



Designation: **F2831–12 (Reapproved 2017) F2831 – 19**

Standard Practice for Internal Non Structural Epoxy Barrier Coating Material Used In Rehabilitation of Metallic Pressurized Piping Systems¹

This standard is issued under the fixed designation F2831; 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 standard is intended to establish the minimum criteria necessary for use of a mechanically mixed, blended, epoxy barrier coating (AWWA Class I) that is applied to the interior of $\frac{1}{2}$ in. (12.7 mm) to 36 in. (914.4 mm) metallic pipe or tube used in pressurized piping systems for corrosion protection and to improve flow rates. There is no restriction as to the developed length of the piping system other than the method of application (“blow through”, spin cast or hand sprayed) and the characteristics of the epoxy coating being applied but the manufacturer’s engineer shall be consulted for any limitations associated with this product, process and its application for the end user.

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](#)

[D3359 Test Methods for Rating Adhesion by Tape Test](#)

[D3363 Test Method for Film Hardness by Pencil Test](#)

[D4541 Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers](#)

[D4752 Practice for Measuring MEK Resistance of Ethyl Silicate \(Inorganic\) Zinc-Rich Primers by Solvent Rub](#)

[D4414 Practice for Measurement of Wet Film Thickness by Notch Gages](#)

[F412 Terminology Relating to Plastic Piping Systems](#)

2.2 AWWA Standard:³

[AWWA C210 – Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines](#)

[AWWA Rehabilitation of Water Mains : Manual of Water Supply Practices M28, Appendix](#)

2.3 NSF Standard:⁴

[NSF/ANSI 61 – Drinking Water System Components – Health Effects](#)

[NSF/ANSI 14 Plastic Piping System Components and Related Materials](#)

2.4 Society of Protective Coatings Standards:⁵

[SSPC-SP 1 – Solvent Cleaning S](#)

[SSPC-SP 6/NACE No. 3 – Commercial blast cleaning](#)

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

⁴ Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140, http://www.nsf.org.

⁵ Available from Society for Protective Coatings (SSPC), 40 24th St., 6th Floor, Pittsburgh, PA 15222-4656, http://www.sspc.org.

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

2.5 *Underwriters Laboratories Standard*.⁶

[UL/ANSI 852 Metallic Sprinkler Pipe for Fire Protection Service](#)

2.6 *National Fire Protection Association Standard*.⁷

[NFPA 13 Standard for Installation of Sprinkler Systems](#)

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:*

3.2.1 *accredited certifying organization, n*—an agency accredited by an independent and authoritative conformity assessment body (ANSI, ISO/ICC or equivalent) to operate a material and product listing and labeling (certification) system that is accepted by the Authority Having Jurisdiction.

3.2.2 *AWWA class I linings, n*—Non-structural systems, such as traditional CML and epoxy. (See AWWA Rehabilitation of Water Mains.)

3.2.3 *listed (third-party certified), adj*—equipment or materials included in a list published by a listing agency (accredited conformity assessment body) that maintains periodic inspection on current production of listed equipment or materials and whose listing states either that the equipment or material complies with approved standards or has been tested and found suitable for use in a specified manner.

3.2.4 *metallic piping, n*—a tubular shape made of metal, intended to convey fluids or gas. Usually semi-rigid or rigid metal such as galvanized steel, galvanized wrought iron black steel, stainless steel, copper, brass or similar metal piping systems.

4. Material Requirements

4.1 When applied to potable water systems, epoxy barrier coatings shall be evaluated, tested and certified for conformance to NSF/ANSI 61, Section 5 for the intended application, field or factory or the health effects portion of NSF/ANSI 14 by an accredited certifying organization.

4.2 Epoxy barrier coatings shall be prepared for application using mechanically engineered metering and mixing methods to ensure mixing and dispensing controls to manufacturer's specifications.

4.3 Epoxy barrier coatings shall be listed and identified for the type of application ("blow through", spin cast or hand sprayed).

5. Significance and Use

5.1 This practice is for use by designers and specifiers, regulatory agencies, owners, contractors, and inspection organizations who are involved in rehabilitation of pressurized piping systems.

6. Coating Application

6.1 *General*—The epoxy coating shall be applied in accordance with the manufacturer's recommendations. Application shall be by blow through, airless-spray or centrifugal-wheel equipment or manufacturer-certified equal. "Blow through" application shall be limited to ~~6-in-~~6 in. (152.4 mm) diameter pipe and shall be applied from small diameter to large. Spin cast applications shall be pre-planned in accordance with the manufacturer's recommendations, which are dependent on pipeline diameter, length and architecture and shall be applied at change of diameter both ways. Random spool pieces of pipe shall be installed within the network architecture for subsequent third party inspection when required or specified by owners or their designated representatives.

6.2 *Piping preparation*—Prior to abrasive blast cleaning, surfaces shall be inspected and, if required, cleaned according to SSPC-SP 1 to remove oil, grease, or other foreign matter. Only solvents approved by the epoxy coating manufacturer shall be used. Preheating of metallic type piping to remove oil, grease, mill scale, water, and ice may be used provided the pipe is preheated in a uniform manner to avoid distorting the pipe. All leaks in the piping system shall be repaired in accordance with the manufacturer's recommendations prior to coating.

