

ANSI/AW WA C222a-09 Addendum to ANSI/AW WA C222-08 Standard for

Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings

Approved by AWWA Board of Directors June 14, 2009. Approved by American National Standards Institute Sept. 17, 2009.

1.	Table 1	Properties of laborato	ry applied coating,	add the following:
			, FF	

Property	Requirement	Test Method
Adhesion to Steel (ASTM D4541)	1,500 psi (10,350 kPa), Minimum	Sec. 4.2.9

2. Sec. 4.2, add the following new section:

4.2.9 *Adhesion*. The adhesion of the coating system to the steel shall be determined in accordance with ASTM D4541. The adhesion of the coating system shall be a minimum of 1,500 psi (10,350 kPa).



The Authoritative Resource on Safe Water®

ANSI/AWWA C222-08 (Revision of ANSI/AWWA C222-99)

AWWA Standard

Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings





Effective date: Dec. 1, 2008. First edition approved by AWWA Board of Directors June 20, 1999. This edition approved June 8, 2008. Approved by American National Standards Institute Sept. 17, 2008.

6666 West Quincy Avenue Denver, C0 80235-3098 **T** 800.926.7337 www.awwa.org Advocacy Communications Conferences Education and Training Science and Technology Sections

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 codes of any governmental authority. AWWA standards are intended to represent a consensus of the water supply industry that the product described will provide satisfactory service. When AWWA revises or withdraws this standard, an official notice of action will be placed on the first page of the classified advertising 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 publication. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036; (212) 642-4900.

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information or retrieval system, except in the form of brief excerpts or quotations for review purposes, without the written permission of the publisher.

Copyright © 2008 by American Water Works Association Printed in USA

Committee Personnel

The SWPMTAC Task Group on C222, which developed this edition, had the following personnel at the time:

Antonio Liberatore, Chair

F.D. Barnes, Barnes Group International, Windsor, Calif.	(AWWA)
M. Bauer, Tnemec Company, Inc., North Kansas City, Mo.	(AWWA)
R.M. Buchanan, Canusa-CPS, Toronto, Ont.	(AWWA)
R.W. Geary, Tek-Rap Inc., Houston, Texas	(AWWA)
B.D. Keil, Continental Pipe Manufacturing, Pleasant Grove, Utah	(SPFA)
A. Liberatore, Madison Chemical Industries Inc., Milton, Ont.	(AWWA)
L. McKinney, Womble Company Inc., Houston, Texas	(AWWA)
R.D. Mielke, Northwest Pipe, Raleigh, N.C.	(AWWA)
R.E. Newby, ICI Devoe Coatings, Mandeville, La.	(AWWA)
J. O'Brien, Tapecoat Company, Evanston, Ill.	(AWWA)
S.P. Scarpone, Reilly Industries Inc., Indianapolis, Ind.	(AWWA)
M.S. Soloninka, ShawCor Pipe Protection, Houston, Texas	(AWWA)
J.A. Wise, Canus International Sales Inc., Surrey, B.C.	(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* George J. Tupac, *Vice-Chair* Dennis Dechant, *Secretary*

General Interest Members

J.B. Allen, [*] Standards Engineer Liaison, AWWA, Denver, Colo.	(AWWA)
W.R. Brunzell, Brunzell Associates Ltd., Skokie, Ill.	(AWWA)
R.L. Coffey, HDR Engineering Inc., Omaha, Neb.	(AWWA)
H.E. Dunham, MWH Inc., Bothell, Wash.	(AWWA)
S.N. Foellmi, Black & Veatch Corporation, Irvine, Calif.	(AWWA)

^{*}Liaison, nonvoting

J.W. Green, McDonough Associates Inc., Chicago, Ill.	(AWWA)
M.B. Horsley, [*] Black & Veatch Corporation, Kansas City, Mo.	(AWWA)
J.K. Jeyapalan, Pipeline Consultant, New Milford, Conn.	(AWWA)
J.L. Mattson, Corrosion Control Technologies, Sandy, Utah	(AWWA)
W.J. Moncreif, [*] HDR Engineering Inc., San Diego, Calif.	(AWWA)
R. Ortega, Lockwood Andrews & Newman, Houston, Texas	(AWWA)
A.E. Romer, Boyle Engineering Corporation, Newport Beach, Calif.	(AWWA)
H.R. Stoner, Consultant, North Plainfield, N.J.	(AWWA)
C.C. Sundberg, CH2M Hill Inc., Issaquah, Wash.	(AWWA)
G.J. Tupac, G.J. Tupac & Associates Inc., Pittsburgh, Pa.	(AWWA)
W.R. Whidden, Post Buckley Schuh & Jernigan, Orlando, Fla.	(AWWA)
K.E. Wilson, [†] Standards Council Liaison, Post Buckley Schuh & Jernigan,	
Tampa, Fla.	(AWWA)

