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100 Barr Harbor Dr., West Conshohocken, PA 19428
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Standard Practice for Underground Installation of Thermoplastic Pressure Piping Irrigation Systems[1]

This standard is issued under the fixed designation F 690; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers general and basic procedures related to the proper installation of thermoplastic, flexible, pressure piping, 36 in. nominal size and smaller, for underground irrigation systems. Because there is considerable variability in end-use requirements, soil conditions, and thermoplastic piping characteristics, it is the intent of this practice to outline general objectives and basics of proper installation and to provide pertinent references, rather than to prescribe detailed installation procedures.

1.2 This practice should not be used for installing thermoplastic underground sewer, drain, potable water, conduit or gas service piping.

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

1.4 *This standard does not purport to address all of the safety problems, 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.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 2487 Test Method for Classification of Soils for Engineering Purposes[2]

D 2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)[2]

F 402 Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings[3]

3. Joints and Connections

3.1 Joints and connections shall be assembled to withstand the design working pressure for the pipeline without leakage, internal restriction or obstruction, which could reduce line capacity below design requirements.

3.2 All joining materials shall be of composition that will not damage the pipe and shall be recommended for use at the design pressure for the pipeline. Consult the manufacturer for design and installation recommendations and refer to Practice F 402.

3.3 When steel or other metallic joining materials, subject to corrosion, are used in the line, they shall be adequately protected by wrapping or coating with high quality corrosion preventatives. Wrapping or coatings that are applied on metallic surfaces should not be applied on plastic pipes and fittings unless it is first established by consulting the piping manufacturer that they have no detrimental effect on the plastic.

3.4 Joining specifications are listed under 2.1.3.

3.5 Manufacturers of joining materials should be consulted for specific assembly instructions not covered by existing specifications. When requesting information, the intended service application should be defined.

4. Trench Preparation

4.1 *Trench Depth*—In stable granular soils which tend to be relatively smooth, and free of all rocks and debris larger than ½ in. (13 mm) in sizes, excavation may proceed directly to final grade. Where rocks of other protrusions are encountered which may cause point loading on the pipe, the trench bottom should be overexcavated to permit installation of proper bedding (see Section 5).

4.2 *Trench Width*—The width of the trench at any point below the top of the pipe should be established with attention given to these considerations:

4.2.1 The wider the trench at the top of the pipe, the greater the earth load imposed on the pipe until the prism load has been achieved.

4.2.2 Trench width should allow sufficient and safe working room for proper alignment and assembly of the joints. Generally, a trench width at the top of the pipe of about 2 ft (600 mm) wider than the pipe diameter is adequate. However, for pipe with an 18-in. (457-mm) diameter and larger in a vertical-walled trench, a clearance of 3 ft (1 m) wider than the nominal pipe size may be needed. For sloped trenches, a minimum of an 18-in. (457-mm) greater trench bottom width than the pipe diameter allows sufficient width. If a wider trench becomes necessary, the enlargement should be restricted as much as possible to only that section above the top of the pipe.

4.2.3 Trench width should allow adequate room for snaking when recommended by the manufacturer or as may be required

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[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] *Annual Book of ASTM Standards*, Vol 08.04.

to accommodate thermal expansion or contraction.

4.2.4 Narrower trench widths may be utilized by joining the pipe above ground and lowering it into the trench, provided enough room is available in the trench for proper haunching. Precautions outlined in 5.2 shall be followed.

4.3 *Trench Depth*—The trench depth shall be established with consideration given to requirements imposed by foundation, bedding, pipe size, and cover.

4.4 *Foundation*—An adequate and stable foundation should be present, or provided, for proper support at the total trench load.

4.4.1 Foundation preparation is not necessary when smooth stable trench bottoms are encountered.

4.4.2 Foundation preparation is necessary when unstable trench bottom conditions are encountered. The designer should specify the stabilizing method and materials which will satisfactorily stabilize the encountered condition and provide adequate and permanent support.

4.5 *Bedding*—The bedding material should consist of gravel, sand, silty sand, silty gravel, or clayey sand in granular form and having a maximum particle size of ¾ in. (19 mm).

4.5.1 Bedding shall be provided whenever rock, hard pan, boulders, or other materials that might damage the pipe are encountered in the trench bottom at the established pipe grade.

