SECTION 221413 - FACILITY STORM DRAINAGE PIPING

TIPS:

To view non-printing Editor's Notes that provide guidance for editing, click on MasterWorks/Single-File Formatting/Toggle/Editor's Notes.

To read detailed research, technical information about products and materials, and coordination checklists, click on MasterWorks/Supporting Information.

Content Requests:

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:

Hub-and-spigot, cast-iron soil pipe and fittings.

Hubless, cast-iron soil pipe and fittings.

Galvanized-steel pipe and fittings.

Ductile-iron pipe and fittings.

Copper tube and fittings.

ABS pipe and fittings.

PVC pipe and fittings.

Specialty pipe and fittings.

Encasement for underground metal piping.

* + - * 1. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

Section 221429 "Sump Pumps" for storm drainage pumps.

section 334400 “stormwater utility equipment” for storm drainage piping outside the building.

* + - 1. ACTION 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.

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

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

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

Retain "Shop Drawings" Paragraphparagraph below if retaining controlled-flow or siphonic roof drainage system.

* + - * 1. Shop Drawings: For [**controlled-flow**] [**siphonic**] roof drainage system. Include calculations, plans, and details.
			1. INFORMATIONAL SUBMITTALS

Retain "Coordination Drawings" Paragraphparagraph 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: Detail storm drainage piping. Show support locations, type of support, weight on each support, required clearances, 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:

Structural members to which drainage piping will be attached or suspended from.

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

* + - * 1. Field quality-control reports.
			1. QUALITY ASSURANCE
				1. Piping materials shall bear label, stamp, or other markings of specified testing agency.
			2. FIELD CONDITIONS

Retain this article if interruption of existing storm drainage service is required.

* + - * 1. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Director’s Representative or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

Notify [**Architect**] [**Construction Manager**] [**Director’s Representative**] no fewer than [**two**] <**Insert number**> days in advance of proposed interruption of storm drainage service.

Do not proceed with interruption of storm drainage service without [**Architect's**] [**Construction Manager's**] [**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. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

If using more than one type of material and joining method, identify various materials on Drawings and indicate points of transition from one material to another.

* + - 1. PERFORMANCE REQUIREMENTS
				1. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

Revise pressure ratings in "Storm Drainage Piping" and "Storm Drainage, Force-Main Piping" subparagraphs below to suit Project. Coordinate with Section 221423 "Storm Drainage Piping Specialties." Storm drainage piping may require higher rating if used in high-rise buildings.

Storm Drainage Piping: [**10-foot head of water (30 kPa)**] <**Insert pressure**>.

Storm Drainage, Force-Main Piping: [**50 psig (345 kPa)**] [**100 psig (690 kPa)**] [**150 psig (1035 kPa)**] <**Insert pressure**>.

* + - 1. HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=12635) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[AB & I Foundry; a part of the McWane family of companies](http://www.specagent.com/Lookup?uid=123457123658).

[Charlotte Pipe and Foundry Company](http://www.specagent.com/Lookup?uid=123457123659).

[Tyler Pipe; a part of McWane family of companies](http://www.specagent.com/Lookup?uid=123457123660).

Approved equivalent.

Pipe in "Pipe and Fittings" Paragraphparagraph below is available in NPS 2 to NPS 15 (DN 50 to DN 375).

* + - * 1. Pipe and Fittings:

Marked with CISPI collective trademark and NSF certification mark.

Class: ASTM A 74 “Standard Specification for Cast Iron Soil Pipe and Fittings”, [**Service**] [**and**] [**Extra Heavy**] class(es).

* + - * 1. Gaskets: ASTM C 564 “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings”, rubber.

Retain "Caulking Materials" Paragraphparagraph below if caulked joints are needed and if allowed by local authorities having jurisdiction.

* + - * 1. Caulking Materials: ASTM B 29 “Standard Specification for Refined Lead”, pure lead and oakum or hemp fiber.
			1. HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=12636) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[AB & I Foundry; a part of the McWane family of companies](http://www.specagent.com/Lookup?uid=123457123662).

[Charlotte Pipe and Foundry Company](http://www.specagent.com/Lookup?uid=123457123663).

[Tyler Pipe; a part of McWane family of companies](http://www.specagent.com/Lookup?uid=123457123664).

Approved equivalent.

Pipe in "Pipe and Fittings" Paragraphparagraph below is available in NPS 1-1/2 to NPS 15 (DN 40 to DN 375).

* + - * 1. Pipe and Fittings:

Marked with CISPI collective trademark and NSF certification mark.

Standard: ASTM A 888 “Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications “ or CISPI 301.

Retain one or more of three paragraphs below. If retaining more than one, indicate location of each on Drawings. Couplings in "CISPI, Hubless-Piping Couplings" Paragraphparagraph below are more economical than those in "Heavy-Duty, Hubless-Piping Couplings" Paragraphparagraph and are made in NPS 1-1/2 to NPS 15 (DN 40 to DN 375). They may be unsuitable for installation in corrosive soil.

* + - * 1. CISPI, Hubless-Piping Couplings:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2265) 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=123457123699).

[Ideal Tridon Group](http://www.specagent.com/Lookup?uid=123457123698).

[MIFAB, Inc](http://www.specagent.com/Lookup?uid=123457123694).

Approved equivalent.

Retain option in first subparagraph below if NSF certification mark is required. Not all coupling manufacturers offer third-party NSF certification. Consult manufacturers.

Couplings shall bear CISPI collective trademark[**and NSF certification mark**].

Some authorities having jurisdiction may have additional compliance requirements besides those specified below. Insert additional standards that are applicable because of Project location. Coordinate with authorities having jurisdiction and with manufacturers.

