Designation: F585 – 16

Standard Guide for Insertion of Flexible Polyethylene Pipe Into Existing Sewers[1]

This standard is issued under the fixed designation F585; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This guide describes design and selection considerations and installation procedures for the rehabilitation of sanitary and storm sewers by the insertion of solid wall or profile wall or corrugated polyethylene pipe into an existing pipe and along its existing line and grade. The procedures in this guide are intended to minimize traffic disruption, surface damage, surface restoration and interruption of service.

1.2 The polyethylene piping product manufacturer should be consulted to determine the polyethylene piping product's suitability for insertion renewal as described in this guide.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *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.* See 6.1, 7.1, and 8.1 for additional safety precautions.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F412 Terminology Relating to Plastic Piping Systems
F1417 Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air
F1804 Practice for Determining Allowable Tensile Load for Polyethylene (PE) Gas Pipe During Pull-In Installation
F2620 Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

2.2 *Other Documents:*[3]

PPI Material Handling Guide

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology F412, unless otherwise specified.

4. Significance and Use

4.1 The procedures described in this guide are intended as a design and review aid for use by the design engineer in conjunction with manufacturer's recommendations for installing a polyethylene pipe using the insertion method.

5. Design and Selection Considerations

5.1 *General Guidelines:*

5.1.1 *Host Pipe Condition Assessment*—Prior to the selection of polyethylene pipe size and installation procedure, measures should be taken to determine in detail the condition of the host (original) sewer piping. A detailed examination should determine if the host sewer piping is structurally sufficient, and that any joint offsets or other host pipe defects will permit polyethylene pipe insertion.

5.1.2 The presence of obstructions should be determined (see 6.3). Protrusions of lateral or service piping into the host sewer pipe, root growths, sedimentation, mineral deposits, or any combination of such obstructions, may require remedial work prior to inserting the polyethylene pipe.

5.1.3 To ensure against interference during insertion, the minimum annular clearance between the polyethylene pipe OD and the host pipe ID should be 10 % of the host pipe ID or 2 in. (50 mm) whichever is less. Greater annular clearance is acceptable. Outside diameter information should be obtained from the polyethylene pipe manufacturer.

5.1.4 The number of insertion excavations should be kept to a minimum and should coincide with areas where problems have been detected in the existing sewer (see Section 7).

5.1.5 Solid wall or profile wall or corrugated polyethylene pipe may be assembled at the time of insertion using heat fusion in accordance with Practice F2620, integral bell and

[1] This guide is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.62 on Sewer.

Current edition approved Oct. 1, 2016. Published December 2016. Originally approved in 1978. Last previous edition approved in 2013 as F585 – 13. DOI: 10.1520/F0585-16.

[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] Available from Plastics Pipe Institute (PPI), 105 Decker Court, Suite 825, Irving, TX 75062, http://www.plasticpipe.org.

*A Summary of Changes section appears at the end of this standard spigot joints, or mechanical connections as appropriate for the polyethylene piping product.

5.1.6 In all cases, the hydraulic capacity of the pipeline should be assessed by an engineer to insure the reduction in flow area from an inserted pipe or deterioration or deformation, or both, of the host pipe does not adversely impact the hydraulic capacity or flow characteristics of the storm or sanitary sewer.

NOTE 1—It should be noted, in many instances, the pipe being retrofitted is not designed to flow at 100 percent capacity, which may provide additional options for downsizing of the inserted pipe.

5.2 *Ancillary materials*—Mechanical fasteners, sealants, grouts and other materials that are or are likely to be exposed to sanitary sewage, sewage gases or other corrosive elements of the sanitary sewer environment should be resistant to deleterious effects of the sanitary sewer environment. Sealants, grouts and other materials must be selected with the ability to adequately cure in underwater, sewage or other corrosive environments.

5.3 *External Loading*—Areas where the host pipe is or may be structurally compromised, or where some or the entire host pipe had been removed will subject the polyethylene pipe to external loads. Information about the resistance of polyethylene pipe (pipe stiffness (PS) or ring stiffness constant (RSC), and buckling resistance) to external hydrostatic and earth loads should be obtained from the pipe manufacturer, and is available in some ASTM polyethylene pipe specifications. Design information about the external load collapse resistance of polyethylene pipe is available in Handbooks and Technical Notes published by the Plastics Pipe Institute.

