ANSI/AWWA C224-17
(Revision of ANSI/AWWA C224-11)

American Water Works Association
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AWWA Standard

Nylon-11-Based Polyamide Coatings and Linings for Steel Water Pipe and Fittings

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American Water Works Association STANDARD Since 1881

Approved American National Standard ANSI

AWWA Standard

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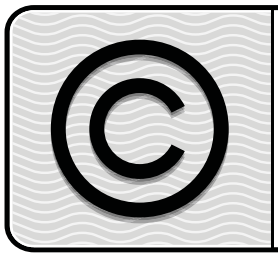

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Committee Personnel

The Steel Water Pipe Manufacturers Technical Advisory Committee (SWPMTAC) Task Group on C224, which reviewed and revised this edition, had the following personnel at the time:

Stephen Serpe, *Chair*
Ashley Fletcher, *Vice-Chair*

A. Fletcher, Steel Mains Pty. Ltd., Victoria, Australia	(AWWA)
G. Larsen, Smith-Blair, Texarkana, Texas	(AWWA)
B. Murphy, Sherman-Williams Company, Villaneuva, N.M.	(AWWA)
V. O'Dea, Tnemec Company Inc., Kansas City, Kan.	(AWWA)
S. Serpe, Arkema Inc., King of Prussia, Pa.	(AWWA)
G. Tate, Viking Johnson, Hitchen, U.K.	(AWWA)
J.A. Wise, Canus, International Sales Inc., Surrey, B.C., Canada	(AWWA)

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*
Dennis A. Dechant, *Vice-Chair*
John L. Luka, *Secretary*

General Interest Members

J.H. Bambei Jr., Bambei Engineering Services, Arvada, Colo.	(AWWA)
W.R. Brunzell, Brunzell Associates Ltd., Skokie, Ill.	(AWWA)
R.J. Card, Lockwood, Andrews & Newnam Inc., Houston, Texas	(AWWA)
R.L. Coffey, HDR Engineering Inc., Omaha, Neb.	(AWWA)
S.N. Foellmi, Black & Veatch Corporation, Irvine, Calif.	(AWWA)
R.L. Gibson, Freese and Nichols Inc., Fort Worth, Texas	(AWWA)
M.D. Gossett,* HDR Engineering Inc., Denver, Colo.	(AWWA)
M.B. Horsley,* Horsley Engineering LLC, Overland Park, Kan.	(AWWA)
R. Issa,* AECOM, McKinney, Texas	(AWWA)
R.A. Kufaas, Norske Corrosion & Inspection Services Ltd., Surrey, B.C., Canada	(AWWA)
J.L. Mattson, Corrosion Control Technologies, Sandy, Utah	(AWWA)
A. Murdock, CH2M, Salt Lake City, Utah	(AWWA)

* Alternate

R. Ortega,* Lockwood, Andrews & Newnam Inc., Houston, Texas (AWWA)
E.S. Ralph,† Standards Engineer Liaison, AWWA, Denver, Colo. (AWWA)
A.E. Romer, AECOM, Orange, Calif. (AWWA)
J.R. Snow, MWH Americas, Denver, Colo. (AWWA)
W.R. Whidden, Woolpert, Winter Park, Fla. (AWWA)

Producer Members

D.W. Angell,† Standards Council Liaison, American Flow Control, Birmingham, Ala. (AWWA)
S.A. Arnaout, Forterra Pressure Pipe, Dallas, Texas (AWWA)
H.H. Bardakjian, Consultant, Glendale, Calif. (AWWA)
D. Dechant, Dechant Infrastructure Service, Aurora, Colo. (AWWA)
V. DeGrande,* Ameron Water Transmission Group, Rancho Cucamonga, Calif. (AWWA)
W.B. Geyer, Steel Plate Fabricators Associates, Lake Zurich, Ill. (AWWA)
B.D. Keil, Northwest Pipe Company, Draper, Utah (AWWA)
J.L. Luka, American SpiralWeld Pipe Company, Columbia, S.C. (AWWA)
R.D. Mielke,* Northwest Pipe Company, Raleigh, N.C. (AWWA)
J. Olmos, Ameron International, Rancho Cucamonga, Calif. (AWWA)
G.F. Ruchti,* Consultant, Punta Gorda, Fla. (AWWA)
B.P. Simpson,* American Cast Iron Pipe Company, Birmingham, Ala. (AWWA)
C.C. Sundberg, Victaulic, Issaquah, Wash. (AWWA)
D. Walker, Avid Protective Products LTD/Tnemec Company, Oakville, Ont., Canada (AWWA)
J.A. Wise, Canus International Sales Inc., Surrey, B.C., Canada (AWWA)