Standards: ASTM C 1277 and CISPI 310. <**Insert standard**>.

Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

Couplings in "Heavy-Duty, Hubless-Piping Couplings" Paragraphparagraph below are made in NPS 1-1/2 to NPS 15 (DN 40 to DN 375).

* + - * 1. Heavy-Duty, Hubless-Piping Couplings:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2266) 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=123457123709).

[Ideal Tridon Group](http://www.specagent.com/Lookup?uid=123457123708).

[MIFAB, Inc](http://www.specagent.com/Lookup?uid=123457123706).

Approved equivalent.

Some authorities having jurisdiction may have additional compliance requirements besides those specified below. Insert additional standards that are applicable because of Project location. Coordinate with authorities having jurisdiction and with manufacturers.

Standard: ASTM C 1540 “Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings”. <**Insert standard**>.

Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564 “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings”, rubber sleeve with integral, center pipe stop.

* + - 1. Cast Iron, Hubless Piping Couplings:
				1. Standard; ASTM C1277 “Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings”. <**Insert standard**>.
				2. Description: Two piece ASTM A 48/A 48M “Standard Specification for Gray Iron Castings”, cast iron housing; stainless steel bolts and nuts; and ASTM C 564 “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings”, rubber sleeve with integral, center pipe stop.

Couplings in "Cast-Iron, Hubless-Piping Couplings" Paragraphparagraph below are made in NPS 1-1/2 to NPS 10 (DN 40 to DN 250).

* + - 1. GALVANIZED-STEEL PIPE AND FITTINGS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=13026) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[U.S. Steel](http://www.specagent.com/Lookup?uid=123457123667).

[Wheatland Tube; Zekelman Industries](http://www.specagent.com/Lookup?uid=123457123666).

Approved equivalent.

Pipe in "Pipe" Paragraphparagraph below is available in NPS 1/8 to NPS 26 (DN 6 to DN 650).

* + - * 1. Pipe: ASTM A 53/A 53M, Type E “Standard Specification for Pipe, Steel, Black and Hot-Dipper, Zinc-Coated, Welded and Seamless”, Standard Weight class. Include square-cut-grooved or threaded ends matching joining method.

Fittings in "(Galvanized-)Cast-Iron Drainage Fittings" Paragraphparagraph below are available in NPS 1-1/4 to NPS 8 (DN 32 to DN 200).

* + - * 1. [**Galvanized-**]Cast-Iron Drainage Fittings: ASME B16.12 “Cast Iron Threaded Drainage Fittings”, threaded.
				2. Steel-Pipe Pressure Fittings:

Fittings in "(Galvanized-)Steel Pipe Nipples" Subparagraphsubparagraph below are available in NPS 1/8 to NPS 12 (DN 6 to DN 300).

[**Galvanized-**]Steel Pipe Nipples: ASTM A 733 “Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples”, made of ASTM A 53/A 53M “Standard Specification for Pipe, Steel, Black and Hot-Dipper, Zinc-Coated, Welded and Seamless” or ASTM A 106/A 106M “Standard Specification for Seamless Pressure Pipe”, Schedule 40, seamless steel pipe. Include ends matching joining method.

Fittings in "Malleable-Iron Unions" Subparagraphsubparagraph below are available in NPS 1/8 to NPS 4 (DN 6 to DN 100).

Malleable-Iron Unions: ASME B16.39 “Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300”; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.

Fittings in "(Galvanized-)Gray-Iron, Threaded Fittings" Subparagraphsubparagraph below are available in NPS 1/4 to NPS 12 (DN 8 to DN 300).

[**Galvanized-**]Gray-Iron, Threaded Fittings: ASME B16.4 “Gray Iron Threaded Fittings Classes 125 and 250”, Class 125, standard pattern.

Flanges in "Cast-Iron Flanges" Paragraphparagraph below are available in NPS 1 to NPS 96 (DN 25 to DN 2400).

* + - * 1. Cast-Iron Flanges: ASME B16.1 “Gray Iron Pipe Flanges and Flanges Fittings Classes 25, 125 and 250”, Class 125.

Flange Gasket Materials: ASME B16.21 “Nonmetallic Flat Gaskets for Pipe Flanges”, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

Flange Bolts and Nuts: ASME B18.2.1 “Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws”, carbon steel unless otherwise indicated.

Fittings and couplings in "Grooved-Joint, Galvanized-Steel-Pipe Appurtenances" Paragraphparagraph below are available in NPS 3/4 to NPS 24 (DN 20 to DN 600).

* + - * 1. Grooved-Joint, Galvanized-Steel-Pipe Appurtenances

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2269) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Apollo Valves; a part of Aalberts Integrated Piping Systems.

[Shurjoint; a part of Aalberts Integrated piping Systems](http://www.specagent.com/Lookup?uid=123457123713).

[Smith-Cooper International](http://www.specagent.com/Lookup?uid=123457123717).

Approved equivalent.

Galvanized, Grooved-End Fittings for Galvanized-Steel Piping: ASTM A 536 “Standard Specification for Ductile Iron Castings” ductile-iron castings, ASTM A 47 /A 47M “Standard Specification for Ferritic Malleable Iron Castings” malleable-iron castings, ASTM A 234/A 234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service” forged-steel fittings, or ASTM A 106 /A 106M “Standard Specification for Seamless Pressure Pipe” steel pipes with dimensions matching ASTM A 53/A 53M “Standard Specification for Pipe, Steel, Black and Hot-Dipper, Zinc-Coated, Welded and Seamless” steel pipe, and complying with AWWA C606 “Standard for Grooved and Shouldered Joints” for grooved ends.

