

CONSTRUCTION SPECIFICATION

45. PLASTIC PIPE

1. SCOPE

The work shall consist of furnishing and installing plastic pipe, except corrugated polyethylene tubing, and the necessary fittings and appurtenances as shown on the drawings or as specified herein.

2. MATERIAL

Pipe, fittings, and gaskets shall conform to the requirements of Material Specification 547 and as specified in Section 14 of this specification or as shown on the drawings.

Perforated pipe shall conform to the requirements of Material Specification 547 and as specified in Section 14 of this specification or as shown on the drawings.

Unless otherwise specified, concrete shall conform to the requirements of Construction Specification 32, Structure Concrete, and Section 8 of this specification.

Unless otherwise specified, earth backfill shall conform to the requirements of Construction Specification 23, Earthfill.

Unless otherwise specified, drainfill shall conform to the requirements of Construction Specification 24, Drainfill.

3. HANDLING AND STORAGE

Pipe shall be delivered to the job site and handled by means which provide adequate support to the pipe and do 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 (by metal edges and/or surfaces or rocks). 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° Fahrenheit or less.

Pipe shall be stored on a relatively flat surface so that the barrels are evenly supported. Unless the pipe is specifically manufactured to withstand exposure to ultraviolet radiation, it shall be covered with an opaque material when stored outdoors for period of fifteen days or longer.

4. EXCAVATION

Excavation shall be in accordance with Construction Specification 21, Excavation, and Section 14 of this specification or as shown on the drawings.

The pipe foundation shall be excavated a minimum of four inches lower than the pipe grade shown on the drawings or staked in the field whenever bedrock,

boulders, cobbles, or other materials that may cause pipe damage are encountered at planned pipe grade.

5. LAYING THE PIPE

Plastic pipe conduits complete with fittings and other related appurtenances shall be installed to the lines and grades shown on the drawings or specified in Section 14 of this specification. The pipe shall be installed 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 into the pipe trench. The ground surface near the pipe trench shall be free of loose rocks and stones greater than one (1) inch in diameter to ensure that rock will not be displaced and impact the pipe.

Just prior to placement, each pipe section shall be inspected to insure that all foreign materials are removed from the inside of the pipe. The pipe ends and the couplings shall be free of foreign material when assembled. At the completion of a work shift, all open ends of the pipeline shall be temporarily closed off by a suitable cover or plug.

Care shall be taken to prevent distortion and damage during periods of hot or cold weather. During unusually hot weather (daytime high temperatures greater than 90° F), the pipe assembled in the trench shall be lightly backfilled or shaded to keep it as near to ground temperature as possible until final backfill is placed. Backfill operations should be performed during daily construction periods when the ground temperature and the temperature of the pipe does not vary more than 40° F.

Perforated pipe shall be installed with the perforations down and oriented symmetrically about the vertical centerline. Perforations shall be clear of any obstructions on the inside and outside of the pipe when the pipe is approved by the Engineer for backfill.

During installation, the pipe shall be firmly and uniformly bedded throughout its entire length, to the depth and in the manner specified in Section 14 of this specification or as shown on the drawings. Bell-holes shall be placed in bedding material under bells, couplings and other fittings to assure the pipe is uniformly supported throughout its entire length. Blocking or mounding beneath the pipe to bring the pipe to final grade will not be permitted.

6. PIPE EMBEDMENT

Earth Bedding. The pipe shall be firmly and uniformly placed on compacted earthfill bedding or an in-place earth material bedding of ample bearing strength to support the pipe without noticeable settlement. The earth material on which the pipe is placed shall be of uniform density to prevent differential settlement.

Unless otherwise specified, a groove that closely conforms to the outside surface of the pipe shall be formed in the bedding. The depth of the groove shall be equal to or greater than 0.3 of the pipe diameter.

Earth bedding shall be compacted to a density not less than adjacent undisturbed in-place earth materials or be compacted earth backfill. Earthfill materials used for compacted earth bedding shall be free of rocks or stones greater than one (1) inch in diameter and earth clods greater than two (2) inches in diameter. The pipe shall be loaded sufficiently during the compaction of bedding under the haunches and around the sides of the pipe to prevent displacement from its final approved placement.

Sand, Gravel, or Crushed Rock Bedding. When sand, gravel, or crushed rock bedding is specified, the pipe shall be firmly and uniformly placed on the bedding material. Material for bedding shall not exceed one (1) inch in diameter. Unless otherwise specified in Section 14 of this specification or shown on the drawings, the coarse-grained bedding material shall be carefully placed and compacted to a depth equal to or greater than 0.3 of the diameter of the pipe above the bottom of the pipe. The pipe shall be loaded sufficiently during backfilling and compaction around the sides to prevent displacement of the pipe from its final approved placement.

