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An American National Standard

Standard Guide for Construction Procedures for Buried Plastic Pipe[1]

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1. Scope*

1.1 This guide describes installation techniques and considerations for open-cut construction of buried pipe. Although this guide was developed for plastic pipe, the concepts of providing the appropriate soil support, care in handling, correct joining techniques, proper soil compaction methods, and prevention of installation damage may apply to any pipe.

1.1.1 Plastic pipe refers to thermoplastic and fiberglass pipe.

1.1.2 Thermoplastic pipe refers to pipe fabricated from polyvinyl chloride (PVC), polyethylene (PE), acrylonitrile-butadiene styrene (ABS), cross-linked polyethylene (PEX), chlorinated polyvinyl chloride (CPVC), or polypropylene (PP). A list of specifications for these products is given in Appendix X2.

1.1.3 Fiberglass pipe refers to a glass-fiber-reinforced thermosetting-resin pipe. A list of ASTM specifications for these products is given in Appendix X2.

NOTE 1—Appendix X2 cannot be considered inclusive because there may be unlisted, recently adopted ASTM specifications for new products that may be installed using this guide.

NOTE 2—Only a few of the ASTM specifications listed in Appendix X2 include the associated fittings. While this guide applies to the installation of pipe, couplings, and fittings, no attempt was made to list all the possible fitting specifications that may be used in conjunction with the pipe specifications. Consult each specification or manufacturer for appropriate fitting standards.

1.1.4 For simplification, the term pipe will be used in this document to mean pipe sections, fittings, and couplings.

1.2 This guide contains general construction information applicable for plastic pipe and supplements the installation standards for the various types of pipe as described in Practices D2321, D2774, D3839, F690, and Guide F645.

NOTE 3—This guide is not applicable for gas pipe applications as additional requirements may apply.

1.3 Flexible pipe, such as thermoplastic and fiberglass, are typically designed to rely on the stiffness of the soil surrounding the pipe for support. The contract documents should describe the requirements of an appropriate soil support system. The construction practices described in this guide can be instrumental in attaining the required soil stiffness.

1.3.1 A discussion of the interaction between a buried pipe and the surrounding soil and the importance of attaining proper soil support is in Appendix X1.

1.3.2 Following these guidelines will be helpful in preventing local deformations in the pipe.

1.4 This guide does not cover underwater installation, pipe that needs to be supported on piling, perforated pipe used for drainage, or gas pipelines.

1.5 Pipelines through areas described as “expansive soils,” “collapsing soils,” landfills or water-logged land (such as swamps) should be constructed using site-specific installation procedures and are not discussed in this guide.

1.6 This guide is not intended to cover all situations. Specific pipe characteristics, fluid transported, local site conditions, environmental concerns, or manufacturer’s recommendations may require different guidelines.

1.7 The construction practices presented in this guide may be affected by the installation requirements of owners, specifying organizations, or regulatory agencies for pipelines crossing roads and highways, other pipelines or cables, or waterways such as streams, drainage channels, or floodways.

1.8 Culverts or pipe that are used as passages through water retaining embankments (for example, earth dams) may be constructed using the principles of this guide, if appropriate provisions are made to prevent water movement along the outside of the pipe (using impervious soils, cutoff collars, head walls, etc.).

1.9 The values stated in SI units are to be regarded as the standard. The inch-pound units in parentheses are given for information only.

NOTE 4—There is no similar or equivalent ISO standard covering the primary subject matter of this guide.

1.10 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

[1] This guide is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.61 on Water.

