Designation: F2019 – 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 F2019; 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 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]

D543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents

D578 Specification for Glass Fiber Strands

D638 Test Method for Tensile Properties of Plastics

D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D1600 Terminology for Abbreviated Terms Relating to Plastics

D1682 Methods of Test for Breaking Load and Elongation of Textile Fabrics[3]

D3039/D3039M Test Method for Tensile Properties of Polymer Matrix Composite Materials

D3567 Practice for Determining Dimensions of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings

D5813 Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems

F412 Terminology Relating to Plastic Piping Systems

F1216 Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube

F1417 Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

F1743 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*:

3.1.1 Definitions are in accordance with Terminology F412. Abbreviations are in accordance with Abbreviations D1600, 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

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

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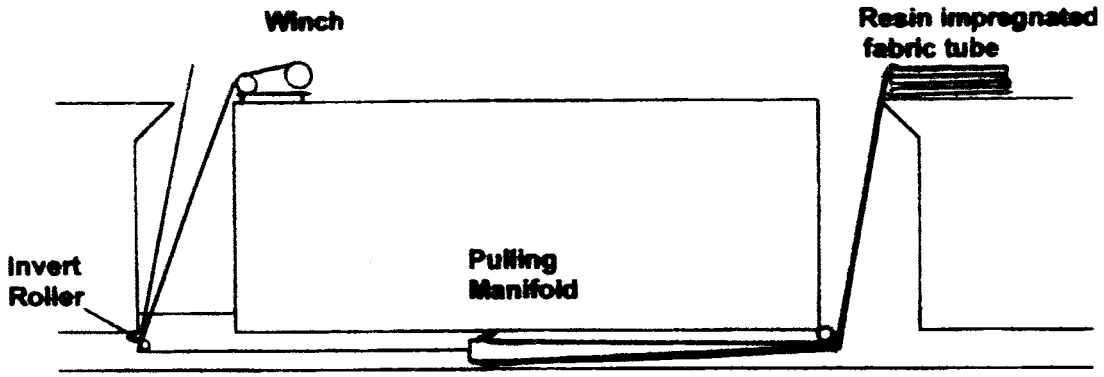
[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

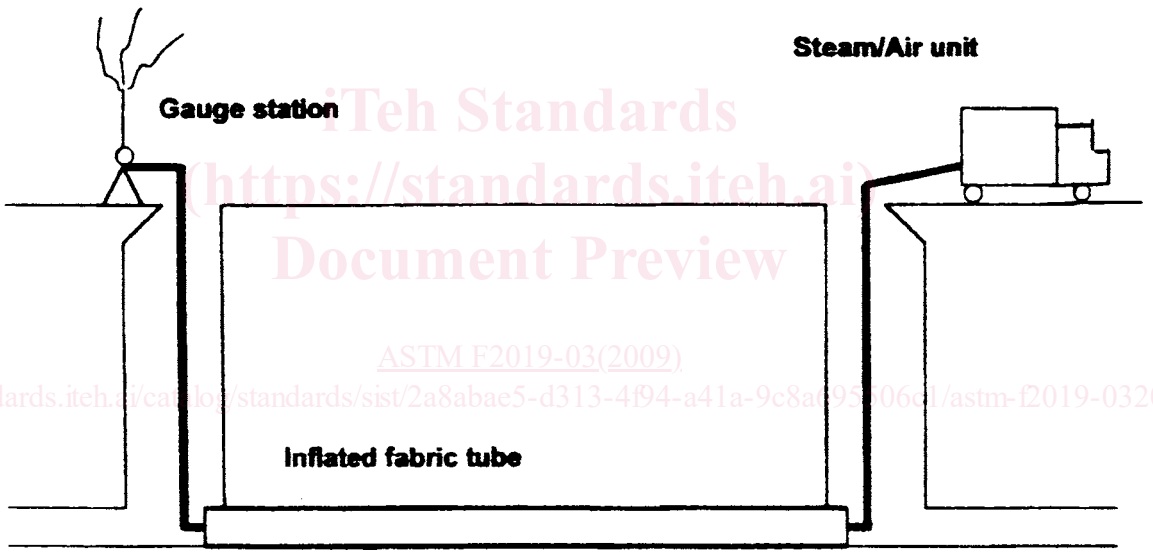
[3] Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

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

[5] Available from National Association of Sewer Service Companies, 423 W. King Street, Suite 3000, Chambersburg, PA 17201



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)

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 *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 D5813.

