

American Water Works Association

ANSI/AWWA C203-02

(Revision of ANSI/AWWA C203-97)



AWWA STANDARD
FOR
COAL-TAR PROTECTIVE
COATINGS AND LININGS FOR STEEL WATER
PIPELINES—ENAMEL AND TAPE—
HOT APPLIED



Effective date: Aug. 1, 2002.

First edition approved by AWWA Board of Directors April 23, 1940.

This edition approved Jan. 20, 2002.

Approved by American National Standards Institute: May 21, 2002.

AMERICAN WATER WORKS ASSOCIATION

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Foreword

This foreword is for information only and is not a part of AWWA C203.

I. Introduction.

I.A. Background. Hot-applied coal-tar enamel has been used for corrosion protection of steel water pipe, both as an interior lining and as an exterior coating since the mid 1930s. Internally, the coal-tar enamel is used without reinforcement or shielding. The hot enamel is spun into the pipe and provides a smooth internal lining having low hydraulic frictional resistance. When used as an external coating, they are, when specified, reinforced with glass fiber inner and outer wraps. These wraps have replaced the original fibrous material, such as asbestos felt, which was a standard wrap for many years until health concerns regarding asbestos surfaced. The glass fiber inner and outer wraps are now being specified as routine reinforcements for coal-tar enamel coatings.

I.B. History. The first AWWA standards for coal-tar enamel were approved Apr. 25, 1940, and were designated 7A.5, for steel water pipe in sizes 30 in. (750 mm) and larger, and 7A.6, for steel water pipe of sizes up to, but not including, 30 in. (750 mm). Revisions of these documents were approved on Oct. 3, 1949; June 21, 1950; May 1, 1951; and July 14, 1955.

In 1951, the designations of 7A.5 and 7A.6 were changed to AWWA C203 and AWWA C204, respectively.

On Mar. 27, 1957, a revision was approved that combined the two standards into one document designated as AWWA C203. Subsequent revisions were approved on Jan. 23, 1962; May 22, 1966; Jan. 29, 1973; June 25, 1978; Jan. 26, 1986; June 23, 1991; and Feb. 1, 1998. This edition was approved on Jan. 20, 2002.

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.
3. Two standards developed under the direction of NSF, ANSI[†]/NSF[‡] 60, Drinking Water Treatment Chemicals—Health Effects, and ANSI/NSF 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 ANSI/NSF 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 ANSI/NSF 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.

AWWA C203-02 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.

*Persons in Canada, Mexico, and non-North American countries should contact the appropriate authority having jurisdiction.

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

‡NSF International, 789 N. Dixboro Rd., Ann Arbor, MI 48106.

§Both publications available from National Academy of Sciences, 2102 Constitution Ave. N.W., Washington, DC 20418.

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.

II.A. *Advisory Information on Product Application.* This standard defines coal-tar protective coatings and linings in terms of performance to establish the quality desired for long-term prevention of corrosion. The standard covers the external coating and internal lining of steel water pipelines for underground or underwater installation. If an extended period of aboveground storage of coated pipe is anticipated, consideration should be given to the ability of the coating to resist ultraviolet degradation and other atmospheric and environmental conditions.

III. Use of This Standard. AWWA has no responsibility for the suitability or compatibility of the provisions of this standard to any intended application by any user. Accordingly, each user of this standard is responsible for determining that the standard's provisions are suitable for and compatible with that user's intended application.

III.A. *Purchaser Options and Alternatives.* The following items should be covered in the purchaser's specifications:

1. Standard used—that is, ANSI/AWWA C203, Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines—Enamel and Tape—Hot-Applied, of latest revision, or any part or combination of Sec. 1, 4.3, 4.4, 4.5, and 4.6.

2. Any exceptions to the standard that may be required.

3. Operating temperature.

4. Requirements for outdoor storage (Sec. 1.1.1).

5. Government regulations (Sec. 1.1.2).

6. Location of coating application with reference to environmental considerations.

7. Diameter, length, and location of pipeline, including maps and drawings necessary to show all details of the pipeline.

8. Length of pipeline requiring internal protection (Sec. 4.4.1.1).

9. Length of pipeline requiring: (1) normal exterior protection (Sec. 4.4.1.2) together with any preference regarding finish coat of whitewash, water-emulsion latex paint, or kraft paper; and (2) each type of additional exterior protection required for unusual underground or underwater conditions (Sec. 4.7).