Producer Members

S.A. Arnaout, Hanson Pressure Pipe Inc., Dallas, Texas	(AWWA)
H.H. Bardakjian, Consultant, Glendale, Calif.	(AWWA)
M. Bauer, Tnemec Company Inc., North Kansas City, Mo.	(AWWA)
R.J. Card, Victaulic, Atlanta, Ga.	(AWWA)
R.R. Carpenter, American SpiralWeld Pipe Company, Birmingham, Ala.	(MSS)
D. Dechant, Dechant Infrastructure Services, Aurora, Colo.	(AWWA)
W.B. Geyer, Street Plate Fabricators Association, Lake Zurich, Ill.	(SPFA)
J.L. Luka, [*] American SpiralWeld Pipe Company, Columbia, S.C.	(AWWA)
R. Mielke, [*] Northwest Pipe Company, Raleigh, N.C.	(AWWA)
J. Olmos, Ameron International, Rancho Cucamonga, Calif.	(AWWA)
B. Vanderploeg, Northwest Pipe Company, Portland, Ore.	(AWWA)
J.A. Wise, Canus International Sales, Surrey, B.C.	(AWWA)

User Members

G.A. Andersen, New York City Bureau of Water Supply, Little Neck, N.Y.	(AWWA)
J.H. Bambei Jr., Denver Water Department, Denver, Colo.	(AWWA)

^{*}Alternate

[†]Liaison, nonvoting

D.W. Coppes, Massachusetts Water Resources Authority,		
Southborough, Mass.	(NEWWA)	
R.V. Frisz, US Bureau of Reclamation, Denver, Colo.	(USBR)	
G. George, Tacoma Water, Tacoma, Wash.	(AWWA)	
T.J. Jordan, Metropolitan Water District of Southern California,		
La Verne, Calif.	(AWWA)	
M. McReynolds, [*] Metropolitan Water District of Southern California,		
LaMirada, Calif.	(AWWA)	
G. Oljaca, Greater Vancouver Regional District, Burnaby, B.C.	(AWWA)	
V.B. Soto, Los Angeles Department of Water & Power, Los Angeles, Calif.	(AWWA)	
G.P. Stine, San Diego County Water Authority, Escondido, Calif.	(AWWA)	
J.V. Young, City of Richmond, Richmond, B.C.	(AWWA)	

^{*}Alternate

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.

PAGE

SEC.

Foreword

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

Standard

1 General

1.1	Scope	1
1.2	Purpose	2
1.3	Application	2
2	References	2
3	Definitions	4
4	Requirements	
4 4.1	Requirements Materials	4
4 4.1 4.2	Requirements Materials Laboratory-Applied Coating	4
4 4.1 4.2	Requirements Materials Laboratory-Applied Coating System Requirements	4
44.14.24.3	Requirements Materials Laboratory-Applied Coating System Requirements Coating Thickness	4 4 6

SEC.	PAGE
4.5	Coating Application 8
4.6	Coating Repair 10
4.7	Welded Field Joints 11
4.8	Nonwelded Joints 12
4.9	Coating Special Pipe Connections
	and Appurtenances 12
4.10	Field Procedures 13
4.11	Safety and Regulations 14
5	Verification
5.1	Quality Assurance and Records 14
5.2	Purchaser's Inspection 14
5.3	Laboratory-Applied Coating
	System Requirements 15
5.4	Surface Preparation Inspection 15
5.5	Shop- or Field-Coated Pipe
	Inspection 16
5.6	Notice of Nonconformance 16
6	Delivery
6.1	General 17
6.2	Packaging 17
6.3	Storage of Materials 17
6.4	Affidavit of Compliance 17
Tables	
1	Properties of Laboratory-Applied
	Coating 5
2	Properties of Production Coating 14

This page intentionally blank.

