid=123457150553).

Or equal.

Source Limitations: Obtain traps from single source from single manufacturer.

Standard: ASTM C1053 “Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent Applications”.

Type: Drum trap.

Size: 1-1/2 inch, 2 inch by 1-1/2 inch, or 2 inch, as required to match connecting piping.

* + - * 1. Corrosion-Resistant Traps:

Type: P-trap or drum trap.

Size: 1-1/2 inch or 2 inch, as required to match connected piping.

High-Silicon Iron: ASTM A861 “Standard Specification for High-Silicon Iron Pipe and Fittings”, with horizontal outlet and hub-and-plain or plain ends to match connecting piping.

PP: ASTM D4101 “Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials”, with mechanical-joint pipe connections.

PVDF: ASTM D3222 “Standard Specification for Unmodified Poly Molding Extrusion and Coating Materials”, with mechanical-joint pipe connections.

Glass: ASTM C1053 “Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent Applications”, with coupling pipe connections.

Copy and revise "Stainless Steel Floor Drains" paragraph below for each type of stainless steel floor drain. Insert drawing designation for each product required. Use these designations on Drawings to identify each product. If only one type is required, drawing designation may be omitted.

* + - * 1. Stainless Steel Floor Drains <**Insert drawing designation**>:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2953) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Josam Company](http://www.specagent.com/Lookup?uid=123457150555).

[Sioux Chief Manufacturing Company, Inc](http://www.specagent.com/Lookup?uid=123457150556).

Or equal.

Source Limitations: Obtain floor drains from single source from single manufacturer.

Standard: ASME A112.3.1 “Stainless Steel Drainage Systems for Sanitary DMV, Storm, and Vacuum Applications Above & Below Ground”; ASTM A666 “Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar”, Type 316L.

Body: With [**8.5-by-8.5-inch**] [**12.4-by-12.4-inch**] top with grate.

Outlet: Bottom, of size indicated.

Copy and revise "PP Floor Drains" paragraph below for each type of PP floor drain. Insert drawing designation for each product required. Use these designations on Drawings to identify each product. If only one type is required, drawing designation may be omitted.

* + - * 1. PP Floor Drains <Insert drawing designation>:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2954) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[IPEX USA LLC](http://www.specagent.com/Lookup?uid=123457150557).

[Orion Fittings; A Watts Water Technologies Company](http://www.specagent.com/Lookup?uid=123457150562).

[WATTS; A Watts Water Technologies Company](http://www.specagent.com/Lookup?uid=123457150560).

[Zurn Industries, LLC](http://www.specagent.com/Lookup?uid=123457150564).

Or equal.

Source Limitations: Obtain floor drains from single source from single manufacturer.

Body: With 7- to 9-inch top diameter, with flashing flange and weep holes; and with [**flashing clamp**] [**basket strainer**] [**funnel attachment**] [**and**] [**trap-primer connection**].

Outlet: Bottom, to match connecting pipe, with 2 inch, 3 inch, 4 inch, or 6 inch outlet as indicated.

* + - * 1. Stainless Steel Cleanouts:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2956) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Josam Company](http://www.specagent.com/Lookup?uid=123457150565).

[Sioux Chief Manufacturing Company, Inc](http://www.specagent.com/Lookup?uid=123457150566).

Or equal.

Source Limitations: Obtain cleanouts from single source from single manufacturer.

Standard: ASME A112.3.1 “Stainless Steel Drainage Systems for Sanitary DMV, Storm, and Vacuum Applications Above & Below Ground”; ASTM A666 “Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar”, Type 316L.

Aboveground Piping: Cleanout tee of size matching piping.

Underground and Underslab Piping: Floor access cleanout of size matching piping.

Valves in "Plastic Backwater Valves" paragraph below are available in NPS 3 (DN 80) only.

* + - * 1. Plastic Backwater Valves:

Description: Full-port 3 inch check valve, PP or PVDF, matching or compatible with system piping and compatible with system liquid, with EPDM seals and flanged ends.

Exception: PVC material for use with PVC piping systems.

* + - * 1. PP Sink Outlets:

Description: 1-1/2 inch, with clamping device, stopper, and 7-inch- high overflow fitting.

* + - * 1. Glass Sink Outlets:

Description: 1-1/2 inch; with sink assembly of outlet, strainer, gasket, and locknut; overflow fitting of length indicated; and tailpiece assembly of borosilicate glass and locknut.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2959) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Schott North America, Inc](http://www.specagent.com/Lookup?uid=123457150595).