Couplings in "Grooved Mechanical Couplings for Galvanized-Steel Piping" Subparagraphsubparagraph below are available in at least NPS 3/4 to NPS 24 (DN 20 to DN 600).

Grooved Mechanical Couplings for Galvanized-Steel Piping: ASTM F 1476 “Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications”, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber gasket suitable for hot and cold water; and bolts and nuts.

* + - 1. DUCTILE-IRON PIPE AND FITTINGS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=13027) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[American Cast Iron Pipe Company](http://www.specagent.com/Lookup?uid=123457123670).

[McWane Ductile](http://www.specagent.com/Lookup?uid=123457123671).

[U.S. Pipe, a Forterra company](http://www.specagent.com/Lookup?uid=123457123672).

Approved equivalent.

Retain one of three paragraphs below. Piping in "Ductile-Iron, Mechanical-Joint Piping" Paragraphparagraph below is available in NPS 3 to at least NPS 24 (DN 80 to at least DN 600).

* + - * 1. Ductile-Iron, Mechanical-Joint Piping:

Ductile-Iron Pipe: AWWA C151/A21.51 “Standard for Ductile-Iron Pipe, Centrifugally Cast”, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

Ductile-Iron Fittings: AWWA C110/A21.10 “Standard for Ductile-Iron and Gray-Iron Fittings”, mechanical-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53 “Standard for Ductile-Iron Compact Fittings”, ductile-iron compact pattern.

Glands, Gaskets, and Bolts: AWWA C111/A21.11 “Standard for Rubber-Gasket Joints for Ductile-iron Pressure Pipe and Fittings”, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

Piping in "Ductile-Iron, Push-on-Joint Piping" Paragraphparagraph below is available in NPS 3 to NPS 64 (DN 80 to DN 1600).

* + - * 1. Ductile-Iron, Push-on-Joint Piping:

Ductile-Iron Pipe: AWWA C151/A21.51 “Standard for Ductile-Iron Pipe, Centrifugally Cast”, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

Ductile-Iron Fittings: AWWA C110/A21.10 “Standard for Ductile-Iron and Gray-Iron Fittings”, push-on-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53 “Standard for Ductile-Iron Compact Fittings”, ductile-iron compact pattern.

Gaskets: AWWA C111/A21.11 “Standard for Rubber-Gasket Joints for Ductile-iron Pressure Pipe and Fittings”, rubber.

Pipe in "Ductile-Iron, Grooved-Joint Piping" Paragraphparagraph below is available in NPS 3 to NPS 64 (DN 80 to DN 1600).

* + - * 1. Ductile-Iron, Grooved-Joint Piping:

Ductile-Iron Pipe: AWWA C151/A21.51 “Standard for Ductile-Iron Pipe, Centrifugally Cast”, with round-cut-grooved ends according to AWWA C606 “Standard for Grooved and Shouldered Joints”.

Appurtenances in "Ductile-Iron, Grooved-End Pipe Appurtenances" Subparagraphsubparagraph below are available in NPS 4 to NPS 24 (DN 100 to DN 600).

Ductile-Iron, Grooved-End Pipe Appurtenances:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2271) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Apollo Valves; a part of Aalberts Integrated Piping Systems.

[Smith-Cooper International](http://www.specagent.com/Lookup?uid=123457123722).

[Victaulic Company](http://www.specagent.com/Lookup?uid=123457123721).

Approved equivalent.

Grooved-End, Ductile-Iron Fittings: ASTM A 536 “Standard Specification for Ductile Iron Castings”, ductile-iron castings with dimensions matching AWWA C110/A21.10 “Standard for Ductile-Iron and Gray-Iron Fittings”, ductile-iron pipe or AWWA C153/A21.53 “Standard for Ductile-Iron Compact Fittings”, ductile-iron fittings; complying with AWWA C606 “Standard for Grooved and Shouldered Joints” for grooved ends.

Couplings in "Grooved Mechanical Couplings for Ductile-Iron Pipe" Subparagraphsubparagraph below are available in NPS 4 to NPS 24 (DN 100 to DN 600). Other AWWA pipe size couplings in NPS 3 to NPS 36 (DN 80 to DN 900) are also available.

Grooved Mechanical Couplings for Ductile-Iron Pipe: ASTM F 1476 “Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications”, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber center-leg gasket suitable for hot and cold water; and bolts and nuts.

* + - 1. COPPER TUBE AND FITTINGS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=13030) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Apollo Valves; a part of Aalberts Integrated Piping Systems.

[Cerro Flow Products, LLC](http://www.specagent.com/Lookup?uid=123457123687).

[Wieland Copper Products, LLC](http://www.specagent.com/Lookup?uid=123457123689).

Approved equivalent.

Tube and fittings in first two paragraphs below are available in NPS 1-1/4 to NPS 8 (DN 32 to DN 200).

* + - * 1. Copper Type DWV Tube: ASTM B 306 “Standard Specification for Copper Drainage Tube”, drainage tube, drawn temper.
				2. Copper Drainage Fittings: ASME B16.23 “Cast Copper Alloy Solder Joint Drainage Fittings: DWV”, cast-copper fittings or ASME B16.29 “Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings- DMV”, wrought-copper, solder-joint fittings.

Tube and fittings in first three paragraphs below are available in NPS 1/4 to NPS 12 (DN 8 to DN 300); unions are available in NPS 1/2 to NPS 4 (DN 15 to DN 100).