3.2.6 *fabric tube*—flexible fiberglass materials formed into a tubular shape which 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 *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

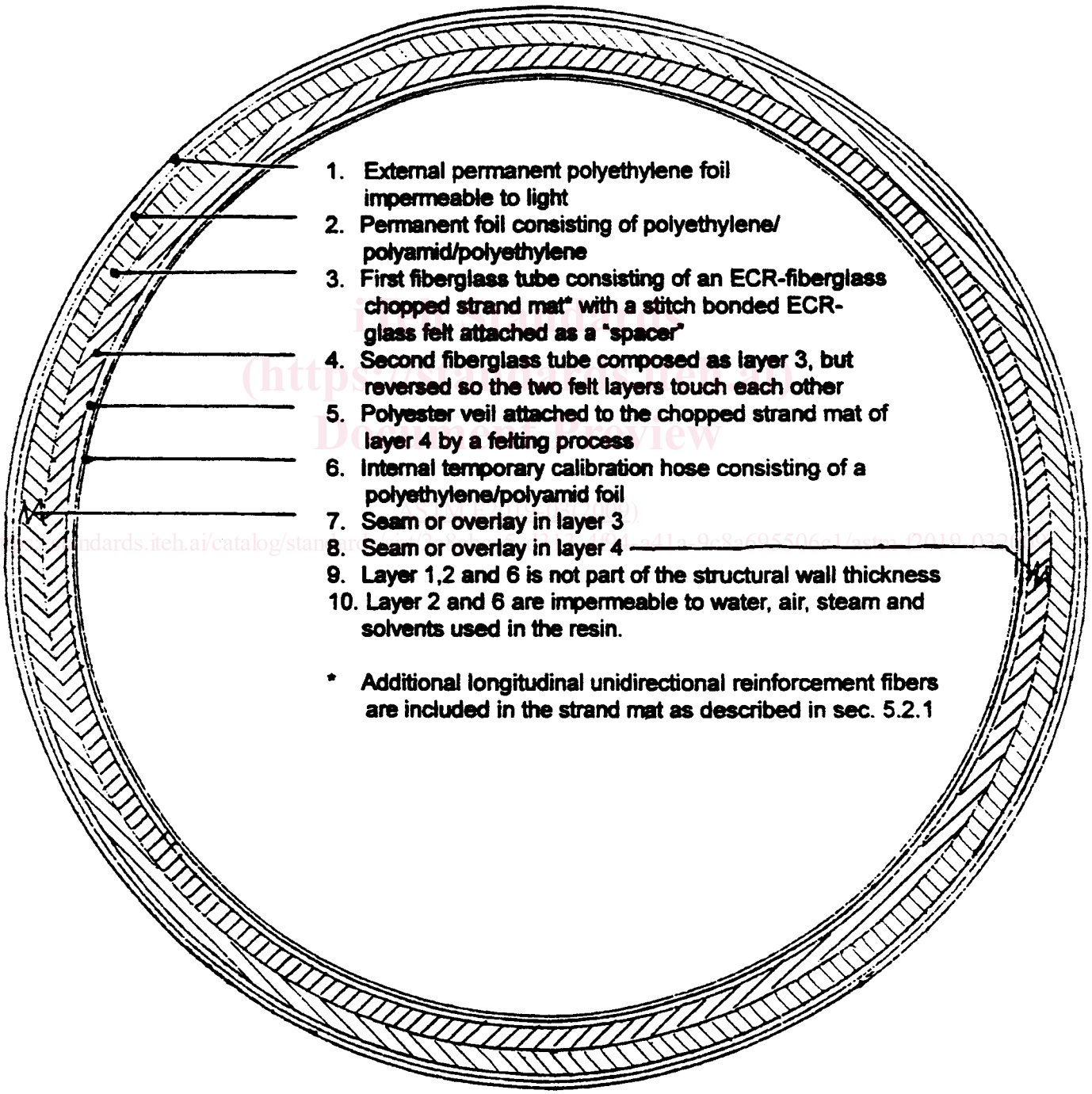


FIG. 2 Composition of Fabric Tube

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 D578. 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 (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.