Or equal.

Source Limitations: Obtain sink outlets from single source from single manufacturer.

Standard: ASTM C1053 “Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent Applications” components for field assembly.

* + - 1. NEUTRALIZATION TANKS

Copy and revise "Plastic Neutralization Tanks" paragraph below for each type of plastic neutralization tank. Insert drawing designation for each product required. Use these designations on Drawings to identify each product. If only one type is required, drawing designation may be omitted.

* + - * 1. Plastic Neutralization Tanks <**Insert drawing designation**>

Description: Corrosion-resistant plastic materials; with removable, gastight cover; interior, sidewall, dip-tube inlet; outlet; vent; and threaded or flanged, sidewall pipe connections.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2960) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[IPEX USA LLC](http://www.specagent.com/Lookup?uid=123457150568).

[Orion Fittings; A Watts Water Technologies Company](http://www.specagent.com/Lookup?uid=123457150573).

[WATTS; A Watts Water Technologies Company](http://www.specagent.com/Lookup?uid=123457150572).

[Zurn Industries, LLC](http://www.specagent.com/Lookup?uid=123457150575).

Or equal.

Source Limitations: Obtain tanks from single source from single manufacturer.

Material: [HDPE] [HDPE or ASTM D4101 PP] [ASTM D4101 PP].

Tank Capacity: <**Insert capacity**>.

Retain "Dip Tube" or "Extension" subparagraph below, or both, if required.

Dip Tube: On outlet pipe instead of inlet pipe.

Extension: HDPE, PE, or PP.

Traffic Cover: [Light-duty] [Heavy-duty pedestrian or light-duty vehicular, steel plate over] plastic, bolted.

Retain "Limestone" or "Dolomitic Limestone" subparagraph below. Retain second subparagraph for chemical wastes with high sulfuric acid content.

Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch diameter.

Dolomitic Limestone: Chips or lumps, with more than 90 percent combined magnesium carbonate and calcium carbonate content and 1- to 3-inch diameter.

Copy and revise "Ceramic Neutralization Tanks" paragraph below for each type of ceramic neutralization tank. Insert drawing designation for each product required. Use these designations on Drawings to identify each product. If only one type is required, drawing designation may be omitted.

* + - * 1. Ceramic Neutralization Tanks <**Insert drawing designation**>

Description: Corrosion-resistant, cast-ceramic shell; with removable, reinforced-plastic, gastight cover; inlet; interior, sidewall, dip-tube outlet; vent; and bell, sidewall pipe connections.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2961) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Koch Knight LLC](http://www.specagent.com/Lookup?uid=123457150576).

Or equal.

Source Limitations: Obtain tanks from single source from single manufacturer.

Tank Capacity: <**Insert capacity**>.

Retain "Extension, Ceramic" or "Extension, Steel" subparagraph below if required.

Extension, Ceramic: Of size and length indicated, and with cast-iron manhole frame and cover.

Extension, Steel: With protective coating, 28-inch diameter, and cast-iron manhole frame and cover.

Retain "Limestone" or "Dolomitic Limestone" subparagraph below. Retain second subparagraph for chemical wastes with high sulfuric acid content.

Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch diameter.

Dolomitic Limestone: Chips or lumps, with more than 90 percent combined magnesium carbonate and calcium carbonate content and 1- to 3-inch diameter.

Tanks in "Collection Tanks" paragraph below can be made of other materials, such as stainless steel, PE, and fiberglass.

* + - * 1. Collection Tanks: Corrosion-resistant, cast-ceramic shell. Include removable, reinforced-plastic, gastight cover; inlet; vent; and bell, sidewall pipe connections.

Extension: [**Ceramic**] [**Steel with protective coating**], 28-inch minimum diameter, and cast-iron manhole frame and cover.

* + - 1. NEUTRALIZATION SYSTEMS

Copy and revise "Plastic-Tank Neutralization Systems" paragraph below for each type of plastic-tank neutralization system. Insert drawing designation for each system required. Use these designations on Drawings to identify each system. If only one type is required, drawing designation may be omitted.

* + - * 1. Plastic-Tank Neutralization Systems <**Insert drawing designation**>

Description: Automatic system for neutralizing chemical waste.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2962) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Orion Fittings; A Watts Water Technologies Company](http://www.specagent.com/Lookup?uid=123457150579).

[Zurn Industries, LLC](http://www.specagent.com/Lookup?uid=123457150581).

Or equal.

Source Limitations: Obtain neutralization systems from single source from single manufacturer.