* + - * 1. Hard Copper Tube: ASTM B 88 “Standard Specification for Seamless Copper Water Tube”, Type L (ASTM B 88M, Type B), water tube, drawn temper.
				2. Soft Copper Tube: ASTM B 88 “Standard Specification for Seamless Copper Water Tube”, Type L (ASTM B 88M, Type B), water tube, annealed temper.
				3. Copper Pressure Fittings:

Copper Fittings: ASME B16.18 “Cast Copper Alloy Solder Joint Pressure Fittings”, cast-copper-alloy fittings or ASME B16.22 “Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings”, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

Unions in subparagraph below are available in NPS 1/2 to NPS 4 (DN 15 to DN 100).

Copper Unions: MSS SP-123 “Non-Ferrous Threaded and Solder-Joint Unions for Use with Copper Water Tube”, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

Flanges in first paragraph below are available in NPS 1/4 to at least NPS 6 (DN 8 to at least DN 150).

* + - * 1. Copper Flanges: ASME B16.24 “Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500 and 2500”, Class 150, cast copper with solder-joint end.

Flange Gasket Materials: ASME B16.21 “Nonmetallic Flat Gaskets for Pipe Flanges”, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

Flange Bolts and Nuts: ASME B18.2.1 “Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws”, carbon steel unless otherwise indicated.

* + - * 1. Solder: ASTM B 32 “Standard Specification for Solder Metal”, lead free with ASTM B 813 “Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube”, water-flushable flux.
			1. ABS PIPE AND FITTINGS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=13028) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Apollo Valves; a part of Aalberts Integrated Piping Systems.

[Charlotte Pipe and Foundry Company](http://www.specagent.com/Lookup?uid=123457123673).

[Royal Building Products, a Westlake Company](http://www.specagent.com/Lookup?uid=123457123675).

Approved equivalent.

Retain "NSF Marking" Paragraphparagraph below if required.

* + - * 1. NSF Marking: Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

Pipe and fittings in this article are available in NPS 1-1/4 to NPS 6 (DN 32 to DN 150). Retain "Solid-Wall ABS Pipe" or "Cellular-Core ABS Pipe" Paragraphparagraph below, or both; coordinate with "Piping Schedule" Article.

* + - * 1. Solid-Wall ABS Pipe: ASTM D 2661 “Standard Specification for Acrylonitrile-Butadiene-Styrene Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings”, Schedule 40.
				2. Cellular-Core ABS Pipe: ASTM F 628 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core”, Schedule 40.
				3. ABS Socket Fittings: ASTM D 2661 “Standard Specification for Acrylonitrile-Butadiene-Styrene Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings”, made to ASTM D 3311 “Standard Specification for Drain, Waste, and Vent Plastic Fittings Patterns”, drain, waste, and vent patterns.
				4. Solvent Cement: ASTM D 2235 “Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings”.
			1. PVC PIPE AND FITTINGS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=13029) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Apollo Valves; a part of Aalberts Integrated Piping Systems.

[Charlotte Pipe and Foundry Company](http://www.specagent.com/Lookup?uid=123457123678).

[North America Pipe Corporation](http://www.specagent.com/Lookup?uid=123457123679).

[Silver-line Plastics](http://www.specagent.com/Lookup?uid=123457123684).

Approved equivalent.

Retain "NSF Marking" Paragraphparagraph below if required.

* + - * 1. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

Pipe and fittings in this article are available in NPS 1-1/4 to NPS 12 (DN 32 to DN 300). Retain "Solid-Wall PVC Pipe" or "Cellular-Core PVC Pipe" Paragraphparagraph below, or both; coordinate with "Piping Schedule" Article.

* + - * 1. Solid-Wall PVC Pipe: ASTM D 2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings”; drain, waste, and vent.
				2. Cellular-Core PVC Pipe: ASTM F 891 “Standard Specification for Coextruded Poly(Vinyl Chloride) Plastic Pipe With a Cellular Core”, Schedule 40.
				3. PVC Socket Fittings: ASTM D 2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings”, made to ASTM D 3311 “Standard Specification for Drain, Waste, and Vent Plastic Fittings Patterns”, drain, waste, and vent patterns and to fit Schedule 40 pipe.
				4. Adhesive Primer: ASTM F 656 “Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) Plastic Pipe and Fittings”.
				5. Solvent Cement: ASTM D 2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems”.
			1. SPECIALTY PIPE FITTINGS
				1. Transition Couplings:

General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections same size as and compatible with pipes to be joined.

Retain pipe couplings in "Fitting-Type Transition Couplings"; "Unshielded, Nonpressure Transition Couplings"; "Shielded, Nonpressure Transition Couplings"; or "Pressure Transition Couplings" Subparagraphsubparagraph below if dissimilar piping materials or piping with small differences in OD must be joined.

Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.

Couplings in "Unshielded, Nonpressure Transition Couplings" Subparagraphsubparagraph below are for underground nonpressure piping and should be available in all sizes.

Unshielded, Nonpressure Transition Couplings:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2272) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Dallas Specialty & Mfg. Co](http://www.specagent.com/Lookup?uid=123457123723).

[Fernco Inc](http://www.specagent.com/Lookup?uid=123457123724).

[Mission Rubber Company, LLC; a division of MCP Industries](http://www.specagent.com/Lookup?uid=123457123725).

Approved equivalent.

Standard: ASTM C 1173 “Standard Specification for Flexible Transition Couplings for Underground Piping Systems”.

Description: Elastomeric sleeve, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

Sleeve Materials:

For Cast-Iron Soil Pipes: ASTM C 564 “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings”, rubber.

For Plastic Pipes: ASTM F 477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”, elastomeric seal or ASTM D 5926 “Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems”, PVC.

For Dissimilar Pipes: ASTM D 5926 “Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems”, PVC or other material compatible with pipe materials being joined.