4.5.2 When bedding is used, it shall be kept as nearly uniform in depth as possible to minimize differential settlement.

4.6 *Minimum Earth Cover*—Protection from traffic loading or frost penetration, or both should be considered when establishing minimum earth cover requirements.

4.6.1 For installations exposed to normal farm vehicle traffic, the minimum total cover should not be less than:

Pipe 1 to 2½ in. in diameter:	18 in. (450 mm)
Pipe 3 to 4 in. in diameter:	24 in. (600 mm)
Pipe 5 in. and larger in diameter:	30 in. (750 mm)
Pipe 5 to 18 in. in diameter:	30 in. (750 mm)
Pipe 18 in. and larger in diameter:	36 in. (900 mm)

4.6.2 The pipe line should be installed at sufficient depths to provide protection from traffic crossing, farming operations, and soil cracking. Load-bearing capabilities of installed pipe vary with type of pipe, type of backfill, soil conditions, and installation procedures. Consult the manufacturer for information on product response to expected maximum earth loading.

4.6.3 The trench depth shall be sufficient to ensure placement of the top of the pipe at least 10 in. (250 mm) below the known frost line. When conditions and design requirements prevent satisfaction of this requirement, system design and installation must ensure proper drainage in the low portions of the line.

5. Pipe Assembly and Installation

5.1 *Preparation of Joints*—Joint assembly shall be done in accordance with specifications listed under 2.1.3.

5.2 If the pipe is to be assembled above ground, it should be lowered into the trench, taking care not to drop it or damage it against the trench walls, nor to subject it or its joints to treatment, such as, dragging or excessive bending which could be injurious to the piping. With elastomeric seal joints, take care to avoid joint displacement and pull out. Allow heat-fused joints to cool or solvent-cemented joints to cure for the minimum prescribed time before moving the pipe. While moving larger diameter pipe lines, care should be taken to avoid excessive stressing of the joints.

5.3 Ensure that elastomeric seal joints are not installed so they remain excessively deflected. Consult the pipe manufacturer for maximum permissible joint deflection limits.

5.4 Changes in the grade and line of direction of the pipe shall be limited and shall be gradual enough so that the bending of the pipe will develop neither excessive diametrical expansion nor excessive bending stresses. At no time should the pipe be blocked or braced to hold a bend. Excess curvature can create stresses which could induce pipe failure under pressure. Consult the pipe manufacturer for recommended minimum pipe bending radius.

5.5 When installing pipe with elastomeric seal, flanged joints, or with any connector which protrudes beyond the pipe diameter, bell holes should be excavated in the bedding material or trench bottom to permit the pipe to be continuously supported. After pipe assembly and placement in the trench, each bell hole should be filled with bedding material and compacted if necessary to attain the same general density as the rest of the bedding.

5.6 It is advisable to permit newly installed pipe to cool to approximately ground temperature prior to backfilling. This will minimize the development of contraction stresses on the joints and, in the case of solvent-cemented connections, it will prevent the possibility of joint separation due to contraction forces acting on an incompletely cured bond. Typically, pipe will cool adequately soon after being placed on a shaded-trench bottom.

5.7 Where differential settlement could create concentrated loading on a pipe or joint, for example, at a point of connection of a buried pipe to a rigid structure, such as a manhole, manufacturer's recommendations should be followed to prevent, or to properly relieve, damaging and shearing forces. One technique is to use extra care when compacting the foundation and bedding under a rigid structure. Other techniques might include construction of a supporting structure underneath the joint and the pipe of about three diameters in cross section or the utilization of a flexible joint.

5.8 *Special Installation*—With certain pipes and in some soil conditions it is possible to install long lengths of pipe by the plowing-in technique. Consult the manufacturer for recommendations.

6. Thrust Blocking

6.1 When installing piping systems that include joints that are not self restraining (for example, elastomeric seal type) thrust blocking may be necessary at certain points in the system, such as changes in direction, in order to prevent possible disengagement of the fitting from the pipe.

6.2 Thrust blocking is required where line shift or joint separation at system operating pressure can be anticipated, that is, pump discharge, directional changes, reducers, and dead ends. Thrust blocking is essential to the proper performance of high pressure irrigation piping when the system includes non-self-restraining joints. (See Fig. 1.)

6.3 *Thrust Block Construction*: