Text in Red is for information and/or guidance. Designer should remove all red text in the final specification documents. Designer should fill in all blue information in the final specification documents.

Section 00 00 00

Polyvinyl Chloride (PVC) Pipe for Non-pressure SEWER Service

# PART 1 GENERAL

1.01 SCOPE

1. This specification section includes all materials, equipment, labor, and incidentals required for the supply and installation of polyvinyl chloride (PVC) pipe and fittings, 4-inch diameter to 60-in diameter for use in storm sewer, sanitary sewer, or other non-pressure sewer applications.

1.02 RELATED SECTIONS

1. Section 00 00 00: Trenching, Backfilling, and Compaction
2. Section 00 00 00: Valves and Appurtenances
3. Section 00 00 00: Submittals
4. Section 00 00 00: Hydrostatic Testing and Acceptance
5. [Add Other Section References as Needed]

1.03 REFERENCES

The Contractor and/or Pipe Manufacturer shall follow the standards listed below, except as otherwise specified herein. The latest revision or edition in effect at the time of bid opening shall be utilized.

1. American Society for Testing and Materials (ASTM)
   1. D1784 – Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
   2. D2321 – Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity-Flow Applications
   3. D3034 – Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
   4. D3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
   5. F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe
   6. F679 – Polyvinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
   7. F1417 – Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
2. American Water Works Association (AWWA)
   1. M23 – PVC Pipe – Design and Installation
3. Uni-Bell PVC Pipe Association
   1. UNI-B-6 – Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe
   2. UNI-PUB-6 – Installation Guide for PVC Solid-Wall Sewer Pipe (4 - 48 in.)
   3. UNI-TR-3 – Maintenance of PVC Sewer Pipe
   4. Handbook of PVC Pipe Design and Construction

1.04 QUALIFICATIONS

1. The Pipe Manufacturer shall be a member of the Uni-Bell PVC Pipe Association.
2. The pipe and fittings shall be designed, manufactured, and installed in accordance with industry standards and shall comply with the specification requirements herein.

1.05 SUBMITTALS

1. Conform to the requirements of Section 00 00 00 – Submittals
2. Submit product data on pipe, fittings, gaskets and appurtenances as required to ensure products meet the requirements of this specification.

1.06 DELIVERY, STORAGE, AND HANDLING

1. Pipe shall be shipped so as to not bend, dent, or otherwise damage the pipe during transport.
2. Contractor shall take all necessary precautions to prevent damage to pipe and fittings during delivery and unloading.
3. Owner shall observe and inspect unloading of pipe to ensure proper unloading procedures are followed.
4. Under no circumstances will pipe be allowed to be rolled, pushed, or dropped off from any height for delivery, storage, or installation. Any pipe found to have been damaged due to improper handling procedures truck will be immediately marked for identification and removed from the jobsite at the Contractor’s expense.
5. Stacking of pipe shall be performed in accordance with Pipe Manufacturer’s recommendations.
6. Once pipe has been unloaded, it shall be stored as near to its point of installation as possible. Contractor shall limit moving or restacking of pipe prior to installation.
7. Where necessary, because of ground conditions, store pipe on wooden sleepers, spaced suitably and of such widths as not to allow deformation of pipe at point of contact with sleeper or between supports.
8. Pipe shall not be stored close to heat sources or hot objects such as heaters, boilers, steam lines, and engine exhaust.
9. If pipe is to be exposed to direct sunlight for extended periods (in excess of two years from the date of manufacture), then Contractor shall cover/shade pipe utilizing canvas or other opaque materials. Black plastic will not be acceptable as a shading material.
10. Gaskets shall be protected from exposure to excessive heat, prolonged direct sunlight, and oil and grease.
11. Material storage shall be performed in accordance with Pipe Manufacturer’s recommendations.

