

TENNESSEE CONSTRUCTION SPECIFICATION

Plastic Pipe Conduits

1. SCOPE

The work shall consist of furnishing and installing polyvinyl chloride (PVC), acrylonitrile-butadiene-styrene (ABS), high density polyethylene (HDPE), polyethylene (PE) and/or polypropylene (PP) plastic pipe and the necessary fittings to the lines and grades shown on the drawings. **This specification does not apply to corrugated polyethylene tubing used for subsurface drainage systems.**

2. MATERIALS

Polyvinyl chloride (PVC) pipe shall conform to the requirements of the following ASTM and/or AWWA specifications unless otherwise stated on the drawings.

PVC plastic pressure pipe, schedule 40, 80, 120, 1/8-inch to 24-inch.....	ASTM D 1785
PVC pressure pipe (bell & gasketed), SDR, 4-inch to 12-inch.....	AWWA C 900
PVC pressure pipe (bell & gasketed), SDR, 1/8-inch to 36-inch	ASTM D 2241
PVC gravity drain, waste, and vent (DWV) pipe and fittings, 1-1/4-inch to 24-inch.....	ASTM D 2665
Joints for IPS PVC pipe using solvent cement, 1/4-inch to 24-inch.....	ASTM D 2672
PVC and ABS composite gravity sewer pipe and fittings, 8-inch to 15-inch.....	ASTM D 2680
PVC, PSM gravity sewer pipe (SDR) and fittings, 3-inch to 15-inch.....	ASTM D 3034
PVC large-diameter gravity sewer pipe and fittings, 18-inch to 48-inch.....	ASTM F 679
PVC smooth-wall under drain systems for highway, airport, and similar drainage, 6-inch to 8-inch.....	ASTM F 758
PVC profile gravity sewer pipe and fittings based on controlled inside diameter, 4-inch to 48-inch.....	ASTM F 794
PVC corrugated gravity sewer pipe with a smooth interior and fittings, 4-inch to 48-inch.....	ASTM F 949
PVC water transmission pipe, nominal diameters 14-inch through 36-inch.....	AWWA C 905

Polyethylene (PE) plastic pipe shall conform to the requirements of the following ASTM and/or AWWA specifications unless otherwise stated on the drawings.

PE pipe & fittings, gravity, 12-inch to 60-inch, annular corrugated profile-wall.....	ASTM F 2306
PE SDR-PR pipe based on controlled inside diameter, 1/2-inch to 3-inch.....	ASTM D 2239
PE DR-PR pipe based on controlled outside diameter, 1/2-inch to 24-inch.....	ASTM D 3035
PE SDR thermoplastic gas pressure pipe, tubing and fittings, 1/4-inch to 12-inch.....	ASTM D 2513
PE SDR pressure plastic tubing, 1/2-inch to 2-inch.....	ASTM D 2737
PE pressure pipe and tubing, 1/2-inch through 3-inch.....	AWWA C 901
PE pressure pipe, 4-inch through 63-inch.....	AWWA C 906
PE DR-PR pipe, 3-inch to 54-inch, controlled OD (water, waste, etc.).....	ASTM F 714
Cross-linked Polyethylene (PEX) Tubing.....	ASTM F 876 / AWWA C 904

High density polyethylene (HDPE) plastic pipe shall conform to the requirements of the following ASTM specifications unless otherwise stated on the drawings.

HDPE Plastic line pipe and fittings (oil, gas, non-potable water, etc.).....	ASTM F 2619
Heat fusion joining of PE pipe and fittings.....	ASTM F 2620
HDPE drainage pipe - bell & spigot - 10-inch to 132-inch.....	ASTM F 894
HDPE drainage pipe – bell & spigot - 3-inch to 6-inch.....	ASTM F 810
HDPE low pressure pipe – bell & spigot – 12-inch to 60-inch.....	ASTM F 2306
HDPE low pressure pipe – bell & spigot – 12-inch to 60-inch.....	AASHTO M294
HDPE land drainage pipe – bell & spigot – 2-inch to 60-inch.....	ASTM F 2648

Acrylonitrile-butadiene-styrene (ABS) plastic pipe shall conform to the requirements of the following ASTM specifications unless otherwise stated on the drawings.