Revise "Controls" subparagraph below for system components.

Controls: Factory wired and tested, 120 V ac, to operate probes, control valves, and metering pumps and to monitor pH of effluent; with wiring and electrical-power terminals.

Panel: NEMA 250 “Enclosures for Electrical Equipment”, Type 4X enclosure unless otherwise indicated; with manufacturer's standard features, control devices, and indicators, but not less than the following:

Power light and on/off switch.

pH analyzer with meter and high- and low-pH indicators.

Low caustic- and acid-solution level indicators.

Alarm horn with silencer and reset switch.

Agitator running light with on/off switch.

Running lights with on/off switches for caustic- and acid-solution pumps.

Recorder in first subparagraph below is available but is not a standard feature; retain if required.

Strip chart recorder with capacity for 30-day record.

Piping between Tanks: Same material as chemical-waste piping system unless otherwise indicated.

Interceptor Tank: Same material as mixing tank; with removable, gastight cover and sidewall inlet and outlet piping connections.

Neutralization Tank: Same material as mixing tank; with removable, gastight cover, sidewall inlet and outlet piping connections, and vent connection in sidewall or top.

Retain "Limestone" or "Dolomitic Limestone" subparagraph below. Retain second subparagraph for chemical wastes with high sulfuric acid content.

Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch diameter.

Dolomitic Limestone: Chips or lumps, with more than 90 percent combined magnesium carbonate and calcium carbonate content and 1- to 3-inch diameter.

Mixing Tank: With removable, gastight cover, sidewall inlet and outlet piping connections, vent connection in sidewall or top, neutralizing-solution piping connections, and openings in top for probe and agitator.

Material: [**HDPE**] [**HDPE or ASTM D4101 PP**] [**ASTM D4101 PP**].

pH Probe: Type and length suitable for mixing-tank size.

Agitator: Electric, with stainless steel shaft and propeller.

Caustic-Solution Storage Tank: PP.

Caustic Chemical: Sodium hydroxide solution.

Acid Storage Tank: PP.

Acid Chemical: Sulfuric acid solution.

Metering Pumps: Types suitable for neutralizing solutions.

Sampling Tank: Same material as mixing tank; with removable, gastight cover, sidewall inlet and outlet piping connections, and opening in top for probe.

pH probe: Type and length suitable for sampling-tank size.

Copy and revise "Ceramic-Tank Neutralization Systems" paragraph below for each type of ceramic-tank neutralization system. Insert drawing designation for each system required. Use these designations on Drawings to identify each system. If only one type is required, drawing designation may be omitted.

* + - * 1. Ceramic-Tank Neutralization Systems <**Insert drawing designation**>:

Description: Automatic system for neutralizing chemical waste.

[Manufaturers:](http://www.specagent.com/Lookup?ulid=2964) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Koch Knight LLC](http://www.specagent.com/Lookup?uid=123457150596).

Or equal.

Source Limitations: Obtain neutralization systems from single source from single manufacturer.

Revise "Controls" subparagraph below for system components.

Controls: Factory wired and tested, 120 V ac, to operate probes, control valves, and metering pumps and to monitor pH of effluent; with wiring and electrical-power terminals.

Panel: NEMA 250, Type 4X enclosure unless otherwise indicated; with manufacturer's standard features, control devices, and indicators, but not less than the following:

Power light and on/off switch.

pH analyzer with meter and high- and low-pH indicators.

Low caustic- and acid-solution level indicators.

Alarm horn with silencer and reset switch.

Agitator running light with on/off switch.

Running lights with on/off switches for caustic- and acid-solution pumps.

Recorder in first subparagraph below is available but is not a standard feature; retain if required.

Strip chart recorder with capacity for 30-day record.

Piping between Tanks: Same material as chemical-waste piping system unless otherwise indicated.

Interceptor Tank: Same material as mixing tank; with removable, gastight cover and sidewall inlet and outlet piping connections.

Neutralization Tank: Same material as mixing tank; with removable, gastight cover, sidewall inlet and outlet piping connections, and vent connection in sidewall or top.

Retain "Limestone" or "Dolomitic Limestone" subparagraph below. Retain second subparagraph for chemical wastes with high sulfuric acid content.

Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch diameter.

Dolomitic Limestone: Chips or lumps, with more than 90 percent combined magnesium carbonate and calcium carbonate content and 1- to 3-inch diameter.

Mixing Tank: With removable, gastight cover, sidewall inlet and outlet piping connections, vent connection in sidewall or top, neutralizing-solution piping connections. and openings in top for probe and agitator.

