SECTION 333100 - SANITARY SEWERAGE PIPING

This Section specifies pipe materials and accessories normally encountered with gravity sanitary building piping from 5 feet outside building to connection with municipal sewers or other discharge method.

Concrete manholes are specified in Section 330561; PE and fiberglass manholes are specified in Sections 330573 and 330576, respectively. Pipe markers are specified in Section 330597.

1. GENERAL
   * + 1. SUMMARY
          1. Section Includes:

Sanitary sewerage piping.

* + - * 1. Related Requirements:

List other Sections directly related to or affecting Work of this Section. Include Sections specifying information expected to be found in this Section as well as Sections required to describe complete system or assembly requirements.

Section 221300 - Facility Sanitary Sewerage: Product and execution requirements for sanitary waste and vent piping at building.

Section 310001 - Earthwork Materials: Soil for bedding and backfill in trenches.

Section 310000 - Earthwork: Requirements for excavation, trenching, and backfill as required by this Section.

Section 330130.61 - Packer Injection Grouting: Grout sealing of piping.

Section [**330505.31 - Hydrostatic Testing**] [**330505.41 - Air Testing**]: Testing of pressurized sewerage piping

Section 330505.33 - Infiltration and Exfiltration Testing: Infiltration testing of gravity-flow sewerage piping.

Section 330505.43 - Mandrel Testing: Deflection testing of plastic sewerage piping.

Section 330561 - Concrete Manholes: Manholes for sanitary sewerage piping.

Section 330573 - Polyethylene Manholes: Manholes for sanitary sewerage piping.

Section 330576 - Fiberglass Manholes: Manholes for sanitary sewerage piping.

Section 330597 - Identification and Signage for Utilities: Pipe markers.

* + - 1. DEFINITIONS

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

* + - * 1. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.
      1. REFERENCE STANDARDS

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

LEED requires compliance with specific editions of referenced standards. Consider including publication dates for referenced standards in this Section to ensure that correct standard is used for LEED compliance.

* + - * 1. American Association of State Highway and Transportation Officials:

AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 10-lb Rammer and a 18-in. Drop.

* + - * 1. American Water Works Association:

AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

AWWA C110 - Ductile-Iron and Gray-Iron Fittings.

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

AWWA C150 - Thickness Design of Ductile-Iron Pipe.

AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.

AWWA C153 - Ductile-Iron Compact Fittings.

* + - * 1. ASTM International:

ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.

ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.

ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.

ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3).

ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3).

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

ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

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

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

ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

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

ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

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

* + - 1. COORDINATION
         1. Coordinate Work of this Section with termination of sanitary sewer connection outside building, connection to [**municipal sewer utility service**] <**\_\_\_\_\_\_\_\_**>, and trenching.
      2. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
        2. Manufacturer’s installation instructions shall be provided along with product data.
        3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
        4. Product Data: Submit manufacturer information indicating pipe material to be used, pipe accessories[**, and**] <**\_\_\_\_\_\_\_\_**>.

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

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

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

* + - * 1. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

Include separate paragraphs for additional certifications.

* + - * 1. Source Quality-Control Submittals: Indicate results of [**shop**] [**factory**] tests and inspections.
        2. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
        3. Qualifications Statement:

Coordinate following subparagraph with requirements specified in QUALIFICATIONS Article.

Submit qualifications for manufacturer and installer.

Remove paragraph if not LEED project.

* + - 1. SUSTAINABLE DESIGN SUBMITTALS
         1. Section 018113 - LEED Documentation Requirements: Requirements for sustainable design submittals.
         2. Manufacturer's Certificate:

Certify that products meet or exceed specified sustainable design requirements.

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

Materials Resources Certificates:

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

Certify recycled material content for recycled content products.

Certify source for regional materials and distance from Project Site.

* + - * 1. Product Cost Data:

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

Exclude cost of labor and equipment to install products.

Provide cost data for following products:

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

Salvaged, refurbished, and reused products.

Products with recycled material content.

Regional products.

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

* + - 1. CLOSEOUT SUBMITTALS
         1. Section 017716 - Contract Closeout: Requirements for submittals.
         2. Project Record Documents: Record finished locations of pipe runs, connections, [**manholes,**] [**cleanouts,**] and invert elevations.
         3. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
      2. QUALITY ASSURANCE

Include this Article to specify compliance with overall reference standards affecting products and installation included in this Section.

Include following paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain <**\_\_\_\_\_\_\_\_**> [**copy**] [**copies**] of each standard affecting Work of this Section on Site.
      1. QUALIFICATIONS

Coordinate following paragraphs with requirements specified in SUBMITTALS Article.

* + - * 1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience.
        2. Installer: Company specializing in performing Work of this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience [**and approved by manufacturer**].
      1. DELIVERY, STORAGE, AND HANDLING
         1. Section 016500 - Materials and Equipment: Requirements for transporting, handling, storing, and protecting products.
         2. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
         3. Storage:

Store materials according to manufacturer instructions.

