Designation: F2994 – 18

Standard Practice for Utilization of Mobile, Automated Cured-In-Place Pipe (CIPP) Impregnation Systems[1]

This standard is issued under the fixed designation F2994; 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 describes the procedures for the impregnation of 2 to 48 in (50 to 1200 mm) diameter cured-in-place pipe utilizing mobile, automated systems. Temporary impregnation facilities set up at the jobsite ("over-the-hole" wet outs) are not covered under this standard. Once resin saturation is complete, the wet out liner is then used to rehabilitate existing gravity flow or pressure pipelines, process piping, electrical conduits or ventilation systems.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1600 Terminology for Abbreviated Terms Relating to Plastics

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

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology F412 and abbreviations are in accordance with Terminology D1600, unless otherwise specified.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *certificate of analysis (COA), n*—Documented evidence of the quality control testing performed on the resin and catalyst formulations. As a minimum, the COA shall include the product name; batch number; date of manufacture; name, address and phone number of manufacturer; test methods; test limits and actual results.

3.2.2 *CIPP automation, n*—The use of PLCs and HMIs to control the operation of a mobile impregnation unit. As a minimum, the following functions shall be controlled and monitored by the CIPP automation process: Operating speed and pressure of resin and catalyst pumps; resin and catalyst temperature, mixing ratio, container levels, utilization, recirculation and dispense; vacuum pump operation; calibration roller speed, direction and gap setting. Data from all installations shall be electronically stored on an internal memory device integrated into the HMI and shall be downloadable to an external storage device for project quality assurance record keeping. The data stored shall at a minimum include: project name, identification number and location; date and time of processing wet out; CIPP liner diameter, thickness and length; and resin and catalyst temperatures, pressures, flow rates, and volumes utilized. Additional data recorded may include the calibration roller distance, gap setting, roller speed, and vacuum level.

3.2.3 *cured-in-place pipe (CIPP), n*—a hollow cylinder containing a nonwoven or a woven material, or a combination of nonwoven and woven material surrounded by a cured thermosetting resin. Plastic coatings may be included. This pipe is formed within an existing pipe. Therefore, it takes the shape of and fits tightly to the existing pipe.

3.2.4 *calibration roller, n*—Electrically driven or variable speed hydraulic drive device used to assist with the impregnation process. Resin saturated liners shall pass through the

[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.

Current edition approved April 1, 2018. Published July 2018. Originally approved in 2013. Last previous edition approved in 2013 as D2994–13. DOI: 10.1520/F2994-18

[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.

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

rollers at a set speed and gap setting. The gap setting shall be adjustable and measurable via a mechanical scale or the electronic display of the HMI. The linear rate of the CIPP liner processed through the roller shall be adjustable by a variable speed drive via the electronic display of the HMI.

3.2.5 *impregnation module, n*—fully contained, insulated system used in the production of CIPP on a mobile impregnation unit. (See Fig. 1.)

3.2.5.1 *Discussion*—The module shall operate through CIPP automation and as a minimum shall include the following components: precision pumps and metering devices, bulk resin and catalyst storage containers with temperature control system, roller bed, work table, external connections for resin and catalyst filling, compatible piping, hoses, directional flow control valves, vacuum system, hoses and connections and resin mixing chamber including static mixer. The vacuum pump may be installed inside or outside the insulated module.

3.2.6 *mobile impregnation unit, n*—a mobile system, usually permanently mounted on a trailer or truck, used to manufacture CIPP at or nearby the point of installation using CIPP automation.

3.3 *Acronyms:*

3.3.1 *PLC, n*—programmable logic controller

3.3.2 *HMI, n*—human machine interface (touch screen)

4. Significance and Use

4.1 This practice is for use by installers who are involved in the rehabilitation of conduits through the use of a mobile, automated CIPP impregnation system to manufacture resin impregnated tube installed through an existing conduit. As for any practice, modifications may be required for specific job conditions.

5. Materials

5.1 All materials shall be handled, packaged, marked and transported in accordance with local, state and federal regulations and requirements.

5.2 *Liner tube*—The liner tube shall consist of one or more layers of flexible needled felt or fiberglass, or both, an equivalent nonwoven or woven material, or a combination of nonwoven and woven materials or fiberglass, or a combination thereof, capable of carrying resin, withstanding installation pressures and curing temperatures. The tube shall be compatible with the resin system used. The outside layer of the tube shall be coated or protected with a material that is compatible with the resin system used. The tube shall be fabricated to a size that, when installed, will tightly fit the internal circumference and the length of the original conduit.

5.3 *Resin*—A formulated resin and catalyst that is compatible with the automation process and end use application shall be used. The resin shall have an initiation temperature for cure that is less than 180°F (82.2°C).

5.4 *Catalyst*—A curing agent, hardener, initiator, diluent, admixture, or combination thereof.

6. Design Considerations

6.1 *Wall Thickness*—The CIPP wall thickness shall be designed in accordance with Practice F1216, Appendix X1.

6.2 Unless otherwise specified, the CIPP shall meet the requirements of grade 3, Type I, II or III CIPP as described in Specification D5813.

7. Equipment

7.1 *Resin pumps*—Positive displacement pumps specifically designed for the formulated resin and catalyst utilized shall be used. The pumps shall be capable of delivering the required volume of mixed resin to the tube during impregnation in a suitable time frame and shall also be capable of pulling suction for container filling.

7.2 *Piping, fittings, and containers*—All piping, fittings and containers used to convey, circulate and store resin and catalyst shall be made of a material suitable for constant contact with

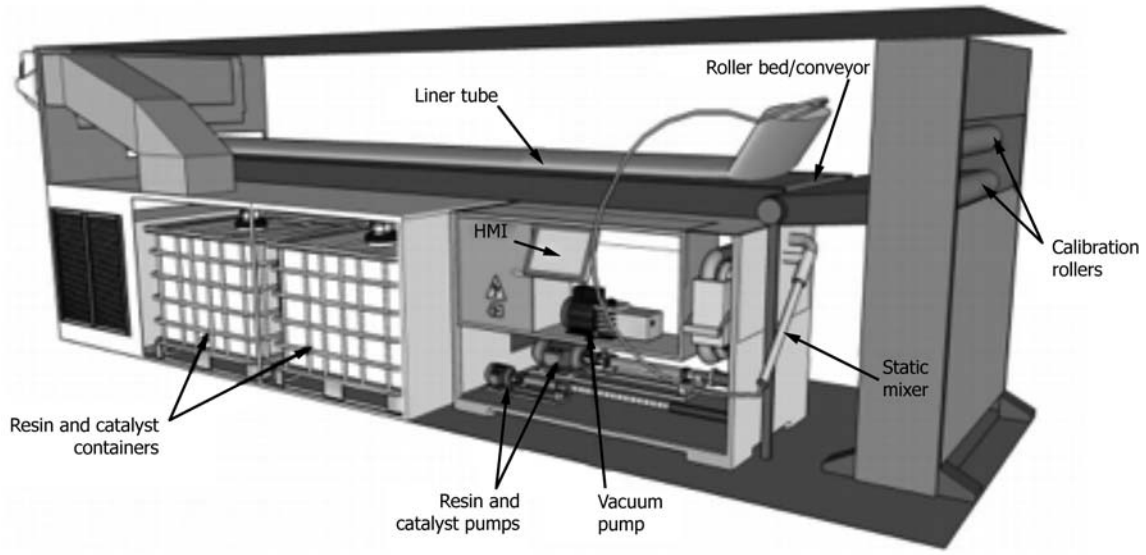

FIG. 1 Typical Impregnation Module