10. Additional exterior protection that may be required (Sec. 4.7).

11. Affidavit of compliance, if required (Sec. 6.3).

12. Type of liquid adhesive (Sec. 4.3.2).
13. Type of coal-tar enamel (Sec. 4.3.3).
14. Samples of materials, if required (Sec. 5.1.4).
15. Inspection, testing, and rejection (Sec. 5.1.4.1).
16. Type of outerwrap (Sec. 4.3.4).
17. Requirements for coating system thickness (Sec. 4.4.1.3 and 4.7).
18. Lining and coating of pipe ends (Sec. 4.4.10).
19. Trench bedding and backfilling (Sec. 4.8.3 and 4.8.4).
20. Additional materials or procedures (Sec. 4.6.2).
21. Thickness of tape (Sec. 4.6.5.2.2).
22. If materials only are being purchased according to the requirements of Sec. 4.3 of this standard, then the purchaser shall specify quantities for the following items: (1) primer by type (Sec. 4.3.2); (2) coal-tar enamel by type (Sec. 4.3.3.1 and Table 1); (3) outerwrap (Sec. 4.3.4); and (4) glass-fiber inner mat (Sec. 4.3.5). The purchaser should also specify if an affidavit of compliance is required (Sec. 6.3).
23. If materials only are being purchased according to the requirements of Sec. 4.6 of this standard, then, in addition to items 20 and 21, the purchaser should specify the following: (1) quantity of liquid adhesive (Sec. 4.6.5.1); (2) quantity of tape (Sec. 4.6.5.2); and (3) affidavit of compliance, if required (Sec. 6.3).
24. Adhesion tests (Sec. 4.6.8).
25. ANSI/AWWA C209, Standard for Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines, and ANSI/AWWA C216, Standard for Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines may also be used in combination with ANSI/AWWA C203, if specified by the purchaser.
26. Application and use of materials covered in this standard should conform to warnings and instructions provided by the manufacturers and with existing federal and local governmental regulations.
27. The purchaser should state whether compliance with ANSI/NSF 61 Drinking Water System Components—Health Effects, is required, in addition to the requirements of the Safe Drinking Water Act. If this certification is required, the purchaser's specification shall read, "this product shall be certified as suitable for contact with drinking water by an accredited certification organization in accordance with ANSI/NSF Standard 61, Drinking Water Systems Components—Health Effects."

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

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

1. The words *primer/priming* have been changed to *liquid adhesive/application of liquid adhesive* throughout the standard.
2. The appendix found in past issues of C203 and relating to additional exterior protection of pipes in more severe service has been incorporated into the body of this issue (Sec. 4.7).
3. Polyethylene Kraft Paper has been deleted as an exterior wrap.
4. Various specification references, TAPPI T-403, T404, T410, ASTM D1000 and D1238, have been removed because the materials previously listed and required to meet these specifications have been removed from this issue.
5. Test procedures and requirements for glass fiber wraps can now be readily found in Table 2, Physical Properties of Base Glass and Outerwraps Used in This Standard.
6. Coating system thickness, Sec. 4.3.9 listed under Materials, Sec. 4.3 found in C203-97 has been relocated to Sec. 4.4.1.3 in this issue.
7. A third liquid adhesive, Type C, has been added (Sec. 4.3.2.3).
8. Sec. 4.3.2 was revised to allow the use of alternate resin-based liquid adhesives where air emissions regulations restrict the use of Type A and Type B liquid adhesives.

V. Comments. If you have any comments or questions about this standard, please call the AWWA Volunteer & Technical Support Group, (303) 794-7711 ext. 6283, FAX (303) 795-7603, or write to the group at 6666 W. Quincy Ave., Denver, CO 80235.

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AWWA STANDARD FOR COAL-TAR PROTECTIVE COATINGS AND LININGS FOR STEEL WATER PIPELINES—ENAMEL AND TAPE— HOT APPLIED

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard provides the requirements for coal-tar protective exterior coatings and interior linings used in the potable water supply industry for buried steel water pipelines.

Sections 4.3 through 4.5 and Sec. 4.8 cover the requirements for hot-applied, coal-tar enamel and its exterior and interior application to pipe, special sections, connections, fittings, and field procedures. Section 4.6 covers the requirements for hot-applied, coal-tar base tapes for application to special sections, connections, and fittings. Section 4.7 presents alternative coal-tar coating systems, wraps, and procedures for external coating systems that provide additional coating protection for use in severe trench locations.

