~~Designation:F2019–00~~ Designation: F 2019 – 03 (Reapproved 2009)

An American National Standard

Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP)[1]

This standard is issued under the fixed designation F 2019; 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 the procedures for the reconstruction of pipelines and conduits (4 to 48 in. (100 to 1200 mm) diameter) by the pulled-in place installation of a resin-impregnated, flexible fabric tube into an existing conduit followed by inflation with compressed air (see Fig. 1~~). The resin/fabric tube is cured by flow through the fabric tube of mixed air and steam. When cured, the finished cured-in-place pipe will be continuous and tight fitting. This reconstruction process can be used in a variety of gravity flow applications such as sanitary sewers, storm sewers, process piping, electrical conduits and ventilation systems.~~

~~1.2The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for informational purposes only.~~). The resin/fabric tube can be cured by either the flow through the fabric tube of mixed air and steam or by use of ultraviolet light. When cured, the finished cured-in-place pipe will be continuous and tight fitting. This reconstruction process can be used in a variety of gravity flow applications such as sanitary sewers, storm sewers, process piping, electrical conduits, ventilation systems, and pressure applications.

1.2 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.

1.3 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D 543 ~~Testing Method of Resistance of Plastics to Chemical Reagents~~ Practices for Evaluating the Resistance of Plastics to Chemical Reagents

D 578 Specifications for Glass Fiber Strands

D 638 ~~Testing~~Test Method for Tensile Properties of Plastics

D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D 1600 Terminology for Abbreviated Terms Relating to Plastics

D 1682 Test Method for Breaking Load and Elongation of Textile Fabrics[3]

D 3039/D 3039M Test Method for Tensile Properties of Polymer Matrix Composite Materials

D 3567 Practice for Determining Dimensions of Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe ~~(RTRP)~~ and Fittings

D 5813 ~~Specification for Cured-in-Place Thermosetting Resin Sewer Pipe~~[5]
Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems

F 412 Terminology Relating to Plastic Piping Systems

F 1216 Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube

F 1417 ~~Test Method for Installation Acceptance of Gravity Plastic Sewer Lines Using Low Pressure Air Testing~~[5] Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

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[1] This practice is under the jurisdiction of ASTM Committee ~~F-17~~ F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.67 on Trenchless Plastic Pipeline Technology.

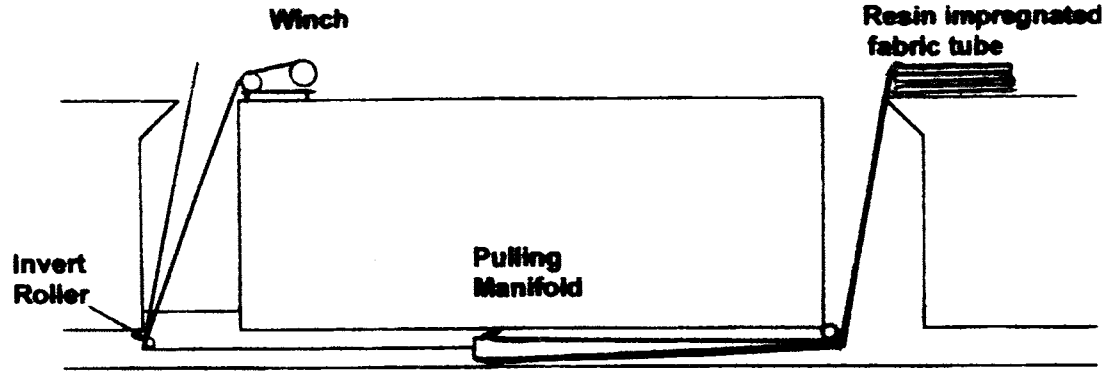
~~Current edition approved May 10, 2000. Published August 2000.~~

Current edition approved Aug. 1, 2009. Published November 2003. Originally approved in 2000. Last previous edition approved in 2003 as F 2019 – 03.