Couplings in "Shielded, Nonpressure Transition Couplings" Subparagraphsubparagraph below are for aboveground nonpressure piping and should be available in most sizes.

Shielded, Nonpressure Transition Couplings:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2273) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Mission Rubber Company, LLC; a division of MCP Industries](http://www.specagent.com/Lookup?uid=123457123729).

Fernco, Inc.

Matco-Norca

Approved equivalent.

Standard: ASTM C 1460 “Standard Specification for Shielded Transition Couplings for Use with Dissimilar DWV Pipe and Fittings Above Ground”.

Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

End Connections: Same size as and compatible with pipes to be joined.

Couplings in "Pressure Transition Couplings" Subparagraphsubparagraph below are for underground pressure piping and are available in at least NPS 1-1/2 to NPS 24 (DN 40 to DN 600).

Pressure Transition Couplings:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2274) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Cascade Waterworks Mfg. Co](http://www.specagent.com/Lookup?uid=123457123654).

[Ford Meter Box Company, Inc. (The)](http://www.specagent.com/Lookup?uid=123457123653).

[JCM Industries, Inc](http://www.specagent.com/Lookup?uid=123457123651).

[Romac Industries, Inc](http://www.specagent.com/Lookup?uid=123457123652).

Approved equivalent.

Standard: AWWA C219 “Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe”.

Description: Metal, sleeve-type couplings same size as pipes to be joined, and with pressure rating at least equal to and ends compatible with pipes to be joined.

Center-Sleeve Material: [**Manufacturer's standard**] [**Carbon steel**] [**Stainless steel**] [**Ductile iron**] [**Malleable iron**].

Gasket Material: Natural or synthetic rubber.

Metal Component Finish: Corrosion-resistant coating or material.

* + - * 1. Dielectric Fittings:

General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

Unions in "Dielectric Unions" Subparagraphsubparagraph below are available in at least NPS 1/2 to NPS 2 (DN 15 to DN 50).

Dielectric Unions:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2275) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[HART Industrial Unions, LLC](http://www.specagent.com/Lookup?uid=123457123733).

[WATTS; A Watts Water Technologies Company](http://www.specagent.com/Lookup?uid=123457123737).

[Zurn Industries, LLC](http://www.specagent.com/Lookup?uid=123457123739).

Approved equivalent.

Description:

Standard: ASSE 1079 “Performance Requirements for Dielectric Pipe Unions”.

Revise pressure rating and temperature in first subparagraph below to suit Project, or insert other options for specific applications.

Pressure Rating: [**150 psig (1035 kPa) minimum at 180 deg F (82 deg C)**] [**150 psig (1035 kPa)**] [**250 psig (1725 kPa)**] <**Insert pressure**>.

End Connections: Solder-joint copper alloy and threaded ferrous.

Flanges in "Dielectric Flanges" Subparagraphsubparagraph below are available in at least NPS 1-1/2 to NPS 4 (DN 40 to DN 100).

Dielectric Flanges:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2276) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[WATTS; A Watts Water Technologies Company](http://www.specagent.com/Lookup?uid=123457123744).

Approved equivalent.

Description:

Standard: ASSE 1079 “Performance Requirements for Dielectric Pipe Unions.

Factory-fabricated, bolted, companion-flange assembly.

Revise pressure rating and temperature in first subparagraph below to suit Project, or insert other options for specific applications.

Pressure Rating: [**150 psig (1035 kPa) minimum at 180 deg F (82 deg C)**] [**175 psig (1200 kPa)**] [**300 psig (2070 kPa)**] <**Insert pressure and temperature**>.

End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

Flanges in "Dielectric-Flange Insulating Kits" Subparagraphsubparagraph below are available in at least NPS 1/2 to NPS 48 (DN 15 to DN 1200).

Dielectric-Flange Insulating Kits:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2277) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Advance Products & Systems, LLC](http://www.specagent.com/Lookup?uid=123457123747).

GPT; a division of EnPRO Industries.

Approved equivalent.

Description:

Nonconducting materials for field assembly of companion flanges.

Revise pressure rating in first subparagraph below to suit Project, or insert other options for specific applications.

Pressure Rating: [**150 psig (1035 kPa)**] <**Insert pressure**>.

Gasket: Neoprene or phenolic.

Bolt Sleeves: Phenolic or polyethylene.

Washers: Phenolic with steel-backing washers.

Nipples in "Dielectric Nipples" Subparagraphsubparagraph below are available in at least NPS 1/2 to NPS 4 (DN 15 to DN 100).

Dielectric Nipples:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2278) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Anvil International/Smith-Cooper International; Tailwind Capital, LLC](http://www.specagent.com/Lookup?uid=123457123752).

Apollo Valves; a part of Aalberts Integrated Piping Systems.

[Matco-Norca](http://www.specagent.com/Lookup?uid=123457123753).

Approved equivalent.

Description: Electroplated steel nipple.

Standard: IAPMO PS 66 “Interim Guide Criteria for Dielectric Fittings”.

Revise pressure rating and temperature in first subparagraph below to suit Project, or insert other options for specific applications.

Pressure Rating: [**300 psig (2070 kPa) at 225 deg F (107 deg C)**] <**Insert pressure and temperature**>.

End Connections: Male threaded or grooved.

Lining: Inert and noncorrosive, propylene.

* + - 1. ENCASEMENT FOR UNDERGROUND METAL PIPING

Retain this article if corrosion protection is required for underground metal piping.

