ANSI/AWWA **C210-24**

(Revision of ANSI/AWWA C210-15)

AWWA Standard

Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings

Effective date: July 1, 2024.
First edition approved by Board of Directors May 18, 1978.
This edition approved Jan. 11, 2024.
Approved by American National Standards Institute Jan. 11, 2024.

American Water Works Association

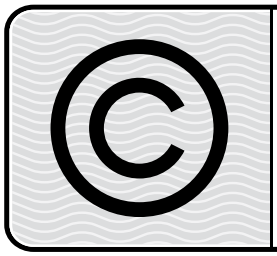
AWWA Standard

This document is an American Water Works Association (AWWA) standard. It is not a specification. AWWA standards describe minimum requirements and do not contain all of the engineering and administrative information normally contained in specifications. The AWWA standards usually contain options that must be evaluated by the user of the standard. Until each optional feature is specified by the user, the product or service is not fully defined. AWWA publication of a standard does not constitute endorsement of any product or product type, nor does AWWA test, certify, or approve any product. The use of AWWA standards is entirely voluntary. This standard does not supersede or take precedence over or displace any applicable law, regulation, or code of any governmental authority. AWWA standards are intended to represent a consensus of the water industry that the product described will provide satisfactory service. When AWWA revises or withdraws this standard, an official notice of action will be placed in the Official Notice section of *Journal AWWA.* The action becomes effective on the first day of the month following the month of *Journal AWWA* publication of the official notice.

American National Standard

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether that person has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review, and users are cautioned to obtain the latest editions. Producers of goods made in conformity with an American National Standard are encouraged to state on their own responsibility in advertising and promotional materials or on tags or labels that the goods are produced in conformity with particular American National Standards.

Caution Notice: The American National Standards Institute (ANSI) approval date on the front cover of this standard indicates completion of the ANSI approval process. This American National Standard may be revised or withdrawn at any time. ANSI procedures require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of ANSI approval. Purchasers of American National Standards may receive current information on all standards by writing to the American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036; calling 212.642.4900; or emailing info@ansi.org.



ISBN-13, print: 978-1-64717-177-3

ISBN-13, electronic: 978-1-61300-704-4

DOI: http://dx.doi.org/10.12999/AWWA.C210.24

Committee Personnel

Steel Water Pipe–Manufacturer's Technical Advisory Committee (SWPMTAC) Task Group on C210, which revised this standard, had the following personnel at the time:

Gino Sincovich, *Chair*
Larry McKinney, *Vice-Chair*

B. Cheshire, Tnemec Company, Inc., Kansas City, Mo.
D. D'Ambrosio, Polyguard Products, Houston, Tex.
A. Fletcher, Consultant representing Steel Mains Pty Ltd, Melbourne, Australia
A. Grigsby, Carboline, St. Louis, Mo.
B.D. Keil, Northwest Pipe Company, Draper, Utah
G. Larsen, Smith-Blair, Texarkana, Tex.
D. Libby, Chase Corporation, Westwood, Mass.
L. McKinney, Womble Company, Houston, Tex.
C. Patton, Seal for Life, Houston, Tex.
F. Rampton, Trenton Corporation, Ann Arbor, Mich.
R.N. Satyarthi, Baker Coupling Company Inc., Los Angeles, Calif.
S. Serpe, Arkema, King of Prussia, Pa.
B.P. Simpson, American Spiralweld Pipe Company, Birmingham, Ala.
G. Sincovich, Sherwin-Williams, Barrie, Ontario

The AWWA Standards Committee on Steel Pipe, which reviewed and approved this standard, had the following personnel at the time of approval:

John H. Bambei Jr., *Chair*
Bob J. Card, *Vice-Chair*
John L. Luka, *Secretary*

General Interest Members

S.A. Arnaout (*alternate*), Stantec, Dallas, Tex.
J.H. Bambei Jr., Bambei Engineering Services, Arvada, Colo.
R.J Card, Lockwood, Andrews & Newnam, Houston, Tex.
R.L. Gibson, Freese and Nichols Inc., Fort Worth, Tex.
M.D. Gossett, HDR, Denver, Colo.
M.B. Horsley (*alternate*), Horsley Engineering LLC, Overland Park, Kans.

R. Issa, AECOM, McKinney, Tex.
C.H. Kirby (*alternate*), Lockwood, Andrews & Newnam Inc., Houston, Tex.
R.A. Kufaas, Norske Corrosion & Inspection Services Ltd., Surrey, B.C.
A.S. Maughn (*alternate*), Freese & Nichols, Inc., Dallas, Tex.
D.L. McPherson (*alternate*), HDR, Charlotte, N.C.
A. Murdock, Jacobs Engineering, Salt Lake City, Utah
R. Ortega, Aurora Technical Services, Houston, Tex.
E.S. Ralph (*liaison, nonvoting*), Standards Engineer Liaison, AWWA, Denver, Colo.
J.R. Snow, Stantec, Denver, Colo.
A.M. Stanton, Black & Veatch, Los Angeles, Calif.
W.R. Whidden, Woolpert, Winter Park, Fla

Producer Members

H.R. Bardakjian, Consultant, Glendale, Calif.
D.A. Dechant, Dechant Infrastructure Service, Aurora, Colo.
D.W. Dunker, Thompson Pipe Group, Rialto, Calif.
B.D. Keil, Northwest Pipe Company, Salt Lake City, Utah
J.L. Luka, American SpiralWeld Pipe Company, Columbia, S.C.
R. Mielke (*alternate*), Northwest Pipe Company, Raleigh, N.C.
L. Prinsloo, Victaulic, Easton, Pa.
B.E. Ripley (*alternate*), Victaulic, Lexington, S.C.
G.F. Ruchti (*alternate*), Consultant, Punta Gorda, Fla.
B.P. Simpson (*alternate*), American Cast Iron Pipe Company, Birmingham, Ala.
R. Wu (*alternate*), Thompson Pipe Group, Grand Prairie, Tex.

User Members

L. Adams, US Bureau of Reclamation, Denver, Colo.
G.A. Andersen, New York City Bureau of Water Supply, Little Neck, N.Y.
B. Cheng, Metro Vancouver, Burnaby, B.C.
B. Fountain, San Diego County Water Authority, San Diego, Calif.
J. Fox, Tampa Bay Water, Clearwater, Fla.
J. Garcia (*alternate*), Metropolitan Water District of Southern California, Los Angeles, Calif.
S. Hattan, Tarrant Regional Water District, Fort Worth, Tex.
M. Lobik, Springfield Water & Sewer Commission, Springfield, Mass.

T. Peng, Metropolitan Water District of Southern California, Los Angeles, Calif.

G. Ramon (*liaison, nonvoting*), Standards Council Liaison, Little Rock Water Reclamation Authority, Little Rock, Ark.

V. Scutelnicu, Los Angeles Department of Water and Power, Los Angeles, Calif.

J. Shieh (*alternate*), Los Angeles Department of Water and Power, Los Angeles, Calif.

M. Turney (*alternate*), Denver Water, Denver, Colo.

This page intentionally blank.

Contents

All AWWA standards follow the general format indicated subsequently. Some variations from this format may be found in a particular standard.

SEC. PAGE

Foreword

I Introduction. ix
I.A Background ix
I.B History ix
I.C Acceptance ix
II Special Issues x
III Use of This Standard xi
III.A Purchaser Options and Alternatives xi
III.B Modification to Standard xii
IV Major Revisions xii
V Comments xiii

Standard

1 General

1.1 Scope 1
1.2 Purpose 2
1.3 Application 2

2 References 2

3 Definitions 3

4 Requirements

4.1 Equipment 4
4.2 Materials and Workmanship 4
4.3 Epoxy System 5
4.4 Surface Preparation 5
4.5 Epoxy Application 6
4.6 Coating or Lining Fittings 8
4.7 Epoxy Repair 8
4.8 Field Joints—Welded 9
4.9 Field Procedures 9

5 Verification

5.1 Epoxy Materials Prequalification 9
5.2 Prequalification Requirements of Epoxy System 9
5.3 Quality Assurance and Records 11
5.4 Inspection and Testing by the Purchaser 12
5.5 Quality Control Requirements of Applied Epoxy System 12
5.6 Rejection 14

6 Delivery

6.1 Marking 15
6.2 Packaging and Storage 15
6.3 Affidavit of Compliance 15

Tables

1 Prequalification Requirements of Epoxy System 10
2 Quality Control Requirements of Applied Epoxy System 11

This page intentionally blank.

Foreword

This foreword is for information only and is not a part of ANSI/AWWA C210.*

I. Introduction.

I.A. *Background*. This standard was developed to provide information for the use of liquid-epoxy coatings for the exterior coating and interior lining of steel water pipe. The standard has been revised periodically to meet increasingly demanding environmental and health-effects regulations and to modify procedures based on technological advances.

I.B. *History*. The first edition of ANSI/AWWA C210 was approved for issue in May 1978 under the title "Coal-Tar Epoxy Coating System for the Interior and Exterior of Steel Water Pipe." The second and third editions were approved on June 10, 1984, and June 18, 1992, respectively, and published under the title "Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines." The fourth edition of ANSI/AWWA C210 was approved by the AWWA Board of Directors on June 15, 1997. Subsequent editions were approved on Jan. 19, 2003; June 24, 2007; and June 7, 2015. This edition was approved on Jan. 11, 2024.

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). 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.

* American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.

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

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 C210 does not address additives requirements. Thus, 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 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 liquid-epoxy coatings 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

[‡] 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.

particulate levels and high velocities would be a viable example. The required finished 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 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, and rocky areas.

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 items should be provided by the purchaser:

1. Standard used—that is, ANSI/AWWA C210, Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings, of latest revision.
2. Details of federal, state, provincial, territorial, and local requirements and regulations (Sec. 4.2).
3. 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).
4. Alternatives to air blowoff (Sec. 4.4.4).
5. Hold-back for field welds (Sec. 4.5.2).
6. Requirements for field joint coating if other than epoxy (Sec. 4.5.3).
7. The minimum and maximum dry film thicknesses (DFTs) of the lining or coating (Sec. 4.5.7).
8. Coating requirements for special connections and appurtenances (Sec. 4.6).
9. Epoxy materials prequalification (Sec. 5.1).
10. Quality assurance records (Sec. 5.3).
11. Requirements for material inspection and rejection (Sec. 5.4, Sec. 5.5, and Sec. 5.6).

12. Cosmetic imperfections greater than 10 percent (Sec. 5.5.2).

13. Requirements for adhesion testing of coating (Sec. 5.5.6).

14. Affidavit of compliance, if required (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 revision 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. Added Sec. 1.1.4 to cover the use of this standard for substrates other than carbon steel.

3. Section 2 References was updated.

4. The definitions for applicator and wastewater were added to Section 3 Definitions.

5. Sec. 4.2.1 Materials was updated with the latest Standards Council boilerplate language, and language was added for wastewater applications to state that additional requirements may be needed due to the more severe environment.

6. Sec. 4.2.2 Certification was updated to include a reference to NSF/ANSI/CAN 600.

7. A new Sec. 4.2.4 Personnel was added for consistency with other standards.

8. Sec. 4.4 Surface Preparation and Sec. 4.6 Coating or Lining Fittings were updated with standardized wording and headings where applicable.

9. Added language to Sec. 4.5.4 Pipe ends for nonwelded field joints, for considerations when using a gasketed joint.

10. Added language to Sec. 4.5.7 Epoxy thickness for potable water considerations. A reference to Sec. 4.5.7 was also added to Table 2 under maximum dry film thickness.

11. Updated Sec. 4.6.4 Application to threaded connections, to allow for thread coatings other than epoxy.

12. Sec. 4.9 Field Procedures was revised to be consistent with other steel pipe coating and linings standards and to not duplicate information provided in AWWA C604.

13. Sec. 5.2.2 Cathodic disbondment was revised to include a minimum DFT for specimens.

14. In Table 1, adhesion testing was added for prequalification testing, and a new Sec. 5.2.4 Adhesion was added to describe the test method.

15. In Table 1, the dielectric strength for prequalification testing was increased from 250 V/mil to 400 V/mil.

16. Water absorption was added to the prequalification requirements with a new Sec. 5.2.5 and a requirement added to Table 1.

17. Water vapor transmission was added to the prequalification requirements with a new Sec. 5.2.6 and a requirement added to Table 1.

18. In Table 2, the minimum adhesion for quality control testing was increased from 800 to 1000 psi.

19. Added language to Sec. 5.3 to make it clear that it is referencing the quality control (QC) tests in Sec. 5.5 Quality Control Requirements of Applied Epoxy System.

20. In Sec. 5.5.2 Epoxy appearance, language was added to differentiate cosmetic imperfections from defects.

21. Sec. 5.5.4 Total dry film thickness (DFT) was revised, and testing was modified to SSPC-PA 2 Level 2 to reflect the language that was approved in the December 2020 addendum.

22. Sec. 5.5.5 Electrical continuity inspection was modified and the reference to SP0188 replaced with SP0274.

23. Sec. 5.5.6 Adhesion to steel was rewritten and updated to reference ASTM D4541 Protocol 2 and Type IV or V automatic instruments.

24. Sec. 5.5.6.4 Frequency of testing was revised and expanded.

25. Sec. 6.2.1 Packaging and Sec. 6.2.2 Shipping, Handling, and Storage were updated to be consistent with the language used in other steel pipe coating and lining standards.

26. Sec. 6.3 was modified to include affidavits from both the manufacturer and the applicator.

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

This page intentionally blank.

ANSI/AWWA C210-24
(Revision of ANSI/AWWA C210-15)

American Water Works Association
Dedicated to the World's Most Vital Resource®

AWWA Standard

Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes the material and application of shop-applied and field-applied liquid-epoxy coatings and linings used in the water-supply industry for steel water pipe, special sections, welded joints, connections, and fittings installed underground or underwater, under normal construction conditions.

1.1.1 *Conditions not described in this standard.* The coating systems described in this standard are not intended for use on pipe that will be bent after the coating or lining system has been applied.

1.1.2 *Coating and lining systems.* The coating and lining systems may consist of any of the following three types: (1) a two-part chemically cured epoxy primer and one or more coats of a different two-part chemically cured epoxy topcoat; (2) two or more coats of the same two-part chemically cured epoxy, in which case the first coat shall be considered as the prime coat; or (3) a single coat of a two-part chemically cured epoxy.

1.1.3 *Maximum temperature.* AWWA steel pipe coating and lining standards are based on the maximum service temperature of potable water. Consult the epoxy manufacturer for conditions and limitations.