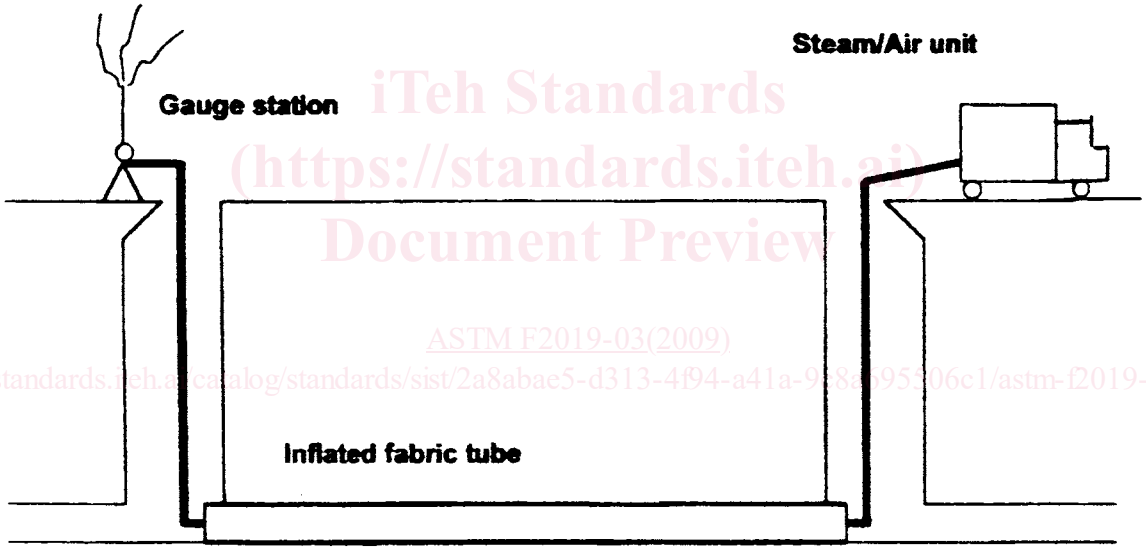
[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* ~~, Vol 08.01.~~volume information, refer to the standard's Document Summary page on the ASTM website.

[3] ~~Annual Book of ASTM Standards, Vol 07.01.~~

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



Step1 - Pulling resin impregnated fabric tube in place



Step 2 Inflated resin impregnated fabric tube

FIG. 1 Cured-In-Place Pipe Installation Method (Air/Steam)

F 1743 Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)

2.2 *AWWA Standard:*

Manual on Cleaning and Lining Water Mains, M28 [4]

2.3 *NASSCO Standard:*

Recommended Specifications for Sewer Collection System Rehabilitation [5]

3. Terminology

3.1 *General*:

[4] ~~Discontinued; see *1991 Annual Book of ASTM Standards*, Vol 07.01.~~
[4] Available from American Water Works Association (AWWA), 6666 W. Quincy Ave., Denver, CO 80235, http://www.awwa.org.
[5] ~~Annual Book of ASTM Standards, Vol 08.04.~~
[5] Available from National Association of Sewer Service Companies, 423 W. King Street, Suite 3000, Chambersburg, PA 17201

3.1.1 Definitions are in accordance with Terminology F 412.Abbreviations are in accordance with Abbreviations D 1600, unless otherwise indicated.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *calibration hose*—an impermeable bladder installed inside the fabric tube, and inflated with air or steam, or both to press the tube firmly against the wall of the existing pipe until the resin is cured with air and steam or ultraviolet light. The calibration hose is removed when the installation is finished.

3.2.2 *cured-in-place pipe (CIPP)*—a hollow cylinder consisting of a glass reinforced plastic (GRP) fabric tube with cured thermosetting resin. External foils are included. The CIPP is formed within an existing pipe and takes the shape of the pipe.

3.2.3 *delamination*—separation of the layers in the sandwich constructed CIPP

3.2.4 *dry spot*—an area of the fabric tube, where the finished CIPP is deficient or devoid of resin.

3.2.5 ~~*E-CR glass*—an E-glass type that is resistant to normal sewer effluents as tested according to 6.4.1 and 6.4.2 of Specification D5813~~fiberglass composite—a material that is resistant to normal sewer effluents as tested in accordance with 6.4.1 and 6.4.2 of Specification D 5813.

3.2.6 *fabric tube*—flexible ~~sandwich~~ fiberglass materials formed into a tubular shape which ~~during the installation~~ is saturated with resin prior to installation and holds the resin in place as a permanent part of the installed cured-in-place pipe as further described in 5.2.1.