* + - * 1. Standard: ASTM A 674 “Standard Practice for Polyethylene Encasement for Ductile Iron Pipe” or AWWA C105/A 21.5 “Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems”.
				2. Material: [**High-density, crosslaminated polyethylene film of 0.004-inch (0.10-mm)**] [**or**] [**linear low-density polyethylene film of 0.008-inch (0.20-mm)**] minimum thickness.
				3. Form: [**Sheet**] [**or**] [**tube**].
				4. Color: [**Black**] [**or**] [**natural**] <**Insert color**>.
1. EXECUTION

See "Writing Guide" Article in the Evaluations for a discussion of how this Section is organized and the most efficient way to revise this Section.

* + - 1. EARTH MOVING

Comply with requirements for excavating, trenching, and backfilling specified in section 312000 “earth moving.”

* + - 1. PIPING INSTALLATION
				1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.

Install piping as indicated unless deviations from layout are approved on coordination drawings.

* + - * 1. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
				2. 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.
				3. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
				4. Install piping to permit valve servicing.
				5. Install piping at indicated slopes.
				6. Install piping free of sags and bends.
				7. Install fittings for changes in direction and branch connections.
				8. Install piping to allow application of insulation.

Retain first paragraph below for projects in seismic areas if piping is required to withstand specific design loads.

* + - * 1. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
				2. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.

Do not change direction of flow more than 90 degrees.

Use proper size of standard increasers and reducers if pipes of different sizes are connected.

Reducing size of drainage piping in direction of flow is prohibited.

* + - * 1. Lay buried building piping beginning at low point of each system.

Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.

Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

Maintain swab in piping and pull past each joint as completed.

* + - * 1. Install piping at the following minimum slopes unless otherwise indicated:

Revise "Building Storm Drain" and "Horizontal Storm Drainage Piping" subparagraphs below as required by authorities having jurisdiction.

Building Storm Drain: [**2**] <**Insert number**> percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; [**1**] [**2**] <**Insert number**> percent downward in direction of flow for piping NPS 4 (DN 100) and larger.

Horizontal Storm Drainage Piping: [**2**] <**Insert number**> percent downward in direction of flow.

* + - * 1. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

Retain subparagraph below if piping will be in corrosive soil.

Install encasement on underground piping according to ASTM A 674 “Standard Practice for Polyethylene Encasement for Ductile Iron Pipe” or AWWA C105/A 21.5 “Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems”.

* + - * 1. Install steel piping according to applicable plumbing code.
				2. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
				3. Install aboveground ABS piping according to ASTM D 2661 “Standard Specification for Acrylonitrile-Butadiene-Styrene Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings”.
				4. Install aboveground PVC piping according to ASTM D 2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings”.
				5. Install underground [**ABS**] [**and**] [**PVC**] piping according to ASTM D 2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications”.
				6. Install engineered [**controlled-flow**] [**siphonic**] drain specialties and storm drainage piping in locations indicated.

Retain first paragraph below if ductile-iron, force-main piping is required.

* + - * 1. Install underground, ductile-iron, force-main piping according to AWWA C600 “Standard for Installation of Ductile-Iron Mains and Their Appurtenances”.

Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints.

Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

Retain subparagraph below if piping will be in corrosive soil.

Install encasement on piping according to ASTM A 674 “Standard Practice for Polyethylene Encasement for Ductile Iron Pipe” or AWWA C105/A 21.5 “Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems”.

Retain first paragraph below for copper, force-main tubing.

* + - * 1. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

Retain subparagraph below if piping will be in corrosive soil.

Install encasement on piping according to ASTM A 674 “Standard Practice for Polyethylene Encasement for Ductile Iron Pipe” or AWWA C105/A 21.5 “Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems”.

* + - * 1. Install force mains at elevations indicated.
				2. Plumbing Specialties:

Install backwater valves in storm drainage gravity-flow piping.

Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping.

Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.

Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."

Install drains in storm drainage gravity-flow piping.

Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

* + - * 1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
				2. 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 paragraph below for piping that penetrates an exterior concrete wall or concrete slab.

* + - * 1. 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."

* + - * 1. Install escutcheons for piping penetrations of walls, ceilings, and floors.

Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

* + - 1. JOINT CONSTRUCTION
				1. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
				2. Hub-and-Spigot, Cast-Iron Soil Piping Caulked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum caulked joints.
				3. Hubless, Cast-Iron Soil Piping Coupled Joints:

Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

* + - * 1. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1 “Pipe Threads, General Purpose, Inch”.

Cut threads full and clean using sharp dies.

Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

Do not use pipe sections that have cracked or open welds.

* + - * 1. Join copper tube and fittings with soldered joints according to ASTM B 828 “Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings” procedure. Use ASTM B 813 “Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube”, water-flushable, lead-free flux and ASTM B 32 “Standard Specification for Solder Metal”, lead-free-alloy solder.
				2. Grooved Joints: Cut groove ends of pipe according to AWWA C606 “Standard for Grooved and Shouldered Joints”. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
				3. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
				4. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

Comply with ASTM F 402 “Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings” for safe-handling practice of cleaners, primers, and solvent cements.

ABS Piping: Join according to ASTM D 2235 “Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings” and ASTM D 2661 “Standard Specification for Acrylonitrile-Butadiene-Styrene Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings” appendices.

PVC Piping: Join according to ASTM D 2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets” and ASTM D 2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings” appendices.

Applicable Project codes and local authorities having jurisdiction may have different or additional requirements for joint bracing. Coordinate with Project code requirements and local authorities having jurisdiction and revise below to suit Project.

* + - * 1. Joint Restraints and Sway Bracing:

Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:

Provide axial restraint for pipe and fittings [**5 inches (125 mm)**] <**Insert dimensions**> and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.