Material: Clay, vitrified into ceramic unit.

pH Probe: Type and length suitable for mixing tank size.

Agitator: Electric, with stainless steel shaft and propeller.

Caustic-Solution Storage Tank: PP.

Caustic Chemical: Sodium hydroxide solution.

Acid Storage Tank: PP.

Acid Chemical: Sulfuric acid solution.

Metering Pumps: Types suitable for neutralizing solutions.

Sampling Tank: Same material as mixing tank; with removable, gastight cover, sidewall inlet and outlet piping connections, and opening in top for probe.

pH probe: Type and length suitable for sampling-tank size.

* + - 1. MANHOLES - HOLDING TANKS

No standard was found that covers PE tanks. Revise this article for a complete description of tanks or detail on Drawings.

* + - * 1. Description: ASTM F1759 “Standard Practice for Design of High-Density Polyethylene Manholes for Subsurface Applications”, fabricated from PE components. Include bottom, sidewalls, and top sections; corrosion-resistant, tanks frame and cover; fusion or other watertight joints; and design to prohibit flotation.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=2966) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[PolyPipe Brand; Dura-Line](http://www.specagent.com/Lookup?uid=123457150586).

[Zurn Industries, LLC](http://www.specagent.com/Lookup?uid=123457150587).

Or equal.

* + - * 1. Source Limitations: Obtain holding tanks from single source from single manufacturer.
				2. Construction: [Single wall] [Double wall with interstitial space].
				3. Bottom: Channeled.
				4. Connections: Inlets and outlet matching or suitable for piping.
				5. Steps: Manufacturer's standard, fusion welded to sidewall. Omit steps for manholes less than [**60 inches**] <**Insert dimension**> deep.
				6. Top: Include 24-inch nominal-diameter frame and cover.
			1. LEAK-DETECTION SYSTEMS

Copy and revise this article for each type of leak-detection system. Insert drawing designation for each system required. Use these designations on Drawings to identify each system. If only one type is required, drawing designation may be omitted.

* + - * 1. Leak-Detection Systems <**Insert drawing designation**>.

Description: Cable leak-detection system capable of detecting and annunciating fluid leaks; with controls, panel, wiring, cable sensors, probes if required, and piping.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2967) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Asahi/America](http://www.specagent.com/Lookup?uid=123457150517).

[IPEX USA LLC](http://www.specagent.com/Lookup?uid=123457150522).

[PermAlert](http://www.specagent.com/Lookup?uid=123457150519).

Or equal.

Source Limitations: Obtain leak-detection systems from single source from single manufacturer.

Annunciator Panel: Enclosure with visual and audible alarms and leak-location indicator.

Sensors: Electric cable, suitable for insertion in double-containment piping annular space, with capability of detecting fluid leaks and signaling locations of leaks.

1. EXECUTION
	* + 1. CONCRETE BASES
				1. Equipment Mounting:

Retain first subparagraph below to require equipment to be installed on cast-in-place concrete equipment bases.

Install [**neutralization tanks**] [**and**] [**neutralization system tanks**] on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

Retain one of two subparagraphs below. Retain first for projects in seismic areas; retain second for projects not in seismic areas. Indicate vibration isolation and seismic-control device type and minimum deflection in supported equipment schedule on Drawings.

Comply with requirements for vibration isolation and seismic-control devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."

Revise paragraph below based on equipment to be installed. Retain only products to be installed on the floor. Indicate dowel rod quantity, size, and spacing on Drawings.

* + - * 1. Anchor [**neutralization tanks] [and] [neutralization system tanks**] to concrete bases.

Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 19-inch centers around full perimeter of base.

For installed equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be imbedded.

Install anchor bolts to elevations required for proper attachment to supported equipment.

* + - 1. PIPING INSTALLATION

Retain installation requirements in this article for pipe and fitting materials that match materials retained in Part 2.

* + - * 1. Chemical-Waste Sewerage Outside the Building:

Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground chemical-waste sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for using lubricants, cements, and other installation requirements.

Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or combination of both.

Install drainage piping pitched down in direction of flow, at minimum slope of [**1**] [**2**] <**Insert number**> percent unless otherwise indicated.

Install drainage piping with [**36-inch**] [**48-inch**] [**60-inch**] [**72-inch**] <Insert dimension> minimum cover.

Install CPVC drainage piping in accordance with ASTM D2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications” and ASTM F1668 “Standard Guide for Construction Procedures for Buried Plastic Pipe”.