3.2.7 *lift*—a portion of the CIPP that is a departure from the existing conduit well forming a section of reverse curvature in the CIPP.

3.2.8 ~~*slip-foil*~~sliding foil—a plastic foil installed prior to the fabric tube covering the lower third of the circumference of the existing pipe to reduce friction.

4. Significance and Use

4.1 This practice is for use by designers and specifiers, regulatory agencies, owners and inspection organizations who are involved in the rehabilitation of conduits through the use of a resin-impregnated fabric tube, pulled in place through an existing conduit and subsequently inflated and cured. As for any standard practice, modifications may be required for specific job conditions.

5. Recommended Materials and Manufacture

5.1 *General*—The fabric tube, resin and external preliners shall produce a CIPP that meets the requirements of these specifications.

5.2 *CIPP Wall Composition*—The wall shall consist of a corrosion resistant fiberglass fabric tube (Fig. 2) saturated with a thermosetting (cross-linked) resin, and if used a filler material.

5.2.1 *Fabric Tube*—The fabric tube shall consist of at least two separate tubes made of corrosion resistant (E-CR) glass fibers in accordance with Specification D 578. The internal surface shall consist of a veil preferably made of polyester. The fabric tube shall further be constructed with longitudinal unidirectional glass roving of sufficient strength to negotiate a pulling force at least equal to the weight of the liner. The fabric tube shall tolerate up to 10 % circumferential changes in the existing conduit.

5.2.2 *External Foils*—~~The external foils (Layers 1 and 2 in Fig. 2) shall consist of one or more layers of styrene and light proof tube shaped plastic foils.~~ —The external foils (Layer 1 in Figs. 2 and 3) shall consist of one or more layers of styrene resistant or light proof, or both, tube-shaped plastic foils.

5.2.3 *Calibration hose*—The calibration hose (Layer 6 in Fig. 2 and Layer 5 in Fig. 3) which is installed during the construction of the fabric tube, shall consist of a tube shaped plastic foil able to resist styrene and temperatures up to 260°F (126°C) while exposed to the installation pressure sufficient to keep the fabric tube tight against the pipe wall. It shall further release easily from the inside wall for removal, when the installation is finished.

5.2.4 *Resin*—The resin system shall consist of a chemically resistant isophthalic polyester or vinyl ester thermoset resin and catalyst system or an epoxy resin and hardener that is compatible to the installation process. The resin system shall have an initiating temperature less than 180°F (82°C).

5.2.5 *Properties*—The cured CIPP product shall at least have the initial structural properties given in Table 1. These physical properties should be determined in accordance with Section 7 of this practice.

5.2.6 *Chemical Resistance*—The cured resin/fabric matrix shall after the calibration hose is removed be evaluated in a laminate for qualification testing of long term chemical exposure to a variety of chemical effluents and should be evaluated in a manner consistent with 6.4.1 and 6.4.2 of Specifications D 5813.

6. Installation Recommendations

6.1 *Cleaning and Pre-Inspection* :

6.1.1 *Safety*—Prior to entering access areas such as manholes, and performing inspection and cleaning operations, an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen ~~must~~shall be undertaken in accordance with local, state or federal safety regulations.

6.1.2 *Cleaning the Pipeline*—All internal debris ~~should~~shall be removed from the original pipeline. Gravity pipes ~~should~~shall be cleaned with hydraulically powered equipment, high velocity jet cleaners, or mechanically powered equipment ~~according to~~ in