# PART 2 PRODUCTS

2.01 PIPE

1. Pipe shall be manufactured and supplied in accordance with ASTM D3034 (4-Inch to 15-Inch) or F679 (18-Inch to 60-Inch).
2. Pipe shall have lay lengths between 14 and 22 feet unless otherwise specified by the Owner.
3. The pipe shall be made of PVC compound having a cell classification of 12454 or 12364 in accordance with ASTM D1784.
4. Pipe shall be homogenous throughout, free of voids, cracks, inclusions, and other defects.
5. Pipe shall have markings at intervals of 5ft or less including:
   1. Manufacturer’s name or trademark and code
   2. Nominal pipe size
   3. PVC cell classification
   4. Legend (e.g. “ SDR-41 PVC Sewer Pipe” or “PS 46 PVC Sewer Pipe”)
   5. ASTM Designation
   6. Gasketed pipe shall be marked with an insertion depth mark on the spigot end
6. Pipe for non-potable water and wastewater uses shall be green or white in color.
7. Pipe outside diameters shall be equal to those of cast iron unless otherwise specified by the Owner.

2.02 PIPE DESIGN

Internal pressures are not considered in non-pressure applications. External loads are calculated utilizing the modified Iowa formula as outlined in the AWWA M23 manual as well as Chapter 7 of the PVC Pipe Handbook.

1. Pipe shall be supplied to meet the external loading requirements of the project as follows:
   1. Maximum calculated deflection of 7.5%
   2. Live loads as calculated per AWWA M23 based on the profile shown on the plans
   3. Depth of cover as shown on the plans
   4. Trench width as shown on the plans
   5. Modulus of soil reaction (E’), bedding constant (K), and soil density (γ) shall be based on design and site conditions.

Trench widths should be kept to a minimum to ensure economical design and construction. For most projects, a minimum trench width of OD x 1.25 + 12 in. or OD + 16 in. total (whichever is greater) is sufficient. Modulus of soil reaction and bedding constant values can be determined in accordance with the AWWA M23 manual. A soil density value of 120 pcf is utilized for most installations.

2.03 FITTINGS

1. Fittings shall be manufactured and supplied in accordance with ASTM D3034 (4-Inch to 15-Inch) or ASTM F679 (18-Inch to 60-Inch). Molded and fabricated fittings may be supplied in accordance with ASTM F1336.
2. Fittings shall be made of PVC compound having a cell classification of 12454 or 13343 in accordance with ASTM D1784.
3. Pipe used in fabricated fittings shall have a wall thickness equal to or greater than the wall thickness of the pipes to which the fitting (or that part of the fitting) will be joined.
4. Molded and fabricated fittings shall have markings including:
   1. Manufacturer’s name or trademark
   2. Nominal size
   3. Material designation (e.g. “PVC”)
   4. ASTM Designation
5. Fittings may also be supplied as ductile iron fittings in accordance with AWWA C110 and/or C153.

2.04 PIPE JOINTS

1. Joints shall be gasketed push-on type conforming to ASTM D3212.
2. Gasket materials shall meet requirements of ASTM F477.
3. Joint lubricant shall be approved by the Pipe Manufacturer and shall have no detrimental effect on the gasket or pipe.

# PART 3 EXECUTION

3.01 GENERAL

1. Install pipe, fittings, specials, and appurtenances in accordance with ASTM D2321, UNI-PUB-6 and/or in accordance with the Pipe Manufacturer’s recommendations.
2. Lay pipe to the lines and grades as indicated on the Plans.

3.02 PIPE HANDLING

1. Handle pipe and piping materials with care to avoid damage.
2. Prior to installation, each pipe length shall be carefully inspected for damage.
3. All pipe, fittings, and appurtenances shall be thoroughly cleaned before installation and shall be kept clean until installation and backfilling has completed.
4. Use only nylon ropes, slings, or other lifting devices that will not damage the surface of the pipe.
5. Keep the pipe clean and free of debris, dirt, animals, and trash during and after laying operations.
6. At the close of each operating day, seal the open end of the pipe using a gasketed night cap.

3.03 PIPE INSTALLATION

1. Do not drag pipe over gravel or rock. Avoid striking rocks or hard objects when lowering pipe into the trench.
2. Placement of pipe and fittings into the trench should be done with ropes and skids, slings on a backhoe bucket, or by hand.
3. Pipe or fittings shall not be thrown into the trench and no part of the pipe shall be allowed to take an unrestrained fall onto the trench bottom.
4. Joint sockets shall be carefully cleaned before pipes are lowered into trenches.
5. Pipe trenches and excavation shall be kept free of water during pipe laying operations and other related work. If high groundwater levels are expected or encountered, Contractor is to ensure that a minimum depth of cover of 1.5 times the pipe diameter will be maintained over the pipe once it has been installed or provide other methods approved by the Owner and Pipe Manufacturer of preventing flotation of the pipe.