Pipe Encased in Drainfill. The pipe shall be firmly and uniformly placed on a bedding of specified drainfill. Drainfill shall be placed and compacted as specified in Section 14 of this specification or as shown on the drawings to form a continuous uniform support around the entire circumference of the pipe. The pipe shall be loaded sufficiently during backfilling around the sides and during compaction to prevent displacement of the pipe.

7. BACKFILL

a. Initial Backfill

Unless otherwise specified, initial backfill to six (6) inches above the top of the conduit is required. Earth haunching and initial backfill materials shall consist of soil material that is free of rocks, stones or hard clods greater than one (1) inch in diameter. Coarse backfill material shall be the specified sand, gravel, crushed rock or drainfill material.

Initial backfill shall be placed in two (2) stages. The first stage (haunching) backfill is placed to the pipe spring line (center of pipe). The second stage backfill is placed to six (6) inches above the top of the pipe. The first stage material shall be worked carefully under the haunches of the pipe to provide continuous support throughout the entire pipe length. The haunching backfill material shall be placed in layers approximately six (6) inches maximum thickness and compacted as specified in Section 14 of this specification or as shown on the drawings. During compaction operations, care shall be taken to ensure that the tamping or vibratory equipment does not come in contact with the pipe and the pipe is not deformed or displaced.

When pressure testing is not specified, the pipe shall be covered with a minimum of six (6) inches of backfill material as soon as possible following assembling of the pipe in the trench, but not later than within the same day that placement has

occurred. When pressure testing is specified, sufficient backfill material shall be placed over the pipe to anchor the conduit against movement during pressure testing activities.

b. 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. Final backfill material within two (2) feet of the top of the pipe shall be free of debris or rocks larger than three (3) inches nominal diameter. Coarse backfill materials shall be the specified sand, gravel, crushed rock or drainfill. Final backfill shall be placed in approximately uniform, compacted layers. Final backfill compaction requirements shall be as specified in Section 14 of this specification or as shown on the drawings.

Vehicles or construction equipment shall not be allowed to cross the pipe until the minimum earth cover and required density as specified in Section 14 of this specification has been obtained.

8. PIPE ENCASEMENT IN CONCRETE

Concrete encasement shall be carefully placed to form a continuous uniform support around the entire circumference of the pipe as specified in Section 14 of this specification 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 1/2 inches shall be maintained between the pipe and the reinforcing steel.

The concrete for the encasement shall conform to the requirements of Construction Specification 32, Structure Concrete, for Class 3000M concrete, unless otherwise specified.

9. JOINTS

Unless otherwise specified in Section 14 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 affect on the gasket or pipe materials.

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

Pipe shall be installed and joined in accordance with the manufacturer's recommendations. Laying deflections and joint fitting or stab depths shall be within the manufacturer's recommended tolerances.

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.

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 14 of this specification or as shown on the drawings.

Pipe ends shall be cut square and be de-burred to provide uniform, smooth surfaces 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.

10. FITTINGS

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

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

11. THRUST BLOCKS AND ANCHORS

When specified, concrete thrust blocks and anchors shall be installed as shown on the drawings or specified in Section 14 of this specification.

The concrete for the thrust blocks and anchors shall conform to the requirements of Construction Specification 32, Structure Concrete, for Class 3000M concrete, unless otherwise specified in Section 14 of this specification.

The thrust block cavity shall be hand dug into undisturbed soil or previously placed compacted backfill. The cavity shall be formed with soil or wood to hold the freshly place concrete without displacement until an initial set has occurred.

When excavation beyond the designated trench widths and depths as shown on the drawings or specified in Section 14 of this specification occurs at locations where installation of concrete thrust blocks is required, the Contractor shall install an alternative thrust block provision. The concrete thrust block shall have a thickness of one pipe diameter and a contact face area as shown on the drawings or specified in Section 14 of this specification which shall be formed against the pipe. Backfill shall be placed on all sides of the thrust block and to the sides of the excavation and compacted as specified for initial backfill.

12. PRESSURE TESTING

Method 1 Pressure testing of the completed conduit is not required.

Method 2 The conduit shall be tested for leaks in the following manner:

a. Prior to 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 three (3) days.
- (4) Earth backfill shall be sufficient to anchor the conduit against movement during the pressure testing and shall be compacted as specified in Section 14 of this specification or as shown on the drawings.
- (5) The conduit shall be braced and/or anchored at each end to restrict all potential pipe movement.
- (6) The ends of the conduit shall be plugged. The upstream plug shall have a standpipe installed vertically having a minimum diameter of two (2) inches and shall be equipped with a shutoff valve. All high points in the line shall be vented to evacuate air pockets. The conduit and the standpipe shall be slowly filled with water such that no air is entrapped during the filling operation. After filling is complete, all vents shall be closed.

b. During pressure testing, the water level in the standpipe shall be continuously maintained at a minimum of ten (10) feet above the highest invert elevation of the conduit for a period of not less than two (2) hours, unless otherwise specified in Section 14 of this specification or as shown on the drawings.