Provide rigid sway bracing for pipe and fittings [**4 inches (100 mm)**] <**Insert dimensions**> and larger, upstream and downstream of all changes in direction 45 degrees and greater.

Provide rigid sway bracing for pipe and fittings [**5 inches (125 mm)**] <**Insert dimensions**> and larger, upstream and downstream of all changes in direction and branch openings.

* + - 1. SPECIALTY PIPE FITTING INSTALLATION
				1. Transition Couplings:

Install transition couplings at joints of piping with small differences in ODs.

In Drainage Piping: [**Unshielded**] [**Shielded**], nonpressure transition couplings.

In Aboveground Force-Main Piping: Fitting-type transition couplings.

In Underground Force-Main Piping:

NPS 1-1/2 (DN 40) and Smaller: Fitting-type transition couplings.

NPS 2 (DN 50) and Larger: Pressure transition couplings.

* + - * 1. Dielectric Fittings:

Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

Dielectric Fittings for [**NPS 2 (DN 50)**] <**Insert pipe size**> and Smaller: Use dielectric [**nipples**] [**unions**].

Dielectric Fittings for [**NPS 2-1/2 to NPS 4 (DN 65 to DN 100)**] <**Insert pipe size range**>: Use dielectric [**flanges**] [**flange kits**] [**nipples**].

Dielectric Fittings for [**NPS 5 (DN 125)**] <**Insert pipe size**> and Larger: Use dielectric flange kits.

* + - 1. VALVE INSTALLATION

Retain this article if valves are required.

* + - * 1. General valve installation requirements for general-duty valve installations are specified in the following Sections:

Section 220523.12 "Ball Valves for Plumbing Piping."

Section 220523.13 "Butterfly Valves for Plumbing Piping."

Section 220523.14 "Check Valves for Plumbing Piping."

Section 220523.15 "Gate Valves for Plumbing Piping."

* + - * 1. Shutoff Valves:

Install shutoff valve on each sump pump discharge.

Install [**gate**] [**full port ball valve**] for piping NS 2 (DN 50) and smaller.

Install [**gate**] <**Insert type**> valve for piping NPS 2-1/2 (DN 65) and larger.

* + - * 1. Check Valves: Install swing-check valve, between pump and shutoff valve, on each sump pump discharge.
				2. Backwater Valves: Install backwater valves in piping subject to backflow.

Horizontal Piping: Horizontal backwater valves.[**Use normally closed type unless otherwise indicated.**]

Install backwater valves in accessible locations.

Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

* + - 1. INSTALLATION OF HANGERS AND SUPPORTS

Retain first paragraph below for projects in areas that require seismic restraints.

* + - * 1. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
				2. Comply with requirements for hangers, supports, and anchor devices specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

Install [**carbon-steel**] <**Insert material**> pipe hangers for horizontal piping in noncorrosive environments.

Install [**stainless-steel**] [**fiberglass**] pipe hangers for horizontal piping in corrosive environments.

Install [**carbon-steel**] <**Insert material**> pipe support clamps for vertical piping in noncorrosive environments.

Install stainless-steel pipe support clamps for vertical piping in corrosive environments.

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

Install individual, straight, horizontal piping runs:

100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.

Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.

Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

Base of Vertical Piping: MSS Type 52, spring hangers.

* + - * 1. Install hangers for [**cast-iron**] [**galvanized steel**] [**ductile iron**] [**and**] [**copper**] soil [**tubing**] [**and**] [**piping**], with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
				2. Install hangers for [**ABS**] [**and**] [**PVC**] piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
				3. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting[**, valve,**] and coupling.
				4. Support vertical [**cast-iron**] [**galvanized steel**] [**ductile iron**] [**and**] [**copper**] [**tubing**] [**and**] [**piping**] to comply with MSS-58 “Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation”, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent, but as a minimum at base and at each floor.
				5. Support vertical [**ABS**] [**and**] [**PVC**] piping with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
			1. CONNECTIONS

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

* + - * 1. Drawings indicate general arrangement of piping, fittings, and specialties.
				2. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
				3. Connect storm drainage piping to roof drains and storm drainage specialties.

Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.

Second option in first subparagraph below should be indicated on Drawings.

Install horizontal backwater valves [**with cleanout cover flush with floor**] [**in pit with pit cover flush with floor**] <**Insert description**>.

Comply with requirements for [**backwater valves**] [**cleanouts**] [**and**] [**drains**] specified in Section 221423 "Storm Drainage Piping Specialties."

* + - * 1. Connect force-main piping to the following:

Revise "Storm Sewer" and "Sump Pumps" subparagraphs below to suit Project.

Storm Sewer: To exterior force main.

Sump Pumps: To sump pump discharge.

* + - * 1. Where installing piping adjacent to equipment, allow space for service and maintenance.
				2. Make connections according to the following unless otherwise indicated:

Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

* + - 1. IDENTIFICATION
				1. Identify exposed storm drainage piping.
				2. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."
			2. FIELD QUALITY CONTROL

Portions of testing and inspecting requirements in this article are taken from model plumbing codes. Revise if requirements vary.

* + - * 1. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.

Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

* + - * 1. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved.

Expose work that was covered or concealed before it was tested.

Test Procedure:

Test storm drainage piping[**, except outside leaders,**] on completion of roughing-in.

Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.

Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

Prepare reports for tests and required corrective action.

* + - * 1. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.

Expose work that was covered or concealed before it was tested.

Cap and subject piping to static-water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials.

Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

Prepare reports for tests and required corrective action.

see section 014000 “quality requirements” for retesting and reinspecting requirements and section 017300 “execution” for requirements for correcting the work.

