ANSI/AWWA **C222-25**

(Revision of ANSI/AWWA C222-18)

AWWA Standard

Polyurethane Coatings and Linings for Steel Water Pipe and Fittings

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American Water Works Association

Approved American National Standard ANSI

STANDARD Since 1881

AWWA Standard

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA C222.*

I. Introduction.

I.A. *Background*. Fast-setting, very high solids polyurethanes were first used in North America to protect steel underground fuel storage tanks from corrosion in the mid-1970s. The materials were also used to protect oil and gas pipelines in Europe at approximately the same time. Because of further development of the technology during the 1980s, polyurethanes have been used successfully in water and wastewater pipelines and tanks.

I.B. *History.* In April 1996, the AWWA Standards Council authorized the Steel Pipe Committee to develop a new standard for the use of polyurethanes on the interior and exterior of steel water pipe and fittings. The first edition of ANSI/AWWA C222 was approved by the AWWA Board of Directors on June 20, 1999. The second edition of this standard was approved on June 8, 2008. The last edition was approved on Jan. 20, 2018. This edition was approved on June 7, 2025.

I.C. *Acceptance.* In May 1985, the US Environmental Protection Agency (USEPA) entered into a cooperative agreement with a consortium led by NSF International (NSF) to develop voluntary third-party consensus standards and a certification program for direct and indirect drinking water additives. Other members of the original consortium included the Water Research Foundation† (formerly AwwaRF) and the Conference of State Health and Environmental Managers (COSHEM). The American Water Works Association (AWWA) and the Association of State Drinking Water Administrators (ASDWA) joined later.

In the United States, authority to regulate products for use in, or in contact with, drinking water rests with individual states.‡ Local agencies may choose to impose requirements more stringent than those required by the state. To evaluate the health effects of products and drinking water additives from such products, state and local agencies may use various references, including

1. Specific policies of the state or local agency.

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* American National Standards Institute, 1180 Avenue of the Americas, 10th Floor, New York, NY 10036.

† Water Research Foundation, 6666 West Quincy Avenue, Denver, CO 80235.

‡ Persons outside the United States should contact the appropriate authority having jurisdiction.

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2. Four standards developed under the direction of NSF:[§] NSF/ANSI/CAN[¶] 60, Drinking Water Treatment Chemicals—Health Effects; NSF/ANSI/CAN 61, Drinking Water System Components—Health Effects; NSF/ANSI/CAN 372, Drinking Water System Components—Lead Content; and NSF/ANSI/CAN 600, Health Effects Evaluation and Criteria for Chemicals in Drinking Water.

3. Other references, including AWWA standards, *Food Chemicals Codex, Water Chemicals Codex*,[**] and other standards considered appropriate by the state or local agency.

Various certification organizations may be involved in certifying products in accordance with NSF/ANSI/CAN 61. Individual states or local agencies have authority to accept or accredit certification organizations within their jurisdictions. Accreditation of certification organizations may vary from jurisdiction to jurisdiction.

NSF/ANSI/CAN 600 (which formerly appeared in NSF/ANSI/CAN 60 and 61 as Annex A, "Toxicology Review and Evaluation Procedures") does not stipulate a maximum allowable level (MAL) of a contaminant for substances not regulated by a USEPA final maximum contaminant level (MCL). The MALs of an unspecified list of "unregulated contaminants" are based on toxicity testing guidelines (noncarcinogens) and risk characterization methodology (carcinogens). Use of NSF/ANSI/CAN 600 procedures may not always be identical, depending on the certifier.

ANSI/AWWA C222 does not address additives requirements. Users of this standard should consult the appropriate state or local agency having jurisdiction in order to

1. Determine additives requirements, including applicable standards.

2. Determine the status of certifications by all parties offering to certify products for contact with, or treatment of, drinking water.

3. Determine current information on product certification.

II. Special Issues. This standard provides guidance in selecting and evaluating polyurethane and sets minimum requirements for linings and coatings used on steel water pipe in the water-supply industry.