Install PVDF drainage piping in accordance with ASTM D2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications” and ASTM F1668 “Standard Guide for Construction Procedures for Buried Plastic Pipe”.

Install field-fabrication containment piping over[**new and**] existing carrier piping. Use containment piping manufacturer's fastening system.

Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain a swab or drag inside piping and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

* + - * 1. Chemical-Waste Piping Inside the Building:

Install piping adjacent to equipment, accessories, and specialties, to allow space for service and maintenance.

Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used unless otherwise indicated.

Flanges may be used on aboveground piping unless otherwise indicated.

Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

Install piping at indicated slopes.

Install piping free of sags and bends.

Install fittings for changes in direction and branch connections.

Verify final equipment locations for roughing-in.

Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Retain first subparagraph below for piping that penetrates an exterior concrete wall or concrete slab.

Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

* + - 1. PIPING SPECIALTY INSTALLATION
				1. Embed floor drains in 4-inch- minimum depth of concrete around bottom and sides. Comply with requirements in Section 033000 "Cast-in-Place Concrete" for concrete.
				2. Fasten grates to drains if indicated.
				3. Set floor drains with tops flush with pavement surface.
				4. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use fittings of same material as sewer pipe at branches for cleanouts and riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in pipe.

Set cleanout bodies in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade. Set cleanout plugs in concrete pavement, with tops flush with pavement surface. Comply with requirements in Section 033000 "Cast-in-Place Concrete" for formwork, reinforcement, and concrete requirements.

* + - * 1. Install backwater valves in horizontal position. Include riser to cleanout at grade.
			1. JOINT CONSTRUCTION

Retain connection requirements in this article for pipe and fitting materials that match materials retained in Part 2.

* + - * 1. Chemical-Waste Sewerage Outside the Building:

Plastic-Piping Fusion Joints: Make PP drainage-piping joints in accordance with ASTM F1290 “Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings”.

Join dissimilar pipe materials with adapters compatible with pipe materials being joined.

* + - * 1. Chemical-Waste Piping Inside the Building:

Plastic-Piping Fusion Joints: Make PP drainage-piping joints in accordance with ASTM F1290 “Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings”.

Dissimilar-Material Piping Joints: Make joints using adapters compatible with both system materials.

* + - 1. HANGER AND SUPPORT INSTALLATION

Piping supports must account for expansion and contraction, vibration, and dead load of piping and its contents. Verify actual loads and consult structural engineer.

Hanger spacing for plastic piping is based on normal maximum operating temperatures for piping materials. Some piping may require continuous support.

* + - * 1. Pipe sizes in this article refer to aboveground single-wall piping[**and carrier piping of containment piping**].
				2. Comply with requirements in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
				3. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices. Install the following:

Vertical Piping: MSS Type 8 or MSS Type 42 riser clamps.

Individual, Straight, Horizontal Piping Runs:

100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

Base of Vertical Piping: MSS Type 52 spring hangers.

* + - * 1. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for installation of supports.
				2. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
				3. Support vertical piping and tubing at base and at each floor.
				4. Rod diameter may be reduced one size for double-rod hangers, to minimum of 3/8 inch.

Maximum spans in remainder of this article were taken from MSS SP-58 for water service, from model plumbing codes, and from manufacturers' literature. The most restrictive spacing dimensions are indicated. Revise spacing to suit Project.

* + - * 1. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:

Spacing for PP piping is based on 180 deg F (82 deg C) maximum.

2 inch: 33 inches with 3/8-inch rod.

2-1/2 inch and 3 inch: 42 inches with 1/2-inch rod.

4 inch and 5 inch: 48 inches with 5/8-inch rod.

6 inch: 48 inches with 3/4-inch rod.

8 inch: 48 inches with 7/8-inch rod.

* + - * 1. Install supports for vertical PP piping every 72 inches.

Spacing for CPVC piping is based on 200 deg F (90 deg C) maximum.

* + - * 1. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1-1/2 inch and 2 inch: 36 inches with 3/8-inch rod.

2-1/2 inch and 3 inch: 42 inches with 1/2-inch rod.

4 inch and 5 inch: 48 inches with 5/8-inch rod.

6 inch: 48 inches with 3/4-inch rod.

8 inch to 12 inch: 48 inches with 7/8-inch rod.

* + - * 1. Install supports for vertical CPVC piping every 48 inches.
				2. Install vinyl-coated hangers for PVDF piping with the following maximum horizontal spacing and minimum rod diameters:

All Sizes: Install continuous support for piping with liquid waste at temperatures above 140 deg F.