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***A Summary of Changes section appears at the end of this standard**

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D8 Terminology Relating to Materials for Roads and Pavements
D653 Terminology Relating to Soil, Rock, and Contained Fluids
D883 Terminology Relating to Plastics
D1600 Terminology for Abbreviated Terms Relating to Plastics
D4914 Test Methods for Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit
D5030 Test Method for Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit
F412 Terminology Relating to Plastic Piping Systems
Pipe Installation:
D2321 Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
D2774 Practice for Underground Installation of Thermoplastic Pressure Piping
D3839 Guide for Underground Installation of "Fiberglass" (Glass-Fiber Reinforced Thermosetting-Resin) Pipe
F645 Guide for Selection, Design, and Installation of Thermoplastic Water- Pressure Piping Systems
F690 Practice for Underground Installation of Thermoplastic Pressure Piping Irrigation Systems (Withdrawn 2012)[3]
Soil Testing:
D698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
D1556 Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
D1557 Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))
D2167 Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
D2216 Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
D2487 Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
D2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)
D4253 Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
D4254 Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
D4564 Test Method for Density and Unit Weight of Soil in Place by the Sleeve Method (Withdrawn 2013)[3]
D4653 Test Method for Total Chlorides in Leather
D4944 Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester
D4959 Test Method for Determination of Water Content of Soil By Direct Heating
D5080 Test Method for Rapid Determination of Percent Compaction
Joining Practices:
D2657 Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings
D2855 Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets
D6938 Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
F402 Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
F913 Specification for Thermoplastic Elastomeric Seals (Gaskets) for Joining Plastic Pipe
F2164 Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure
F2620 Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
Other ASTM Standards:
C94/C94M Specification for Ready-Mixed Concrete
F1417 Practice for Installation Acceptance of Plastic Nonpressure Sewer Lines Using Low-Pressure Air

2.2 *American Water Works Association (AWWA) Standards:*[4]

C651 Disinfecting Water Mains
C904 Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping system Using Hydrostatic Pressure

2.3 *American Association of State Highway and Transportation Officials (AASHTO) Standard:*

Standard Specification for Highway Bridges[5]

2.4 *Uni-Bell PVC Pipe Association Standard:*

UNI-B-13 Recommended Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride (PVC) Pipe[6]

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminologies D8, D653, D883, D1600, and F412 unless otherwise indicated. Abbreviations are in accordance with Terminology D1600, unless otherwise indicated.

3.1.1 The definitions and descriptions of soil are in accordance with the Unified Soil Classification System as presented

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from American Water Works Association (AWWA), 6666 W. Quincy Ave., Denver, CO 80235, http://www.awwa.org.

[5] Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, http://www.transportation.org.

[6] Available from the Uni-Bell PVC Pipe Assoc., 2655 Villa Creek Dr., Suite 155, Dallas, TX 75234.

in Classification D2487. Soils may be identified and described in the field using the procedures stated in Practice D2488.

NOTE 5—The terms describing an installation cross-section are illustrated in Fig. 1. Other terms related to parts of the pipe are illustrated in Fig. 2.

NOTE 6—These terms may be different from the ones used in Practices D2321, D2774, D3839, or F690. The terms in this guide are used to describe the construction sequence and are not meant to replace or conflict with other standards.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *backfill*—material placed over the embedment up to the ground surface.

3.2.2 *bedding*—material placed in the bottom of the trench on top of the foundation soil to provide uniform support for the pipe.

3.2.3 *embedment*—material placed around the pipe that provides side support.

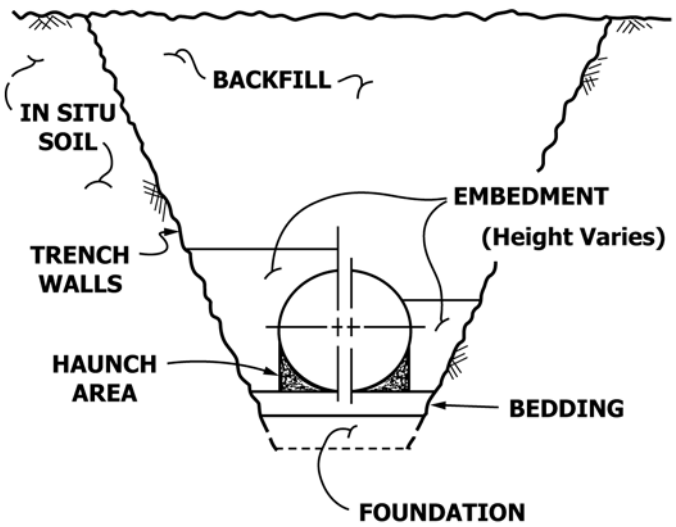
3.2.4 *foundation soil*—material in the bottom of the trench that is (*1*) undisturbed and remains in place; (*2*) removed and replaced by another material, (*3*) displaced by another material; or (*4*) removed and then recompacted into place.