6.3 *Abrasive blast cleaning*—The interior of the piping system surfaces shall be abrasive blast cleaned to achieve a clean metal surface conforming to SSPC-SP 6/NACE. No. 3 Abrasive blast cleaning and coating shall only be performed when the metal temperature is more than 5 °F (2.9°C)(-15 °C) above dew point. When required to meet the standard, or as required by manufacturer's instructions, the cleaning process shall be conducted both ways, from small diameter to large and from large diameter to small, to ensure all foreign material on the wall of the pipe is removed.

6.4 *Pipe Cleaning*—A description of the quality and cleanliness of the pipe to be coated shall be required. When viewed without magnification, the cleaned surface shall be free of all visible oil, grease, dirt, mill scale, rust and previously applied coatings.

⁶ Available from Underwriters Laboratories (UL), 2600 N.W. Lake Rd., Camas, WA 98607-8542, <http://www.ul.com>.

⁷ Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, <http://www.nfpa.org>.

Evenly dispersed, very light shadows, streaks, and discolorations caused by stains of mill scale, rust and old coatings shall be permitted to remain on no more than 33 percent of the surface to be coated. The manufacturer's instructions shall require that the details of the visual observation of the cleaned pipe to be recorded.

6.5 *Interior cleaning*—If abrasives or other loose foreign matter has entered the interior of the piping system, then clean, dry, oil-free compressed air shall be used to remove the loose foreign matter in a manner that does not adversely affect the cleaned surface. Alternatively, vacuum cleaning or other methods may be used in place of compressed air.

6.6 *Coating thickness*—The minimum coating thickness shall be recommended by the coating manufacturer but shall be greater than 0.01 in. (0.2454 mm). The coating thickness shall be determined in the field via a wet film thickness gauge, meeting Practice **D4414**-Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages.

6.7 *Coating material preparation*. Coating material preparation shall be in accordance with the manufacturer's recommendation. Application shall be performed when the temperature is more than ~~5°F (-2.8°C)~~ 5 °F (-15 °C) above dew point. The temperature of the mixed coating material shall not be lower than ~~50°F (10°C)~~ 50 °F (10 °C). The temperature of the piping system during application shall conform to the recommendations of the coating manufacturer.

6.8 *Cure*—The coating manufacturer shall be consulted as to the proper cure time and methods but The minimum cure time, cure temperature and flushing requirements shall be in accordance with certification and listing requirements appropriate for the application. For potable water applications, minimum cure time, cure temperature and flushing requirements shall be in accordance with the NSF/ANSI 61 certification and listing requirements for the epoxy.

6.9 *Field Testing*—At completion of installation, the pipe spool pieces randomly inserted into the piping network prior to coating shall be removed for third party inspection and reporting for proper coating thickness and adhesion. A visual inspection at of the entrance and exit points shall also be made by a qualified, third-party inspector. CCTV shall be used to inspect pipe diameters of sizes ~~2 inches-in. (50.8 mm)~~ and above and a hand held bore scope used on ~~1/2 to 2 in. (12.7 to 50.8 mm)~~ (4 ft (1.2 m) maximum length of inspection). Also at completion of installation an air test or hydrostatic test shall be conducted on the piping system. An air test of 150 psig (1034 kPa) or hydrostatic test of 1 1/2 times the normal working pressure shall be put on the system for a minimum of one hour to assure there are no leaks or observed drop in pressure. In addition the completed system shall be flow tested and the piping system shall be required to meet the minimum flow rates as specified in the model codes (UPC, IPC, NSPC, NPC) adopted by the local jurisdiction.

TEST METHODS

7. General Requirements

7.1 *Minimum Coating Thickness*—The minimum coating thickness shall be as specified by the manufacturer but shall be not less than that specified in section 6.6 of the standard. Testing in accordance with 8.1 shall verify performance of the epoxy barrier coating material at the minimum thickness.

7.2 *Samples*: Six test samples shall be prepared for each piping material specified by the manufacturer. Each of the samples shall be coated according to the manufacturer's installation instructions and allowed to cure for 24 hours at room temperature. The samples shall be subjected to the test specified in 8.2 – 8.4.

8. Performance Requirements

8.1 *Thickness Verification Test*—A test assembly shall be set up for coating utilizing five 10 ft (3 m) lengths of ~~4-in.~~ 1 in. (25.4 mm) diameter pipe with fittings attached to simulate actual installation. The test assembly pipes and fittings shall be coated in accordance with the coating tables in the manufacturer's installation instructions. The coated pipes and fittings shall be allowed to dry at room temperature for at least 24 h. The thickness of the coating shall be measured at the inlet and outlet ends of the test assemblies and the last fitting shall be removed and axially sectioned for thickness testing along its length. The coating thickness shall be equal to or greater than the minimum coating thickness specified by the manufacturer. A mathematical evaluation of the coating tables in the manufacturer's installation instructions shall be performed, based on the test results for the ~~4-inch~~ 1 in. (25.4 mm) pipe, to establish that the minimum coating will be provided. Maximum thicknesses are determined on an average basis and are addressed in NSF/ANSI 61.

8.2 *Pull-off Strength Test*—A sample shall be tested for resistance to pull-off of the epoxy barrier coating in accordance with Test Method **D4541**. On metallic surfaces, such as copper, steel or brass, the minimum pull-force without loss of coating adhesion shall be 2500 ~~psi-~~psi (17237 kPa).

8.3 *Immersion Test*—A sample shall be tested in accordance with AWWA C210. The sample shall display no blistering, peeling or disbondment of the epoxy barrier coating.

8.4 *Adhesion Test*—A sample shall be tested in accordance with Test Method **D3359**. The adhesion of the coating to the piping material shall meet a minimum rating of 4A when tested to Method A of the standard.