Spacing for PVDF piping is based on 140 deg F (60 deg C) maximum.

1/4 inch and Smaller: 30 inches with 3/8-inch rod.

3/4 inch to 1-1/2 inch: 36 inches with 3/8-inch rod.

2 inch: 36 inches with 3/8-inch rod.

2-1/2 inch and 3 inch: 42 inches with 1/2-inch rod.

4 inch and 5 inch: 48 inches with 5/8-inch rod.

6 inch: 48 inches with 3/4-inch rod.

* + - * 1. Install supports for vertical PVDF piping 1-1/2 inch every 48 inches and 2 inch and larger every 72 inches.
				2. Install hangers for stainless steel drainage piping with the following maximum horizontal spacing and minimum rod diameters:

2 inch: 10 feet with 3/8-inch rod.

2-1/2 inch: 11 feet with 1/2-inch rod.

3 inch: 12 feet with 1/2-inch rod.

4 inch and 5 inch: 12 feet with 5/8-inch rod.

6 inch: 12 feet with 3/4-inch rod.

* + - * 1. Install supports for vertical, stainless steel drainage piping every 15 feet.
				2. Install vinyl-coated hangers for glass piping with the following maximum horizontal spacing and minimum rod diameters:

1 inch and 1-1/4: 72 inches with 3/8-inch rod.

1-1/2 inch and 2 inch: 96 inches with 3/8-inch rod.

3 inch: 96 inches with 1/2-inch rod.

4 inch and 6 inch: 96 inches with 5/8-inch rod.

* + - * 1. Install supports for vertical glass piping every 96 inches.
				2. Support piping and tubing not listed above in accordance with MSS SP-58 “Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation”.
			1. NEUTRALIZATION TANK INSTALLATION
				1. Install exterior [**collection**] [**and**] [**neutralization**] tanks, complete with appurtenances indicated.

Set tops of tank covers flush with finished surface where covers occur in pavements. Set covers 3 inches above finished surface elsewhere unless otherwise indicated.

Include initial fill of limestone for neutralization tanks.

* + - * 1. Install interior neutralization tanks on smooth and level [**concrete base**] [**floor surface**]. Include full initial charge of limestone.
			1. NEUTRALIZATION SYSTEM INSTALLATION
				1. Install neutralization systems on smooth and level [**concrete base**] [**floor surface**]. Include neutralizing solutions and full initial charge of limestone.
			2. MANHOLE - HOLDING TANK INSTALLATION
				1. General: Install tanks, complete with appurtenances and accessories indicated.
				2. Set tops of tank frames and covers flush with finished surface where tanks occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.
			3. LEAK-DETECTION SYSTEM INSTALLATION

Revise this article as required for leak-detection systems. Revise paragraphs for special system requirements.

Installation in "Single-Pipe, Chemical-Waste Sewerage Piping" paragraph below will be only marginally better than that for no leak-detection system. Double-containment piping is recommended.

* + - * 1. Single-Pipe, Chemical-Waste Sewerage Piping: Install leak-detection system below piping.
				2. Double-Containment Piping: Install leak-detection system in piping annular space.

Installation in "Tanks" paragraph below will be only marginally better than that for no leak-detection system. Double-containment manholes may be available and, if so, installation between manhole sidewalls is recommended.

* + - * 1. Tanks: Install leak-detection system around bottom of exterior.
				2. Install panel in location indicated.
			1. CONCRETE PLACEMENT
				1. Comply with requirements in Section 033000 "Cast-in-Place Concrete" for concrete supports.
				2. Place cast-in-place concrete in accordance with ACI 318/318R “Building Code Requirements for Structural Concrete and Commentary”.
			2. PIPING CONNECTIONS

Coordinate piping installations and specialty arrangements with Drawings and with requirements specified. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Drawings indicate general arrangement of piping, fittings, and specialties.
				2. Make connections to existing piping, so finished Work complies as nearly as practical with requirements specified for new Work.
				3. Use commercially manufactured wye fittings for sewerage piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of [**3000 psi**] <**Insert value**>.
				4. Protect existing piping to prevent concrete or debris from entering while making connections. Remove debris or other extraneous material that may accumulate.
				5. Where installing piping adjacent to equipment, allow space for service and maintenance.
			1. LABELING AND IDENTIFICATION
				1. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for labeling of equipment and piping.

Use [**warning tape or**]detectable warning tape over ferrous piping.