* + - * 1. Piping will be considered defective if it does not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. CLEANING AND PROTECTION
				1. Clean interior of piping. Remove dirt and debris as work progresses.
				2. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
				3. Place plugs in ends of uncompleted piping at end of day and when work stops.
			2. PIPING SCHEDULE

Retain and revise applicable piping applications in this article. Coordinate with materials specified.

* + - * 1. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

Retain " any of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground storm drainage piping [**NPS 6 (DN 150) and smaller**] <**Insert pipe size range**> shall be[**any of**] the following:

Retain one or more of first six subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

Hubless, cast-iron soil pipe and fittings; [**CISPI,**] [**heavy-duty,**] hubless-piping couplings; and coupled joints.

Galvanized-steel pipe, drainage fittings, and threaded joints.

Copper tube and fittings in first subparagraph below are only available in NPS 1-1/4 to NPS 8 (DN 32 to DN 200).

Copper Type DWV tube, copper drainage fittings, and soldered joints.

[**Solid-wall**] [**Cellular-core**] ABS pipe, ABS socket fittings, and solvent-cemented joints.

[**Solid-wall**] [**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.

Dissimilar Pipe-Material Couplings: [**Unshielded**] [**Shielded**], nonpressure transition couplings.

Retain " any of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground, storm drainage piping [**NPS 8 (DN 200) and larger**] <**Insert pipe size range**> shall be[**any of**] the following:

Retain one or more of first five subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

Hubless, cast-iron soil pipe and fittings; [**CISPI,**] [**heavy-duty,**] hubless-piping couplings; and coupled joints.

Galvanized-steel pipe, drainage fittings, and threaded joints.

Copper tube and fittings in first subparagraph below are only available in NPS 1-1/4 to NPS 8 (DN 32 to DN 200).

Copper Type DWV tube, copper drainage fittings, and soldered joints.

[**Solid-wall**] [**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.

Dissimilar Pipe-Material Couplings: [**Unshielded**] [**Shielded**], nonpressure transition couplings.

Retain " any of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Underground storm drainage piping [**NPS 6 (DN 150) and smaller**] <**Insert pipe size range**> shall be[**any of**] the following:

Retain one or more of first four subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

[**Extra Heavy**] [**Service**] class, cast-iron soil pipe and fittings; [**gaskets; and gasketed**] [**caulking materials; and caulked**] joints.

Hubless, cast-iron soil pipe and fittings; [**CISPI,**] [**heavy-duty,**] hubless-piping couplings; and coupled joints.

[**Solid-wall**] [**Cellular-core**] ABS pipe, ABS socket fittings, and solvent-cemented joints.

[**Solid-wall**] [**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.

Dissimilar Pipe-Material Couplings: [**Unshielded**] [**Shielded**], nonpressure transition couplings.

Retain " any of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Underground, storm drainage piping [**NPS 8 (DN 200) and larger**] <**Insert pipe size range**> shall be[**any of**] the following:

Retain one or more of first four subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

[**Extra Heavy**] [**Service**] class, cast-iron soil pipe and fittings; [**gaskets; and gasketed**] [**caulking materials; and caulked**] joints.

Hubless, cast-iron soil pipe and fittings; [**CISPI,**] [**heavy-duty,**] hubless-piping couplings; and coupled joints.

PVC piping in first subparagraph below is limited in size to NPS 12 (DN 300).

[**Solid-wall**] [**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.

Cellular-core, sewer and drain series, PVC pipe; PVC socket fittings; and solvent-cemented joints.

Dissimilar Pipe-Material Couplings: [**Unshielded**] [**Shielded**], nonpressure transition couplings.

Retain " any of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground storm drainage force mains [**NPS 1-1/2 and NPS 2 (DN 40 and DN 50)**] <**Insert pipe size range**> shall be[**any of**] the following:

Retain one or both subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

Hard copper tube, Type L (Type B) copper pressure fittings, and soldered joints.

Galvanized-steel pipe, pressure fittings, and threaded joints.

Retain " any of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground storm drainage force mains [**NPS 2-1/2 to NPS 6 (DN 65 to DN 150)**] <**Insert pipe size range**> shall be[**any of**] the following:

Retain one or more of first three subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

Hard copper tube, Type L (Type B) copper pressure fittings, and soldered joints.

Galvanized-steel pipe, pressure fittings, and threaded joints.

Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

Fitting-type transition couplings if dissimilar pipe materials.

Retain " any of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Underground storm drainage force mains [**NPS 4 (DN 100) and smaller**] <**Insert pipe size range**> shall be[**any of**] the following:

Retain one or more of first four subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

[**Hard**] [**Soft**] copper tube; Type L (Type B) [**wrought-**]copper pressure fittings; and soldered joints.

Ductile-iron, mechanical-joint piping and mechanical joints.

Ductile-iron, push-on-joint piping and push-on joints.

Ductile-iron, grooved-joint piping and grooved joints.

Fitting-type transition coupling for piping smaller than NPS 1-1/2 (DN 40) and pressure transition coupling for NPS 1-1/2 (DN 40) and larger if dissimilar pipe materials.

Retain " any of" option in paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Underground storm drainage force mains [**NPS 5 (DN 125) and larger**] <**Insert pipe size range**> shall be[**any of**] the following:

Retain one or more of first four subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

Hard copper tube; Type L (Type B) [**wrought-**]copper pressure fittings; and soldered joints.

Ductile-iron, mechanical-joint piping and mechanical joints.

Ductile-iron, push-on-joint piping and push-on joints.

Ductile-iron, grooved-joint piping and grooved joints.

Pressure transition couplings if dissimilar pipe materials.

END OF SECTION 221413