Store valves in shipping containers with labeling in place.

* + - * 1. Protection:

Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

Block individual and stockpiled pipe lengths to prevent moving.

Provide additional protection according to manufacturer instructions.

* + - 1. EXISTING CONDITIONS
         1. Field Measurements:

Verify field measurements prior to fabrication.

Indicate field measurements on Shop Drawings.

1. PRODUCTS
   * + 1. SANITARY SEWERAGE PIPING

Reinforced concrete pipe is typically used for larger diameter applications, low-pressure applications, or where subsoil pressure requires greater pipe strength than nonreinforced concrete pipe. Sizes range from 12 to 108 inches based on class and wall type. Absorption of moisture may be a concern if using this pipe material.

* + - * 1. Reinforced Concrete Pipe:

Comply with ASTM C76, Class [**I**] [**II**] [**III**] [**IV**] [**V**], with Wall Type [**A**] [**B**] [**C**].

Reinforcement: [**Mesh**] [**Bar**].

Inside Nominal Diameter: <**\_\_\_\_\_\_\_\_**> inches.

End Connections: [**Bell and spigot**] <**\_\_\_\_\_\_\_\_**>.

Fittings: Reinforced concrete.

Joints:

Rubber compression gasket.

Comply with ASTM C443.

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

Plastic pipe is typically used for acidic or corrosive waste sewer systems, its ease of jointing, and its relative flexibility in subsoils that are prone to movement. Plastic pipe is impervious to moisture infiltration or exfiltration.

For 6 inches Diameter and Larger

* + - * 1. Plastic Pipe:

Material: PVC.

Comply with ASTM D3034, SDR-[**35**] <**\_\_\_\_\_\_\_\_**>.

Inside Nominal Diameter: <**\_\_\_\_\_\_\_\_**> inches,

End Connections: Bell and spigot with rubber-ring-sealed gasket joint.

Fittings: PVC.

Joints:

Elastomeric gaskets.

Comply with ASTM F477.

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

Consider using following plastic pipe for piping up to 12 inches in diameter.

* + - * 1. Plastic Pipe:

Material: PVC, Schedule [**40**] [**80**] [**120**].

Comply with ASTM D1785.

Inside Nominal Diameter: <**\_\_\_\_\_\_\_\_**> inches

End Connections: Bell and spigot with solvent-sealed ends.

Fittings:

Material: PVC.

Comply with ASTM D2466.

Joints:

Solvent welded with solvent cement according to ASTM D2564.

Comply with ASTM D2855.

* + - 1. MANHOLES
         1. As specified in Section [**330561 - Concrete Manholes**] [**330573 - Polyethylene Manholes**] [**330576 - Fiberglass Manholes**].
      2. FLEXIBLE COUPLINGS
         1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=13255&mf=04&src=wd):

Fernco Inc., (810) 503-9000, 300 South Dayton St., Davidson, MI 48423.

Romac Industries, Inc., (800) 426-9341, 21919 20th Ave. SE, Suite 100, Bothell, WA 98021.

Approved equivalent.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

* + - * 1. Description:

Material: Resilient, chemical-resistant, elastomeric PVC.

Attachment: Two [**Series-300**] stainless-steel clamps, screws, and housings.

* + - 1. FLEXIBLE PIPE BOOTS FOR MANHOLE PIPE ENTRANCES
         1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=13256&mf=04&src=wd):

A-Lok, 697 Main St., (800) 822-2565, Tullytown PA 19007.

Press-Seal Corporation, (800) 822-2565, 2424 West State Blvd, Fort Wayne IN, 46808.

Approved equivalent.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

* + - * 1. Description:

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

Comply with ASTM C923.

Attachment: [**Series-300**] stainless-steel clamp and hardware.

Remove paragraph if not LEED project.

* + - 1. SUSTAINABILITY CHARACTERISTICS

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

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

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

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

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

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

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

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

* + - 1. MATERIALSACCESSORIES
         1. Pipe Markers: As specified in Section 330597 – Identification and Signage for Utilities.
      2. SOURCE QUALITY CONTROL
         1. Provide shop inspection and testing of pipe.

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

* + - * 1. Director’s Inspection:

Make completed pipe sections available for inspection at manufacturer’s factory prior to packaging for shipment.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspection is allowed.

* + - * 1. Director’s Witnessing:

Allow witnessing of factory inspections and tests at manufacturer's test facility.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspections and tests are scheduled.

Include following paragraph if reliance on manufacturer's approved quality-control program is sufficient for Project requirements.

* + - * 1. Certificate of Compliance:

If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

Specified shop tests are not required for Work performed by approved manufacturer.

1. EXECUTION
   * + 1. EXAMINATION
          1. Verify that [**trench cut**] [**excavation base**] is ready to receive Work of this Section.
          2. Verify that excavations, dimensions, and elevations are as indicated on [**Drawings**] [**layout drawings**].
       2. PREPARATION

Type of correcting materials (fine aggregate, coarse aggregate, or lean concrete) depends on type of subsoil, percolation characteristics, and compaction requirements.