Use detectable warning tape over nonferrous piping and over edges of underground structures.

* + - 1. ADJUSTING
				1. Adjust neutralization-system set points.
				2. Adjust leak-detection-system control and device settings.
			2. CLEANING
				1. Use procedures prescribed by authorities having jurisdiction or, if not prescribed, use procedures described below:

Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

Clean piping by flushing with potable water.

* + - 1. STARTUP SERVICE
				1. Engage a Company Field Advisor to perform startup service for [**neutralization systems**] [**and**] [**leak-detection systems**].

Complete installation and startup checks according to manufacturer's written instructions.

Neutralization Systems:

Verify that neutralization system is installed and connected according to the Contract Documents.

Verify that electrical wiring installation complies with manufacturer's submittal.

Install neutralizing solutions and limestone.

Energize circuits.

Start and run systems through complete sequence of operations.

Adjust operating controls.

<**Insert startup steps if any**>.

Leak-Detection Systems:

Verify that electrical wiring installation complies with manufacturer's submittal.

Energize circuits.

Adjust operating controls.

<**Insert startup steps if any**>.

* + - 1. FIELD QUALITY CONTROL
				1. Inspect interior of sewerage piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place and again at completion of Project.

Defects requiring correction include the following:

Alignment: Less than full diameter of inside of pipe is visible between inspection points.

Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

Crushed, broken, cracked, or otherwise damaged piping.

Retain "Hydrostatic Tests for Drainage Piping" or "Air Tests for Drainage Piping" subparagraph below.

Hydrostatic Tests for Drainage Piping:

Allowable leakage is a maximum of [**50 gal./inch of nominal pipe size per mile**] <**Insert value**> of pipe during 24-hour period.

Close openings in system and fill with water.

Purge air and refill with water.

Disconnect water supply.

Test and inspect joints for leaks.

Air Tests for Drainage Piping: Comply with UNI-B-6 “Recommended Practice of Low-Pressure Air Testing of Installed Sewer Pipe”.

Leaks and loss in test pressure constitute defects that must be repaired.

Submit separate reports for each test.

* + - * 1. Replace leaking sewerage piping using new materials and repeat testing until leakage is within allowances specified.

Retain "Testing Agency," "Manufacturer's Field Service," "Perform tests and inspections," or "Tests and Inspection" paragraphs below. Retain first option in first paragraph if Director’s Representative will hire an independent testing agency.

* + - * 1. Testing Agency: Director’s Representative will engage a qualified testing agency to perform tests and inspections.

Retain "Manufacturer's Field Service" paragraph below to require a Company Service Advisor to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a Company Field Advisor to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform tests and inspections" paragraph below to require Contractor to perform tests and inspections and retain option to require Contractor to arrange for the assistance of a Company Service Advisor.

* + - * 1. Perform tests and inspections with the assistance of a Company Field Advisor.

Retain "Tests and Inspections" paragraph below with any combination of paragraphs above.

* + - * 1. Tests and Inspections:

Manufacturer's Field Service: Engage a Company Field Advisor to inspect assembled [**neutralization systems**] [**and**] [**leak-detection systems**] and their installation, including piping and electrical connections, and to assist in testing.

Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

* + - * 1. Chemical-waste piping will be considered defective if it does not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. DEMONSTRATION
				1. Engage a Company Field Advisor to trainDirector’s Representative's Facility’s maintenance personnel to adjust, operate, and maintain [**neutralization systems**] [**and**] [**leak-detection systems**].
			2. PIPING SCHEDULE

Retain this article if more than one piping material is required and is specified in Part 2.

Retain and revise applicable piping applications. Coordinate with materials specified in Part 2.

* + - * 1. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below unless otherwise indicated.

Retain " any of" option in "Single-Wall, Chemical-Waste Sewerage Piping" paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Single-Wall, Chemical-Waste Sewerage Piping: Use[**any of**] the following piping materials for each size range:

Retain one or more of first nine subparagraphs below. Verify availability of materials in sizes listed. If more than one type of material and joining method is used, identify various materials on Drawings and indicate points of transition from one material to another.

Piping in first two subparagraphs below is unavailable in NPS 1-1/2 (DN 40).

2 inch to 4 inch: Stainless steel drainage pipe and fittings and gasketed joints.

1-1/2 inch to 4 inch: PP drainage pipe and fittings and fusion joints.

1-1/2 inch to 4 inch: CPVC drainage pipe and fittings and solvent-cemented joints.