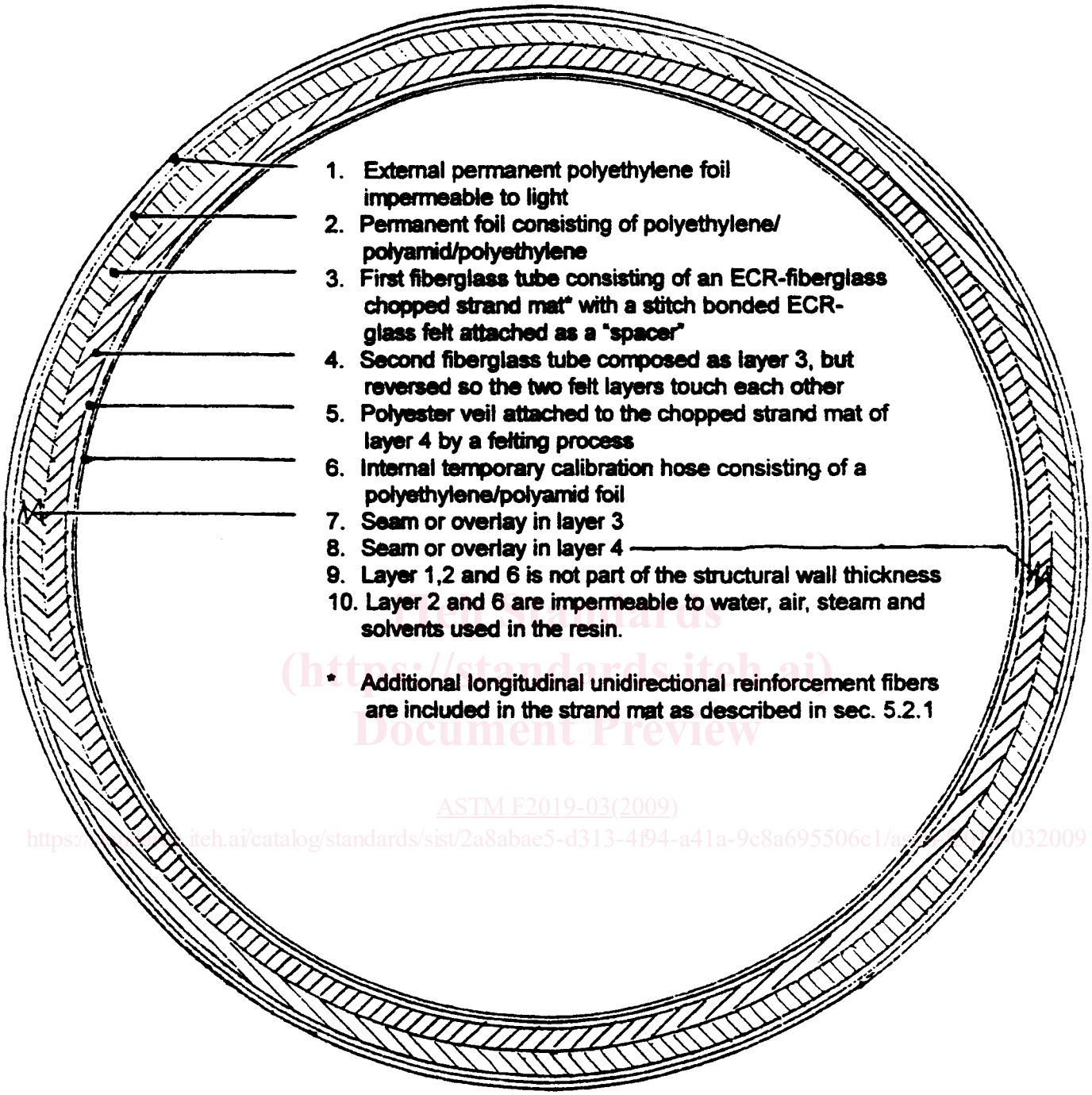


FIG. 2 Composition of Fabric Tube

accordance with NASSCO Recommended Specifications for Sewer Collection System Rehabilitation. Pressure pipelines ~~should~~shall be cleaned with cable attached devices or fluid propelled devices ~~according to~~in accordance with AWWA Manual on Cleaning and Lining Water Mains, M28.

6.1.3 *Line Obstructions*—The original pipeline should be clear of obstructions such as solids, dropped joints, protruding service connections, collapsed pipe, and reductions in the cross-sectional area of more than 40 % that may hinder or prevent the installation of the resin impregnated fabric tube. ~~If~~Where the inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment, then a point repair ~~should~~shall be made to remove the obstruction.

6.1.4 *Inspection of Pipelines*—Inspection of pipelines ~~should~~shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by closed circuit television or man entry. The interior of the pipeline ~~should~~shall be carefully inspected to determine the location of any conditions that ~~may~~ prevent proper installation of the impregnated tube, such as protruding service taps, collapsed or crushed pipe, and reductions in the cross-sectional area of more than 40 %. These conditions ~~should~~shall be noted ~~so they can be~~and corrected prior to the installation.