The volume of water leakage in the two (2) hour test period shall be recorded. The maximum allowable leakage (L) in gallons per hour shall not exceed 0.02 times the nominal pipe diameter (D) in inches for each 1000 feet of pipe line which is approximately 50 pipe joints ($L = 0.02 \times D$).

c. When observed leakage exceeds the allowable, leaks shall be sealed by replacement of pipe and fittings as necessary. The conduit shall be re-tested as described above. This procedure shall be repeated until the conduit leakage does not exceed the allowable specified above.

The Contractor shall be fully responsible for any and all work required to correct leakage exceeding the amount specified.

Method 3 The conduit shall be tested for leaks in the following manner:

a. Prior to 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 anchor and thrust blocks shall be in place and allowed to cure for a minimum of three (3) days.
 - (4) Earth backfill shall be sufficient to anchor the conduit against movement during the pressure testing and compacted as specified in Section 14 of this specification or as shown on the drawings.
 - (5) The conduit shall be braced and/or anchored at each end to prevent all potential pipe movement.
 - (6) The ends of the conduit shall be plugged and a pressure gauge shall be attached to the upstream and downstream ends. All high points along the pipeline shall be vented to permit the complete removal of all air within the pipeline. The conduit shall be slowly filled with water such that no air is entrapped during the filling operations.
- b. The testing pressure specified in Section 14 of this specification shall be continuously maintained at the upstream gauge for a minimum period of two (2) hours. The pressure at the downstream gauge shall not exceed the pressure rating of the pipe.
- c. The volume of water leakage for the two (2) hour test period shall be recorded. Maximum allowable leakage shall be in accordance with the following:

ALLOWABLE LEAKAGE FOR PLASTIC PIPE
(GALLONS PER HOUR PER 1,000 FEET OR 50 PIPE JOINTS) **

Nominal Pipe Size (Inches)	Test Pressure in the Pipeline – P. S. I.			
	50	100	150	200
		<u>Allowable Leakage</u>		
4	0.19	0.27	0.33	0.38
6	0.29	0.41	0.50	0.57
8	0.38	0.54	0.66	0.76
10	0.48	0.68	0.83	0.96
12	0.57	0.81	0.99	1.15
14	0.67	0.95	1.16	1.34
15	0.72	1.02	1.25	1.44
16	0.76	1.07	1.32	1.52
18	0.86	1.22	1.49	1.72

** Computation Basis

$$L = \frac{ND\sqrt{P}}{7,400}$$

Where: L = allowable leakage in gallons per hour
N = number of joints (pipe and fittings)
D = nominal diameter of pipe in inches
P = test pressure in pounds per square inch (psi)

- d. When observed leakage exceeds the allowable, leaks shall be sealed by replacement of pipe and fittings as necessary. The conduit shall be re-tested as described above.

The Contractor shall be fully responsible for any and all work required to correct leakage exceeding the amount specified.

13. MEASUREMENT AND PAYMENT

Method 1 For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe will be determined to the nearest foot by measurement of the laid length along the crown centerline of the conduit. Payment for each kind, size, and class of pipe will be made at the contract unit price for that kind, size, and class. Such payment will constitute full compensation for furnishing, transporting, and installing the pipe including excavation, shoring, backfill, bedding, thrust blocks, and all fittings, appurtenances, and all other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule will be made at the contract prices for those items.

Method 2 For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe will be determined as the sum of the nominal laying lengths of the sections used. Payment for each kind, size, and class of pipe will be made at the contract unit price for the kind, size, and class. Such payment will constitute for compensation for furnishing, transporting, and installing the pipe including excavation, shoring, backfill, bedding, thrust blocks, and all fittings, appurtenances, and other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule will be made at the contact prices for those items.

Method 3 For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe will be determined to the nearest foot by measurement of the laid length along the crown centerline of the conduit. Payment for each kind, size, and class of pipe will be made at the contract unit price for the kind, size, and class. Such payment will constitute full compensation for furnishing, transporting, and installing the pipe including shoring, all fittings, thrust blocks, appurtenances, and other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule will be made at the contract prices for those items.

Methods 3 and 4 Excavation, backfill, and bedding will be paid separately under their respective bid items.

All Methods The following provisions apply to all methods of measurement and payment. Compensation for any items of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and items to which they are made subsidiary are identified in Section 14 of this specification.