1-1/2 inch to 4 inch: PVDF drainage pipe and fittings and fusion joints.

Piping in first subparagraph below may not be available in NPS 1-1/2 (DN 40).

2 inch to 4 inch: [**Centrifugally cast**] [**Filament-wound**] fiberglass pipe and fittings and [**butt-and-wrap**] [**bonded**] joints.

1-1/2 inch to 4 inch: Glass pipe and fittings and coupled joints.

Retain one or more of eight subparagraphs below. Verify availability of materials in sizes listed. If more than one type of material and joining method is used, identify various materials on Drawings and indicate points of transition from one material to another.

6 inch: Stainless steel drainage pipe and fittings and gasketed joints.

6 inch: PP drainage pipe and fittings and fusion joints.

6 inch: PVDF drainage pipe and fittings and fusion joints.

6 inch: [**Centrifugally cast**] [**Filament-wound**] fiberglass pipe and fittings and [**butt-and-wrap**] [**bonded**] joints.

6 inch: Glass pipe and fittings and coupled joints.

Retain one or more of three subparagraphs below. Verify availability of materials in sizes listed. If more than one type of material and joining method is used, identify various materials on Drawings and indicate points of transition from one material to another.

8 inch to 12 inch: PP drainage pipe and fittings and fusion joints.

8 inch to 12 inch: PVDF drainage pipe and fittings and fusion joints.

8 inch to 12 inch: [**Centrifugally cast**] [**Filament-wound**] fiberglass pipe and fittings and [**butt-and-wrap**] [**bonded**] joints.

Retain " any of" option in "Underground, Double-Containment, Chemical-Waste Sewerage Piping" paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Underground, Double-Containment, Chemical-Waste Sewerage Piping: Use[**any of**] the following piping materials for each size range:

Retain one or more of four subparagraphs below. Verify availability of materials in sizes listed. If more than one type of material is used, identify various materials on Drawings and indicate points of transition from one material to another.

2 inch to 12 inch: PP double-containment drainage pipe and fittings.

2 inch to 12 inch: CPVC double-containment drainage pipe and fittings.

2 inch to 12 inch: PVDF double-containment drainage pipe and fittings.

2 inch to 12 inch: PVDF/CPVC double-containment drainage pipe and fittings.

Retain " any of" option in "Aboveground Chemical-Waste Piping" paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground Chemical-Waste Piping: Use[**any of**] the following piping materials for each size range:

Retain one or more of five subparagraphs below. Verify availability of materials in sizes listed. If more than one type of material and joining method is used, identify various materials on Drawings and indicate points of transition from one material to another.

1-1/2 inch to 6 inch: PP drainage piping and [**fusion**] [**mechanical**] joints.

Piping in first subparagraph below is available in NPS 1-1/4 (DN 32) if required.

1-1/2 inch to 6 inch: CPVC drainage piping and solvent-cemented joints.

1-1/2 inch to 6 inch: PVDF drainage piping and [**fusion**] [**mechanical**] joints.

Piping in first subparagraph below is limited to NPS 4 (DN 100) and smaller.

1-1/2 inch to 6 inch: Use 2 inch to 4 inch stainless steel drainage piping with socket-and-spigot ends and gasketed joints.

1-1/2 inch to 6 inch: Borosilicate glass pipe and fittings, couplings, and coupled joints.

Retain " any of" option in "Under Slab-on-Grade, Indoor, Chemical-Waste Piping" paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Under Slab-on-Grade, Indoor, Chemical-Waste Piping: Use[**any of**] the following piping materials for each size range:

Retain one or more of first five subparagraphs below. Verify availability of materials in sizes listed. If more than one type of material and joining method is used, identify various materials on Drawings and indicate points of transition from one material to another.

1-1/2 inch to 6 inch: PP drainage piping and fusion joints.

1-1/2 inch to 6 inch: PVDF drainage piping and fusion joints.

1-1/2 inch to 6 INCH: Stainless steel drainage piping with socket-and-spigot ends and gasketed joints.

1-1/2 inch to 6 inch: Borosilicate glass piping with covering, couplings, and coupled joints.

1-1/2 inch to 6 inch: [**PP**] [**PVDF**], double-containment drainage piping and manufacturer's standard joints.

Retain subparagraph below. Verify availability of materials in sizes listed. If more than one type of material and joining method is used, identify various materials on Drawings and indicate points of transition from one material to another.

8 inch: [**PP**] [**PVDF**], double-containment drainage piping and manufacturer's standard joints.

END OF SECTION 226600