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 polyurethane coatings 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, the coating system was 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 polyurethane coatings on the interior and exterior of steel water pipe and fittings. The first edition of ANSI/ AWWA C222 was approved on June 20, 1999. This is the second edition of this standard and was approved on June 8, 2008.

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 all direct and indirect drinking water additives. Other members of the original consortium included the American Water Works Association Research Foundation (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. An advisory program formerly administered by USEPA, Office of Drinking Water, discontinued on Apr. 7, 1990.

2. Specific policies of the state or local agency.

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

 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.

4. 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 jurisdiction. 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 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. There are no special issues described by this standard.

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 C222, Standard for Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe, and Fittings of latest revision.

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

^{*}NSF International, 789 N. Dixboro Road, Ann Arbor, MI 48105.

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

2. Whether compliance with NSF/ANSI 61, Drinking Water System Components—Health Effects, is required, in addition to the requirements of the Safe Drinking Water Act.

- 3. Any exceptions to the standard.
- 4. Diameter, length, and location of pipeline.
- 5. Color of coating required (if applicable).
- 6. Internal or external coating system to be provided (Sec. 1.1.1).
- 7. Temperature of conveyed water (Sec. 1.1.3).
- 8. Details of other federal, state or provincial, and local requirements (Sec. 4.1).
- 9. Additional reagents for chemical resistance testing (Sec. 4.2.5)
- 10. Dry film thickness (Sec. 4.3).
- 11. Thickness for special applications (Sec. 4.3.2).
- 12. Abrasive blast profile (Sec. 4.4.2.2).
- 13. Visual comparative standard for surface preparation (Sec. 4.4.2.3).
- 14. Field joint material selection (Sec. 4.7.5).
- 15. Coating requirements for flange faces and other mating surfaces (Sec. 4.9.4).
- 16. Bedding and backfill requirements (Sec. 4.10.3).
- 17. Government regulations (Sec. 4.11.1).
- 18. Optional inspection (Sec. 5.2).
- 19. Prequalification testing (Sec. 5.3).
- 20. Affidavit of compliance (Sec. 6.4).

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. Maximum temperature has been modified in Sec. 1.1.3.

2. The properties of laboratory-applied coating requirements in Table 1 have been revised.

3. The section on coating adhesion has been removed (Sec. 4.2.1, C222-99).

4. Revised impact resistance testing to be determined using ASTM G14 (Sec. 4.2.3).

5. Added dielectric strength testing per ASTM D149 (Sec. 4.2.6).

6. Changed dry film thickness measurement in Sec. 4.3.4.

7. Pipe preparation has been modified (Sec. 4.4.2). The abrasive blast cleaning section has been revised, changes have been made to the visual comparative standards requirements, and a new section on abrasive working mix has been added.

8. The requirements for overcoating in Sec. 4.5.5 have been revised. The term *recoat* was changed to *overcoat* and a new section on curing of coatings has been added (Sec. 4.5.6).

9. Requirements for protection during welding of field joints have been changed (Sec. 4.7.2), and Sec. 4.7.5 has been updated to require approval by the purchaser for welded field joint materials.

10. A maximum particle size for backfill was added to Sec. 4.10.3.2.

11. Table 2 has been updated and renamed to Properties of Production Coating.

12. The paragraph on coating application inspection has been removed from Sec. 5.2.

13. Coating tests in Sec. 5.3 were modified.

14. Sec. 5.5 on coated pipe inspection has been modified. The section on cure test was removed, and the requirements for adhesion testing have been changed.

V. Comments. If you have any comments or questions about this standard, please call the AWWA Volunteer and Technical Support Group at 303.794.7711, FAX at 303.795.7603, write to the group at 6666 West Quincy Avenue, Denver, CO 80235-3098, or e-mail at standards@awwa.org.



ANSI/AWWA C222-08 (Revision of ANSI/AWWA C222-99)

AWWA Standard

Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings

SECTION 1: GENERAL

Sec. 1.1 Scope

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

1.1.1 *Coating and lining systems.* Unless otherwise specified by the purchaser, the lining and coating systems shall consist of an ASTM D16 Type V thermoset, aromatic polyurethane plastic polymer that is the reaction product of diphenylmethane diisocyanate (MDI) resin and polyol resin or 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 wide variety of polyurethane technologies available on the