3.2.5 *haunch area*—the area of the embedment under the pipe from the bottom of the pipe up to the springline, as illustrated in Fig. 1.

3.2.6 *in situ material*—the in-place soil or rock that a trench is excavated through that is either (*1*) naturally formed or deposited; or (*2*) manmade.

3.2.7 *manufactured aggregates*—aggregates that are products or byproducts of a manufacturing process (such as slag), or natural aggregates that are reduced to their final form by a manufacturing process such as crushing.

3.2.8 *springline*—a line along the length of the pipe at its maximum width along a horizontal plane. **(F412)**



NOTE 1—This drawing is illustrative only. Trench dimensions and slope vary with depth and soil conditions.

FIG. 1 Trench Cross Section Terminology

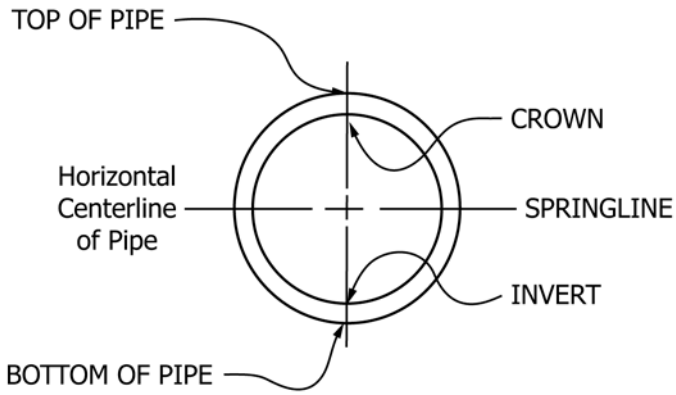


FIG. 2 Pipe Terminology

4. Significance and Use

4.1 This guide may be used as a reference of acceptable open-cut construction practices for the proper installation of buried fiberglass and thermoplastic pipe. This guide may be used as follows:

4.1.1 Installation contractors have an awareness of the level of workmanship required and use this information for bidding purposes and during construction.

4.1.2 Construction inspectors have a reference of acceptable installation practices.

4.1.3 Specification writers may use this guide as a reference in contract documents.

4.1.4 Designers may review this information during planning and design for factors to consider in the preparation of plans and specifications.

4.1.5 The owner of the pipeline may use this guide as a reference for restoration of proper pipe support and embedment when original construction is disturbed due to repairs, modifications, or construction of adjacent or crossing pipelines or cables.

4.2 This guide should not be used to replace project specification requirements, manufacturer's recommendations, plumbing codes, building codes, or ASTM installation standards, but may be used to supplement that information.

5. Inspection, Handling, and Storage

5.1 *Load Inspection*—The pipe should be packaged or loaded as recommended by the supplier. The receiver of the pipe should be aware of (*1*) the loading and packaging requirements for each mode of transportation used; (*2*) the continuance of proper handling in any multiple loading and unloading before arrival; and (*3*) any transportation incident (wreck). Before unloading, the receiver should examine the load for transportation damage, particularly if the load has shifted, packaging is broken, or if there are signs of rough treatment. Damage may also have been caused from overtightening tie-down straps or from the tie-down straps not being located at the same point along the pipe barrel where the pipe supports are located. The pipe should be examined for abrasion due to (*1*) bells, couplings, or other joint surfaces being in contact with each other or any hard object or surface; and (*2*) unpadded metal tie-down straps.