User Members

L. Adams, US Bureau of Reclamation, Denver, Colo. (AWWA)
G.A. Andersen, New York City Bureau of Water Supply, Little Neck, N.Y. (AWWA)
B. Cheng, Metro Vancouver, Burnaby, B.C., Canada (AWWA)
M.E. Conner, San Diego County Water Authority, San Diego, Calif. (AWWA)
S. Hattan, Tarrant Regional Water District, Fort Worth, Texas (AWWA)
P.K. Karna, Tacoma Water, Tacoma, Wash. (AWWA)
T.J. Jordan,* Metropolitan Water District of Southern California, LaVerne, Calif. (AWWA)
M. McReynolds, Metropolitan Water District of Southern California, Oak Park, Calif. (AWWA)
M. Turney,* Denver Water, Denver, Colo. (AWWA)
N.A. Wigner, Los Angeles Department of Water and Power, Los Angeles, Calif. (AWWA)

* Alternate
† Liaison, nonvoting

Contents

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

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA C224.*

I. Introduction.

I.A. *Background.* Polyamide (Nylon-11-based) coatings and linings are thermoplastics. Typically, they are placed by applying dry polyamide powder (ordinarily in a controlled plant environment, by any of several techniques, e.g., electrostatic spray, immersion in a fluidized bed, spray onto preheated article, or rotocoating) onto steel surfaces previously primed with a thin layer of epoxy primer (note that other primers may be used, as appropriate). When treated at the appropriate temperature, the dry polyamide powder melts to form a uniform, continuous polyamide layer on the steel surface. Simultaneously during this thermal treatment, chemical reactions occur between the steel surface and epoxy and between epoxy and polyamide. These chemical reactions provide for bonding between the polyamide and steel surface.

The first commercial use of polyamide systems for the protection (from corrosion) of steel used in water-handling applications was in West Germany in 1970. Regarding the United States, it is believed that first use was in 1985. However, prior to this, polyamide systems had been used in 1983 for the protection of the interior of steel piping used in the petroleum industry. Currently, the use of polyamides to protect steel has grown to include many types of articles (both interiors and exteriors) in a variety of industries, such as oil and natural gas exploration and production, and water and wastewater handling. Polyamide systems also can be used to protect accessory steel articles, such as pumps, valves, couplers, and flowmeters.

I.B. *History.* C224-01 was the first standard specifically concerning polyamide coating and lining systems. However, it is noted that polyamide-based systems have been used according to ANSI/AWWA Standard C550-01. The second edition of C224 was approved by the AWWA Board of Directors on Feb. 12, 2006. The third edition was approved on June 12, 2011. This edition was approved on Jan. 14, 2017.

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)

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

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.
2. Two standards developed under the direction of NSF:† NSF/ANSI 60, Drinking Water Treatment Chemicals—Health Effects, and NSF/ANSI 61, Drinking Water System Components—Health Effects.
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 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.

Annex A, "Toxicology Review and Evaluation Procedures," to NSF/ANSI 61 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 Annex A procedures may not always be identical, depending on the certifier.

ANSI/AWWA C224 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.

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

† NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105.

‡ Both publications available from National Academy of Sciences, 500 Fifth Street, NW, Washington, DC 20001.