ABS plastic pressure pipe, 1/8-inch to 12-inch, schedules 40 and 80 ASTM D 1527
ABS and PVC composite gravity sewer pipe and fittings, 8-inch to 15-inch ASTM D 2680
ABS plastic pipe and fittings, 1-1/4-inch to 6-inch drain, waste & vent
(DWV), sch 40 ASTM D 2661
ABS plastic pressure pipe, 1/8-inch to 12-inch, SDR ASTM F 2969
ABS plastic gravity sewer pipe, 3-inch to 12-inch, SDR..... ASTM D 2751

Polypropylene plastic pipe (PP) shall conform to the requirements of the following specifications unless otherwise stated on the drawings.

PP pipe, gravity, 12-inch to 30-inch, smooth interior and annular exterior
corrugations.....ASTM F2736 / AASHTO M330
PP pipe, gravity, 36-inch to 60-inch, smooth interior and annular exterior
corrugations.....ASTM F2881 / AASHTO M330

The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign matter, or other defects. The pipe shall be as uniform in color, opacity, density, and other physical properties as is commercially practicable.

3. FITTINGS and JOINTS

Fittings and joints shall be of a schedule, SDR or DR, pressure class, external load carrying capacity, or pipe stiffness that equals or exceeds that of the plastic pipe. The dimensions of fittings and joints shall be compatible with the pipe and measured in accordance with ASTM D 2122. Joint and fitting material shall be compatible with the pipe material and be in accordance with manufacturer's recommendations. The joints and fittings shall be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties and shall be free from visible cracks, holes, foreign inclusions, or other defects.

Unless otherwise specified in Section 12 of this specification or shown on the drawings, joints shall be either bell and spigot type with elastomeric gaskets, coupling type, solvent cement bell and spigot, or jointed by butt heat fusion. When a lubricant is required to facilitate joint assembly, it shall be a type having no deleterious effect on the gasket or pipe material. The joints shall be installed according to the manufacturer's recommendations unless otherwise specified.

When solvent cement joints are specified for PVC or ABS pipe and fittings, they shall be made in accordance with the following ASTMs and the related appendix of each ASTM; D 2855 for PVC pipe and fittings and D 2235 for ABS pipe and fittings.

PVC plastic pipe pressure fittings shall meet ASTM D 2466 for schedule 40 pipe and ASTM D 2467 for schedule 80 pipe.

Flanged, banded, heat-fusion, or elastomeric-sealed mechanical joints shall be used when joining polyethylene (PE) and high density polyethylene (HDPE) pipe and fittings unless otherwise specified in Section 12 of this specification or as shown on the drawings.

Rubber gaskets for pipe joints shall conform to the requirements of ASTM F 477, Elastomeric Seals (Gaskets) for Jointing Plastic Pipe in gravity, low and high pressure systems using push on joints.

Joints & fittings for polypropylene pipe (PP) using gravity flow shall be gasketed integral bell & spigot and meet the requirements of ASTM F2736, F2881 and AASHTO M330, for their respective diameters. Joints must be watertight in accordance with ASTM D3212.

Based on the type of installation, refer to specific manufacturer's recommendations for joints and fittings when installing Cross-linked Polyethylene (PEX) Tubing. Fittings shall be compatible with PEX pipe conforming to ASTM F 876 and provide a watertight joint under normal operating conditions.

Pipe joints shall be watertight at the pressures specified except where unsealed joints are indicated.

Laying deflections and joint fitting or stab (seating) depths shall be within the manufacturer's recommended tolerances.

Pipe ends shall be cut square and be de-burred to provide a uniform, smooth surface for the jointing process. Reference marks shall be placed on the spigot ends to assist in determining when proper seating depth has been achieved within the joint.

Unless otherwise specified, steel fittings, valves, and bolted connections shall be painted or coated as recommended by the manufacturer for corrosion resistance.

Fittings for non-pressure pipe shall be of the same or similar material as the pipe and shall provide the same durability, water-tightness, and strength as the pipe unless otherwise specified.

4. HANDLING AND STORAGE

Pipe shall be delivered to the job site and handled by means which provide adequate support to the pipe and does not subject it to undue stresses or damage. When handling and placing plastic pipe, care shall be taken to prevent impact blows, abrasion damage, and gouging or cutting. *All special handling requirements of the manufacturer shall be strictly observed.* Special care shall be taken to avoid impact when the pipe must be handled at temperatures of 40°F or less.

Pipe shall be stored on a relatively flat surface so that the barrels are evenly supported. Unless the pipe is specifically coated to withstand exposure to ultraviolet radiation, it shall be covered with an opaque material when stored outdoors.