Users of this standard are advised to consider additional lining thickness for pipe that handles water containing higher than normal levels of particulates or that operates at higher than normal velocities. A penstock carrying stream or lake water with high particulate levels and high velocities would be a viable example. The required finished

[§] NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105.

[¶] Standards Council of Canada, 55 Metcalfe Street, Suite 600, Ottawa, ON K1P 6L5 Canada.

[**] Both publications available from National Academies Press, 500 Fifth Street, NW, Washington, DC 20001.

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coating thickness shall be specified by the purchaser. The specified thickness should not exceed the maximum recommended by the coating manufacturer.

Soluble salts and other inorganic contaminants on a prepared steel surface have been known to influence coating performance. Procedures for determining the presence of these contaminants as well as the method of quantifying them are currently being evaluated by technical organizations serving the coating and lining industry.

If an extended period of aboveground storage of the coated pipe is anticipated, consideration should be given to the ability of the coating to resist degradation by ultraviolet light and the other atmospheric and environmental conditions. The purchaser should consult the manufacturer for specific conditions and limitations.

This standard does not describe materials and procedures that may be required for difficult conditions, such as those encountered in construction of some submarine lines, casing pipe, river crossings, microtunneling, and rocky areas.

ISO 8502-3[††] may be used to evaluate the consistency of the substrate cleanliness in accordance with the coating manufacturer's recommendation.

III. Use of This Standard. It is the responsibility of the user of an AWWA standard to determine that the products described in that standard are suitable for use in the particular application being considered.

III.A. *Purchaser Options and Alternatives*. The following information should be provided by the purchaser:

1. Standard used—that is, ANSI/AWWA C222, Polyurethane Coatings and Linings for Steel Water Pipe and Fittings, of latest revision.
2. Color of coating required (if applicable).
3. Coating system or lining system to be provided (Sec. 1.1.1).
4. Temperature of conveyed water (Sec. 1.1.3).
5. Details of federal, state, provincial, territorial, and local requirements (Sec. 4.2.1).
6. For applications other than potable water, whether compliance with NSF/ANSI/CAN 61, Drinking Water System Components—Health Effects, is required (Sec. 4.2.1 and Sec. 4.2.2).
7. Abrasive blast profile (Sec. 4.4.3.1).
8. Dry film thickness (Sec. 4.5.5 and Sec. 5.5.3).
9. Field joint material selection (Sec. 4.7.5).

[††] ISO 8502-3. Preparation of Steel Substrates Before Application of Paints and Related Products—Tests for the Assessment of Surface Cleanliness, Part 3. Geneva, Switzerland: ISO.

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10. Coating requirements for other mating surfaces (Sec. 4.9).

11. Prequalification testing (Sec. 5.1).

12. Additional reagents for chemical resistance testing (Sec. 5.2.5).

13. Scoring requirements around dolly, if required (Sec. 5.5.5).

14. Additional adhesion tests, if required (Sec. 5.5.5).

15. Affidavit of compliance (Sec. 6.3).

III.B. *Modification to Standard*. Any modification of the provisions, definitions, or terminology in this standard must be provided by the purchaser.

IV. Major Revisions. Major changes made to the standard in this edition include the following:

1. Updated Sec. I.C Acceptance in the foreword with the latest Standards Council language reflecting the addition of reference to NSF/ANSI/CAN 372 and NSF/ANSI/CAN 600.

2. Revised and expanded Sec. II Special Issues in the foreword.

3. Added Sec. 1.1.4 to discuss considerations when C222 is referenced for substrates other than carbon steel.

4. Section 2 References was updated.

5. In Section 3 Definitions, added definitions for *applicator, reclaimed water,* and *wastewater.*

6. Added a new Sec. 4.1 Equipment to be consistent with other coating and lining standards.

7. Updated Sec. 4.2.1 Materials with the latest Standards Council boilerplate language and added language for wastewater applications stating that additional requirements may be needed due to the more severe environment.