5.3.1 *Hydraulic Loads*—When the ground water level may be above the polyethylene pipe, the ground water level and its duration should be estimated by the design engineer, and the polyethylene pipe should be designed to withstand the estimated external hydrostatic pressure without collapsing.

5.3.2 *Filling the Annulus*—Filling the annulus between the host pipe and the polyethylene pipe with a cementitious grout or other structurally stable material increases the resistance of the polyethylene pipe to external hydrostatic or structural load, and may improve the overall external load capacity of the host pipe. Flexible pipe such as polyethylene pipe relies in part on materials that surround the pipe for external structural load resistance. Flexible pipe ring stiffness and the stiffness of materials surrounding the flexible pipe act together to support external loads. Structurally stable fill materials are materials that remain in place and resist movement from the rise and fall of groundwater around the pipeline. Fill materials may be able to penetrate into cracks and voids in the host pipe, and in combination with the inserted polyethylene pipe provide partial structural rehabilitation. Host pipe condition assessment per 5.1.1 should identify if filling the annulus is needed for structural reasons. Hydraulic load analysis per 5.3.1 should identify if filling the annulus is needed for hydraulic load resistance.

5.3.3 *Point Excavation Encasement*—At all points where the polyethylene pipe has been exposed, such as at excavations for polyethylene pipe insertion, or for service connections, or excavations at other points where structurally unsound host pipe is removed, the polyethylene pipe, fittings, and service connections should be encased in embedment that provides structural support for the polyethylene pipe. Polyethylene pipe embedment design information is available from organizations such as the Plastics Pipe Institute. If the annulus is not filled (5.3.2), stabilized embedment material should be used to seal the ends of the excavation against embedment migration into the annulus. Stabilized embedment material is at least 6 in. (150 mm) of concrete, or cement-stabilized sand, or other stable high-density material as specified by the design engineer. Preparations for placing of the encasement material include the removal of debris and soil along each side of the host pipe down to the spring line. After the encasement material has been placed and accepted by the design engineer, backfill is placed and compacted to the required finished grade in accordance with the design engineer's specifications. At service connections, care should be taken to ensure compaction of earth beneath the lateral service pipe in order to reduce subsidence that can cause bending at the lateral connection.

5.3.4 *Host Pipe Deterioration*—Structural deterioration of the host pipe may continue after the polyethylene pipe has been installed. Uneven or concentrated point loading on the polyethylene pipe or subsidence of the soil above the host pipe may occur if the host pipe collapses or if large parts of the host pipe fall into the annulus between the host pipe and the polyethylene pipe. This can be avoided by filling the annular space between the inside diameter of the host pipe and the outside diameter of the polyethylene pipe. See 5.3.2.

5.4 *Axial Bending:*

5.4.1 Solid wall polyethylene pipe is relatively flexible such that the barrel of the pipe may be curved during installation. It will accommodate reasonable irregularities in line and grade. Excessive pipe barrel bending during handling and installation that may cause the pipe to kink should be avoided. Axial (longitudinal) bends induced during the insertion step, in transporting pipe lengths from assembly sites to job sites, or permanent bends to accommodate line or grade changes, should not be less than the minimum bending radius in Table 1. The bending radius is the inside radius of curvature.

5.4.2 Axial bending of bell and spigot joined or coupled profile wall or corrugated polyethylene pipe is generally limited by the allowable angular displacement of bell and spigot or spigot and coupling joints. The manufacturer should be contacted for information.

TABLE 1 Minimum Bending Radii for Solid Wall Pipe

Dimension Ratio, DR	Minimum Bending Radius
<9	20 x Pipe OD
>9 to 13.5	25 x Pipe OD
>13.5 to 21	27 x Pipe OD
>21 to 26	34 x Pipe OD
>26 to 32.5	42 x Pipe OD
>32.5	52 x Pipe OD
Fitting, Flange or MJ Adapter in Bend[A]	100 x Pipe OD

[A]Because fittings, flange and MJ Adapter connections are rigid compared to the pipe, the minimum bend radius is 100 times the pipe OD when a fitting flange or MJ adapter is present in the bend. The bend radius should be limited to 100 x OD for a distance of about 5 times the pipe OD on either side of the fitting, flange or MJ adapter location.