5. EXCAVATION

Excavation shall be as shown on the drawings and/or in accordance Section 12 of this specification. The pipe foundation shall be excavated a minimum of 4 inches lower than the pipe grade shown on the drawings or staked in the field whenever bedrock, boulders, cobbles, or other material that may cause pipe damage is encountered at planned pipe grade. For the excavation requirements for Cross-linked Polyethylene (PEX) Tubing, follow the manufacturer's installation guidelines.

6. PIPE ASSEMBLY AND MOVEMENT

Before assembly, each pipe section and fitting shall be inspected to ensure that all foreign material is removed from inside the pipe and fitting. Joining surfaces shall be cleaned immediately before assembly. Pipe assembly shall be conducted in accordance with published manufacturer's recommendations. Jointing methods and requirements shall be as specified in Section 12 or on the construction drawings.

Out of trench assembly is permitted for solvent cementing, heat fusion and thrust connections as specified in Section 12 or on the construction drawings. Gasket jointing out of the trench shall be permitted using manufacturer's recommendations, provided the moving of the assembled pipe will not cause joint disassembly. Gasket lubricants shall only be allowed if recommended by the pipe manufacturer. Where applicable, no moving of the pipe shall be made until the joint has properly cured.

Unassembled pipe ends, fittings and gaskets shall be protected from contamination by caps, plugs or covering. The caps, plugs or covering shall be removed immediately before assembly. Damaged or un-cleanable ends, fittings, gaskets, etc. shall not be used.

After assembly, movement and bending of the pipe shall be limited to less than the manufacturer's allowable bending radius of the assembled pipe to avoid damaging stress, strain or buckling of the assembly. Broken, bent, buckled, cracked or otherwise damaged assemblies shall not be used.

7. PIPE EMBEDMENT

Bedding and haunch material – The pipe shall be placed on compacted earthfill bedding or an in-place earth material bedding of adequate bearing strength and uniform density to continuously support the pipe over its entire length without noticeable deflection or settlement. Compaction, moisture and placement requirements shall be as specified in Section 12 or on the construction drawings.

Unless otherwise specified, a groove that closely conforms to the outside surface of the pipe shall be formed above the bedding in the haunch zone material up to the spring line (centerline) of the pipe. The depth of the groove shall be between 30 and 50 percent of the pipe diameter. In addition, a hole matching the size of the bell, fittings, etc. shall be formed at the appropriate location.

Earth bedding and haunch material shall be compacted to the specified density. Earthfill material used for compacted earth bedding and haunch material shall be free of rocks, stones and material particles with a diameter greater than ½ inch for pipe or tubing up to 4 inch, ¾ inch for pipes 6 to 8 inch, and 1 inch for 10 inch and larger pipes, or as required by the manufacturer for PEX tubing,. After bedding placement, the pipe shall be secured and loaded sufficiently during the compaction of the haunch material to prevent displacement from its final approved placement. To minimize deformation of thin walled pressure pipeline, the pipeline should be filled with water, all air removed, and kept full during the backfill operation.

Sand, gravel, or crushed rock bedding and haunch material – When sand, gravel, or crushed rock material is specified, the requirements shall be the same as for earth material except the layer and compaction requirements shall be as specified in Section 12 or on the construction drawings.

Pipe encased in drainfill – When drainfill is specified, the requirements shall be the same as for earth material except the layer and compaction requirements shall be as specified in Section 12 or on the construction drawings.

Pipe encased in concrete – Concrete encasement shall be carefully placed to form a continuous uniform support around the entire circumference of the pipe or as shown on the drawings. Pipes encased in concrete shall be securely anchored to prevent movement of the pipe during concrete placement. A clear distance of 1.5 inches shall be maintained between the pipe and any reinforcing steel.

For the embedment of Cross-linked Polyethylene (PEX) Tubing, refer to manufacturer's installation guidelines and the requirements of Section 12.

8. LAYING THE PIPE

The pipe shall be laid to the lines and grades as shown on the drawings and specified in Section 12. The pipe shall be laid so that there is no reversal of grade between joints, unless otherwise shown on the drawings. The pipe shall not be dropped or dumped on the bedding or haunching in the pipe trench. The ground surface near the pipe trench shall be free of loose rocks, stones or material larger than the allowed particle size so that such material may not damage the pipe or be included in the backfill.. Pipelines shall be placed so that they are protected against hazards imposed by traffic, farm operations, freezing temperatures or soil cracking.

Care shall be taken to prevent distortion and damage during unusually hot (over 90°F) or cold weather (under 40°F). After the pipe has been placed in the trench, it shall be allowed to reach ground temperature before backfilling to prevent pull out of joints due to thermal contraction.

Bell and spigot pipe shall be laid with the bell pointed upstream. The pipe ends and couplings shall be free of foreign material when assembled.

Perforated pipe shall be laid with the perforations down and oriented symmetrically about the vertical centerline of the pipeline. Perforations shall be clear of any obstructions when the pipe is laid and before the pipe is approved for backfill.

The pipe shall not be laid until the bedding and haunch materials have been inspected and approved. The pipe groove and bell or fitting depressions in the haunch material shall be properly configured and uncontaminated before placement of the pipe in the pipe trench. The pipe shall be firmly and uniformly supported throughout its entire length. The bedding and haunch depth and materials to be used will be as shown on the drawings. Blocking or mounding beneath the pipe to bring the pipe to final grade is not permitted.

For the laying of Cross-linked Polyethylene (PEX) Tubing, refer to manufacturer's installation guidelines.

9. THRUST BLOCKS AND ANCHORS

When specified, concrete thrust blocks and anchors shall be installed changes in direction or terminal ends as shown on the drawings or as specified in Section 12 of this specification.

The concrete for the thrust blocks and anchors shall conform to the requirements specified in Section 12 of this specification or as noted on the construction drawings.

The thrust block cavity shall be excavated using hand methods into undisturbed soil or previously placed compacted backfill. Where thrust blocks are designed to be in direct contact with the pipe, the pipe shall be laid and secured in-place prior to concrete placement. The soil bearing surfaces shall remain undisturbed.

10. PRESSURE TESTING

The conduit shall be tested for leaks in the following manner prior to backfilling over the pipe:

- a. Before pressure testing:
 1. Joints of the assembled pipeline shall be allowed to cure as recommended by the manufacturer.
 2. Pipeline shall be flushed and cleaned.
 3. All concrete anchors and thrust blocks shall be in place and allowed to cure for a minimum of 3 days.
 4. Backfill shall be sufficient to anchor the conduit against movement during the pressure testing. Joints and fittings shall remain exposed to facilitate inspection for leakage.
 5. The conduit shall be braced, anchored, or both, at each end to restrict all potential pipe movement.
- b. Potable water shall be used in potable water systems for testing. The pipeline shall be slowly filled with water taking care to prevent surges. Insure the release of all entrapped air. Installation of all valves and vents shall be complete.

- c. Pipelines shall be pressure tested by applying a minimum of a 10ft head or by applying the working pressure to the pipe for a minimum of 2 hours. Visually inspect the entire system to include all pipes, joints, fittings, etc. All leaks shall be sealed by replacement of pipe and fittings as necessary. The conduit shall be retested as described above. This procedure shall be repeated until pipe leakage does not occur.

11. BACKFILL

Initial backfill – Unless otherwise specified or shown on the drawings, initial backfill is required from the springline to 6 inches above the top of the conduit. Initial backfill material shall consist of the same material specified for haunch material (see No. 7 Pipe Embedment).

Initial backfill shall be placed from the haunch material to 6 inches above the top of the pipe. Compaction, moisture and placement requirements shall be as specified in Section 12 of this specification or as noted on the construction drawings.

Final backfill – Final backfill shall consist of placing the remaining material required to complete the backfill from the top of the initial backfill to the ground surface, including mounding at the top of the trench for settlement. Final backfill material within 2 feet of the top of the pipe shall be free of frozen earth, and debris or rocks larger than 3 inches nominal diameter. Soil backfill shall be the best available material from trench excavations with rocks and debris removed as specified. Coarse backfill material shall be the specified sand, gravel, crushed rock, or drainfill as specified in Section 12 or as noted on the construction drawings. Final backfill shall be placed in approximately uniform layers. Final backfill compaction, compaction equipment, moisture, and layer thickness requirements shall be as shown on the drawings or as stated in Section 12 of this specification. Absolutely no self-propelled heavy compaction equipment shall be allowed within the pipeline area until compacted final backfill is at least 2 feet over the top of the pipe.

For the backfilling of Cross-linked Polyethylene (PEX) Tubing, refer to manufacturer's installation guidelines.

12. ADDITIONAL ITEMS OF WORK OR CONSTRUCTION DETAILS

(Information to be added, if needed, for project specific requirements for embedment of pipe, laying of pipe, compaction, etc.)