II. Special Issues.

II.A. *Advisory Information on Material Application.* This standard defines the use of polyamide systems for the lining and coating of steel articles used for water handling in the following environments: aboveground, belowground, or underwater—under normal conditions. Also, this standard describes the quality of polyamide systems needed to produce long-term performance—in particular, long-term corrosion protection. Normal conditions are defined as those conditions specified by the polyamide system manufacturer (see Section 3) that are known beforehand not to adversely affect polyamide systems.

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 C224, Nylon-11-Based Polyamide Coatings and Linings for Steel Water Pipe and Fittings, of latest revision
2. Any required exceptions to the standard.
3. Diameter, length, thickness, design, and location of coated steel articles.
4. For applications other than potable water, whether compliance with NSF/ANSI 61, Drinking Water System Components—Health Effects, is required.
5. Temperature (Sec. 1.1.2), pH, and composition of water to be handled.
6. Details of other federal, state or provincial, and local requirements (Sec. 4.2).
7. Weld treatment (Sec. 4.5.2.1).
8. Visual standards (Sec. 4.5.2.4).
9. Polyamide holdback at pipe ends (Sec. 4.5.3.2).
10. Polyamide thickness (Sec. 4.5.3.3).
11. Field-welded joint coating and lining (Sec. 4.5.5).
12. Pipe bedding and trench backfill (Sec. 4.6).
13. Inspection (Sec. 5.4).
14. Number of adhesion tests (Sec. 5.5.5).
15. Delivery (Section 6).
16. Outdoor storage (Sec. 6.2.2).
17. 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 edition include the following:

1. The title of the standard was changed to be consistent with other AWWA steel pipe coating and lining standards.
2. Section 2, References, was updated.
3. The definition for *applicator* was added to Section 3, Definitions.
4. Sec. 4.2, Materials and Workmanship, was revised for consistency with the other coating and lining standards.
5. A new Sec. 4.2.2, Certification, was added to include a requirement for NSF/ANSI 61 certification on products if they will be in contact with potable water.
6. Sec. 4.5.2.3, Abrasive Blast Cleaning, was revised.
7. All existing wording in Sec. 4.6, Field Procedures, was removed. The section now references AWWA C604.
8. A new Sec. 5.2, Requirements of Coating and Lining Systems, was added that includes requirements for the polyamide material for properties, specific gravity, particle size distribution, melting point, water absorption, and inherent viscosity.
9. Sec. 5.2.2.6, Cathodic Disbondment, was updated.
10. In Sec. 5.5.3, Thickness, the reference to ASTM G12, which has been withdrawn, was replaced with ASTM D7091, which has replaced it.
11. Section 6, Delivery, was modified to be consistent with other AWWA steel pipe coating and lining standards.
12. Sec. 6.3 was modified to include affidavits from both the polyamide manufacturer and the applicator.

V. Comments. If you have any comments or questions about this standard, please call AWWA Engineering and Technical Services at 303.794.7711, FAX at 303.795.7603; write to the department at 6666 West Quincy Avenue, Denver, CO 80235-3098; or email at standards@awwa.org.

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AWWA Standard

Nylon-11-Based Polyamide Coatings and Linings for Steel Water Pipe and Fittings

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes Nylon-11-based polyamide systems for lining and coating of steel pipe, connections, fittings, and special sections (articles) that are used in water-handling equipment that is installed aboveground, belowground, or underwater. Polyamide systems are thermoplastic and are ordinarily applied in a shop or manufacturing facility.

1.1.1 *Minimum pipe diameter.* The minimum pipe diameter for application of the polyamide system to the interior of a pipe shall be the diameter that permits effective inspection and repair. For joints of pipe, this minimum diameter is ordinarily 24 in. (600 mm). For pipe diameters less than 24 in. (600 mm), the polyamide manufacturer shall be consulted regarding methods of inspection and repair.

1.1.2 *Maximum temperature.* AWWA pipe coating and lining standards are written for and based on the service temperature of potable water. The maximum temperature at which a polyamide system can be used shall be as recommended by the manufacturer.