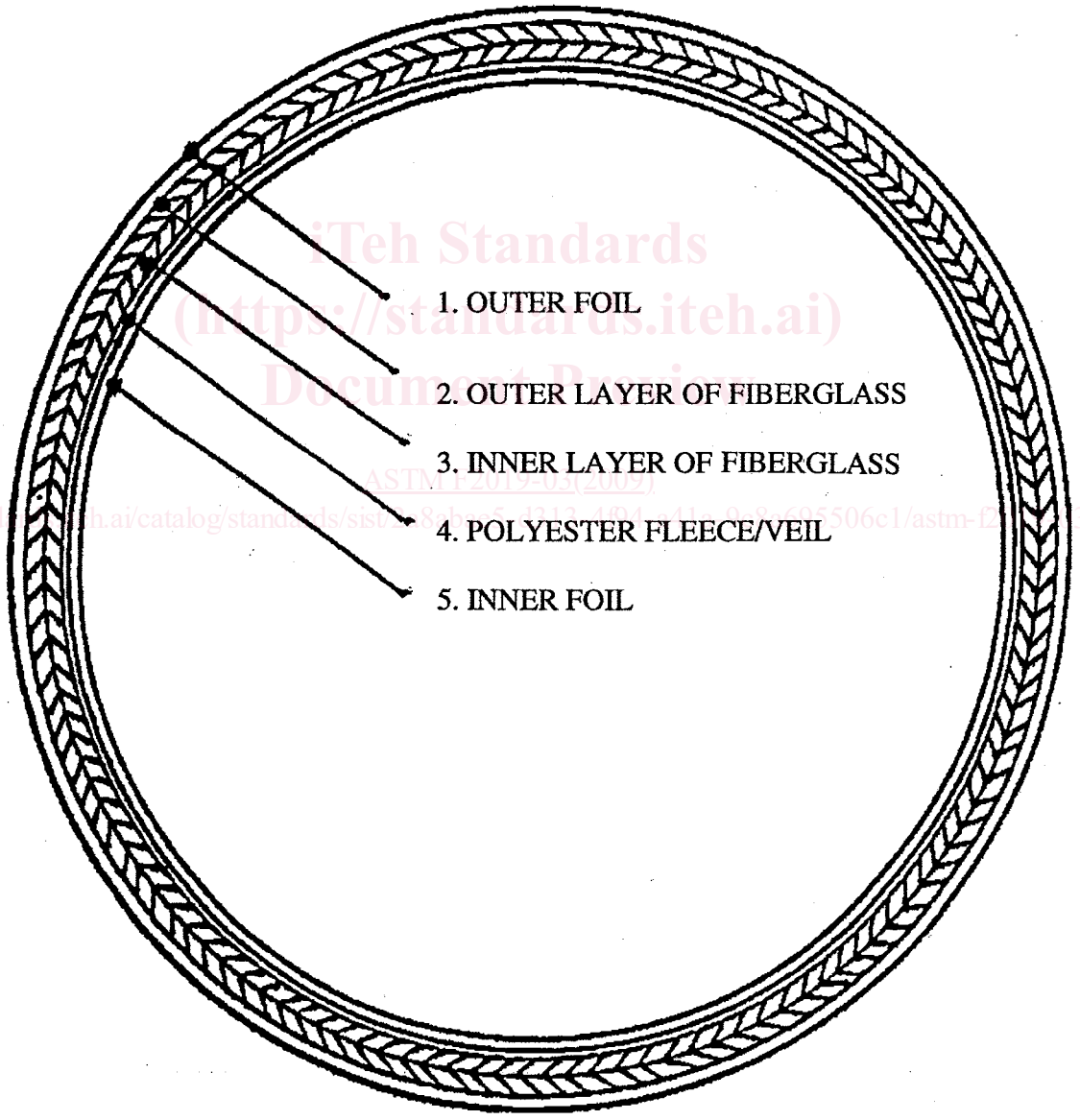


FIG. 3 Composition of Alternative Fabric Tube