* + - * 1. Correct over-excavation with [**fine aggregate**] [**coarse aggregate**] [**lean concrete**].
        2. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.
        3. Protect and support existing sewer lines, utilities, and appurtenances.
        4. Utilities:

Maintain profiles of utilities.

Coordinate with [**other utilities**] <**\_\_\_\_\_\_\_\_**> to eliminate interference.

Notify Director’s Representative if crossing conflicts occur.

* + - 1. INSTALLATION
         1. Bedding:

Excavate pipe trench as specified in Section [**310000 - Earthwork**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

Place bedding material at trench bottom.

Level materials in continuous layer not exceeding [**6**] [**8**] <**\_\_\_\_\_\_\_\_**> inches.

Maintain optimum moisture content of bedding material to attain required compaction density.

* + - * 1. Piping:

Refer to geotechnical report for subsoil capability to support piping and for compaction of fill requirements. Consider using ASTM D2321 to specify installation of plastic pipe.

Coordinate reference standards and manufacturer instructions to avoid conflicts.

Install pipe, fittings, and accessories according to [**ASTM D2321**] <**\_\_\_\_\_\_\_\_**>, and seal joints watertight.

Verify that collection system is indicated on Drawings or will be included on Shop Drawings. Drawing details should describe location of aggregate types in relation to pipe and pipe bedding, dimensions of cut trench width, and details of connections to other Work.

Lay pipe to slope gradients as indicated on [**Drawings**].

Begin at downstream end of system and progress upstream.

Bedding: Install at sides and over top of pipe, to minimum compacted thickness of [**12**] <**\_\_\_\_\_\_\_\_**> inches.

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

Bedding: As indicated on Drawings.

Lay bell-and-spigot pipe with bells upstream.

Following subparagraph makes direct reference to Section 310000 for backfilling and compaction.

Backfill and compact as specified in Section 310000 - Earthwork.

Do not displace or damage pipe when compacting.

Connect to [**building sanitary sewer outlet**] [**and**] [**municipal sewer system**] <**\_\_\_\_\_\_\_\_**> [**through installed sleeves**].

Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.

Install Site sanitary sewage system piping to within 5 feet of building, and connect to building sanitary waste system as specified in Section 221300 - Facility Sanitary Sewerage.

* + - * 1. Manholes: As specified in Section [**330561 - Concrete Manholes**] [**330573 - Polyethylene Manholes**] [**330576 - Fiberglass Manholes**].
        2. Backfilling:

Backfill around sides and to top of pipe with cover fill in minimum lifts of [**6**] <**\_\_\_\_\_\_\_\_**> inches.

Tamp fill in place, and compact to [**95**] <**\_\_\_\_\_\_\_\_**> percent of maximum density.

[**Place and compact material immediately adjacent to pipes to avoid damage to pipe and prevent pipe misalignment**].

Maintain optimum moisture content of bedding material as required to attain specified compaction density.

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

* + - * 1. Backfilling: As specified in Section 310000 - Earthwork.
      1. TOLERANCES
         1. Maximum Variation from Indicated Slope: [**1/8**] <**\_\_\_\_\_\_\_\_**> inch in [**10**] <**\_\_\_\_\_\_\_\_**> feet.
      2. FIELD QUALITY CONTROL
         1. Request inspection by Director’s Representative <**\_\_\_\_\_\_\_\_**> prior to [**and immediately after**] placing bedding.
         2. Testing:

If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest. Coordinate with Director’s Representative.

Lamping:

Lamp gravity piping after flushing and cleaning.

Perform lamping operation by shining light at one end of each pipe section between manholes.

Observe light at other end.

Pipe not installed with uniform line and grade will be rejected.

Remove and reinstall rejected pipe sections.

Clean and lamp until pipe section is installed to uniform line and grade.

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

Pipe Testing:

Pressure Testing: As specified in Section [**330505.31 - Hydrostatic Testing**] [**330505.41 - Air Testing**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

Infiltration and Exfiltration Testing: As specified in Section [**330505.33 - Infiltration and Exfiltration Testing**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

Deflection Testing: As specified in Section [**330505.43 - Mandrel Testing**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

Compaction Testing:

Select from among test standards referenced in following subparagraph appropriate for fill materials and Project requirements.

Consult geotechnical report to select compaction test method appropriate to fill materials being used and to Project requirements.

AASHTO T180 in following subparagraph is similar to ASTM D1557.

Comply with [**AASHTO T 180**] [**ASTM D698**] [**ASTM D1557**] [**ASTM D6938**].

Testing Frequency: <**\_\_\_\_\_\_\_\_**>.

* + - 1. PROTECTION
         1. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
         2. Cap open ends of piping during periods of Work stoppage.

END OF SECTION 333100