3.04 JOINT MAKING

1. Install push-on joints in accordance with Pipe and Fittings Manufacturer’s recommendations.
2. Inspect the gasket, pipe spigot bevel, gasket groove, and sealing surfaces for damage or deformation. In cases when gaskets are supplied separately from pipe, Contractor is to ensure that gaskets supplied are designed for the pipe in use.
3. Clean the gasket of all extraneous matter.
4. Apply a thin film of joint lubricant to the inside of the gasket and the outside of the spigot prior to entering the spigot into the bell. Lubricated spigots ends shall not come in contact with soil or backfill material.
5. Insert the spigot end of the pipe carefully into the bell until the reference mark on the spigot is flush with the bell. If two reference marks are present, the mark closest to the spigot end shall be considered the minimum insertion mark, and the second mark shall be considered the maximum insertion mark. Under no circumstances will the spigot be inserted into the bell past the reference mark or maximum insertion mark.
6. For small diameter pipe, use the bar-and-block method for joint assembly or other method approved for use by the Owner and Pipe Manufacturer.
7. For large diameter pipe, use mechanical assistance such as hydraulic pipe pullers, jacks, pulleys, come-alongs, or a backhoe bucket. Observation by a spotter will be required when assembling joints for large diameter pipe to prevent over-insertion.
8. When using a field cut plain end piece of pipe, bevel the end with a beveling tool, wood rasp, or power sander to the same angle and length as provided on the factory-finished pipe. Redraw the insertion line on the spigot using a factory-marked spigot as a guide.
9. Angular changes in pipe alignment shall be achieved by either fittings, joint deflection, or longitudinal bending of the pipe.
10. Joint deflection shall not exceed the Pipe Manufacturer’s recommendation.
11. Field assembly of pipe fittings shall follow the Pipe Fittings Manufacturer’s recommendations.
12. Mechanical joints shall be assembled per the Pipe and/or Fittings Manufacturer’s recommendations as well as the recommendations of the mechanical joint supplier.

3.05 LONGITUDINAL PIPE BENDING

1. Controlled changes in direction may be accomplished by longitudinal bending of the pipe barrel.
2. Pipe Manufacturer shall be consulted prior to start of construction for recommendations on longitudinal bending.
3. When longitudinal bending of pipe is utilized, Contractor shall use manual force alone to achieve prescribed bending. Mechanical means shall not be utilized to achieve longitudinal bending of the pipe.
4. When the desired change of direction in the pipeline exceeds the maximum allowable deflection specified, the longitudinal bending shall be made throughout a number of pipe lengths.
5. Contractor will ensure that pipe joints will not be over-pulled or over-inserted during longitudinal bending operations.

3.06 FIELD TESTING

1. After pipe has been installed and backfilled, deflection testing shall be performed in accordance with ASTM D3034 and/or F679, PVC Pipe Handbook, and the specifications herein. Deflection testing shall utilize a “go/no-go” mandrel for measurement of pipe deflection. Where practical, Contractor should allow for stabilization of the pipe/soil system (up to 30 days) prior to testing.
2. All finished installations for non-pressure applications shall be tested via low-pressure air testing in accordance with ASTM F1417, UNI-B-6, and the specifications herein.
3. Isolate the section of non-pressure sewer line to be air tested by inflatable stoppers or other suitable test plugs/caps.
4. Ends of all branches, laterals, tees, wyes, and/or stubs in the test section shall be plugged or capped to prevent air leakage. One of the plugs/caps shall have an inlet tap or other method for connecting the air hose to an air control source.
5. Test ends should be restrained and/or braced during air testing.
6. Add air slowly to the test section until the pressure reaches 4.0 psi. After the test pressure is obtained, regulate the air supply so that the pressure is maintained between 3.5 and 4.0 psi for at least 2 minutes until the air temperature stabilizes and is in equilibrium with the temperature of the pipe walls.
7. After equilibrium is achieved, determine the rate of air pressure loss by either the constant pressure method or the time-pressure drop method as outlined in ASTM F1417.
8. Upon completion of the test, open the bleeder valve and allow all air to escape. Caps/plugs shall not be removed until all air pressure in the test section has been reduced to atmospheric pressure.

**END OF SECTION**

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