8. The certification and safety sections were moved from previous Sec. 4.11 to Sec. 4.2, and a reference to NSF/ANSI/CAN 600 was added to the certification section for consistency with other coating and lining standards.

9. The personnel section was moved from previous Sec. 4.5.2 to Sec. 4.2.4 for consistency with other coating and lining standards.

10. A new Sec. 4.3.1 Shelf Life was added for consistency with other coating and lining standards.

11. Updated Sec. 4.4 Surface Preparation to be consistent with the language used in other coating and lining standards. The minimum level of surface preparation has not changed. The details included from the referenced SSPC standards were removed since they are in the SSPC standards.

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12. Moved Table 1 Prequalification Requirements of Polyurethane System and Table 2 Quality Control Requirements of Applied Polyurethane System to Sec. 5.2 for consistency with other steel pipe coating and lining standards.

13. Updated Sec. 4.5.4 Overcoating and the adhesion testing requirements were moved to Sec. 4.6.8 Repair Inspection.

14. The polyurethane thickness requirements (previously in Sec. 4.3) were moved to new Sec. 4.5.5 Polyurethane Thickness, and language was added to Sec. 4.5.5 and Table 2 noting that coatings and linings may have limits for the maximum thickness tied to the potable water certification and the manufacturer's recommendations.

15. Updated Sec. 5.2.3 Impact Resistance to reduce the coating thickness tested from 75 mils (1.9 mm) to 25–30 mils (635–760 µm).

16. In Sec. 5.2.9 Adhesion to Steel, the lab adhesion testing method was updated to reference ASTM D4541 Protocol 1 and Type IV or V automatic instruments, and a requirement for substrate temperatures was added.

17. Increased minimum requirement for dielectric strength from 250 to 400 V/mil in Table 1 to better represent properties of current polyurethane materials.

18. Added language to Sec. 5.3 Quality Assurance and Records to make it clear that the quality control (QC) tests in Sec. 5.5 are being referenced.

19. Revised Sec. 5.5.3 Dry Film Thickness and changed the SSPC-PA 2 requirement from Level 1 to Level 2.

20. Revised Sec. 5.5.4 to list SP0274 instead of SP0188 for electrical continuity testing.

21. In Sec. 5.5.5 Adhesion to Steel, the QC adhesion testing method was revised to reference ASTM D4541 Protocol 2 and Type IV or V automatic instruments.

22. Added Sec. 5.5.5.4 Frequency of Testing to the QC adhesion section.

23. Updated Sec. 6.2.2 Shipping, Handling, and Storage to be consistent with the language used in other coating and lining standards.

V. Comments. If you have any comments or questions about this standard, please call AWWA Engineering and Technical Services at 303.794.7711, write to the department at 6666 West Quincy Avenue, Denver, CO 80235-3098, or email standards@awwa.org.

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ANSI/AWWA C222-25
(Revision of ANSI/AWWA C222-18)

AWWA Standard

Polyurethane Coatings and Linings for Steel Water Pipe and Fittings

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard sets minimum requirements for shop-applied and field-applied polyurethane coatings and linings used in the water supply industry. Polyurethanes are used for steel water pipe, special sections, welded joints, connections, and fittings for steel water pipelines installed underground or underwater operating under normal conditions.

1.1.1 *Coating and lining systems.* The coating and lining systems shall consist of an ASTM* D16 Type V thermoset aromatic polyurethane plastic polymer that is the reaction product of diphenylmethane diisocyanate resin and polyol resin, polyamine resin, or a mixture of polyol and polyamine resins. Typically, these systems are solvent free or almost solvent free (less than 10 percent solvent by volume). They are fast setting (cure to handle in less than 30 min) and are applied in one coat direct to steel. However, there are a variety of polyurethane technologies available on the market that may contain up to 10 percent solvent or are slower setting that also meet the requirements of this standard.

* ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

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