All AWWA steel pipe coating standards are written for and based on the service temperature of potable water. For operating temperatures higher than the normal temperature of potable water, consult the manufacturer for recommendations concerning temperature limitations for coal-tar protective coatings and linings.

1.1.1 *Storage conditions.* Because aboveground and environmental conditions vary, the purchaser should consult the manufacturer as to type of coating that is recommended for the specific anticipated storage conditions, including the necessity for ultraviolet-light protection.

1.1.2 *Government regulations.* The purchaser (or the constructor) shall determine that no portion of this standard is in conflict with any existing government regulations.

1.1.3 *Safety and environmental considerations.* The components of the coating system may contain skin irritants and may be flammable. Precautions should be taken to protect against these hazards and to comply with the manufacturer's recommendations concerning the use and handling of the components.

Sec. 1.2 Purpose

The purpose of this standard is to provide the requirements for coal-tar protective coatings and linings for steel water pipelines—enamel and tape—hot applied, including materials, application, verification, and delivery.

Sec. 1.3 Application

This standard can be referenced in specifications for hot-applied coal-tar protective coatings and linings of steel water pipelines. The stipulations of this standard apply when this document has been referenced and then only to protective coatings and linings of steel water pipelines with hot-applied coal-tar enamel systems and to hot-applied coal-tar tape on the exterior of special sections, connections, and fittings.

SECTION 2: REFERENCES

This standard references the following documents. In their latest editions, they form a part of this standard to the extent specified within the standard. In any case of conflict, the requirements of this standard shall prevail.

ANSI*/ASTM D146—Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing.

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

ANSI/ASTM D882—Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

ANSI/ASTM D2103—Standard Specification for Polyethylene Film and Sheeting.

ANSI/AWWA C205—Cement-Mortar Protective Lining and Coating for Steel Water Pipe—4 in. (100 mm) and Larger—Shop Applied.

ANSI/AWWA C209—Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipe.

ANSI/AWWA C216—Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.

ASTM* D5—Standard Test Method for Penetration of Bituminous Materials.

ASTM D36—Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus).

ASTM D71—Standard Test Method for Relative Density of Solid Pitch and Asphalt (Displacement Method).

ASTM D388—Standard Classification of Coals by Rank.

ASTM D546—Standard Test Method for Sieve Analysis of Mineral Filler for Road and Paving Mixtures.

ASTM D689—Standard Test Method for Internal Tearing Resistance of Paper.

ASTM D737—Standard Test Method for Air Permeability of Textile Fabrics.

ASTM D1505—Standard Test Method for Density of Plastics by the Density-Gradient Technique.

ASTM D2415—Standard Test Method for Ash in Coal Tar and Pitch.

BS† 4164—Coal Tar Based Hot-Applied Coating Materials for Protecting Iron and Steel Including Suitable Primer.

ISO‡ 719—Waterproofing Fiberglass at 98° C, Testing Procedure and Classification.

SSPC§ SP1—Solvent Cleaning.

SSPC SP2—Hand Tool Cleaning.

SSPC SP3—Power Tool Cleaning.

* American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

† British Standard Institution, 2 Park St., London, England W1A 2BS.

‡ International Standards Organization.

§ SSPC: The Society for Protective Coatings, 40 24th St., Pittsburgh, PA 15222.

SSPC SP6/NACE* No. 3—Commercial Blast Cleaning.

SSPC SP10/NACE No. 2—Near-White Blast Cleaning.

TAPPI† T411—Thickness (Caliper) of Paper, Paperboard, and Combined Board.

TAPPI T414—Internal Tearing Resistance of Paper.

SECTION 3: DEFINITIONS

The following definitions shall apply in this standard:

1. *Blasting*: Blasting shall refer to blasting with sand, steel shot, or grit.
2. *Centrifugal casting*: The process of applying coal-tar enamel to the inside surface of the pipe. Molten coal-tar enamel is introduced into the pipe, spread on the surface of the pipe, and held thereon by the centrifugal force developed by rotating the pipe about its longitudinal axis until the enamel has cooled and solidified and become bonded to the pipe.
3. *Constructor*: The party that provides the work and materials for placement or installation.
4. *Manufacturer*: The party that manufactures, fabricates, or produces materials or products.
5. *Purchaser*: The person, company, or organization that purchases any materials or work to be performed.

SECTION 4: REQUIREMENTS

Sec. 4.1 Equipment

The constructor's equipment for blasting, priming, enameling, wrapping, and taping shall be designed, manufactured, and maintained in adequate condition so that the application procedure produces the results prescribed in this standard.

*NACE International, 1440 South Creek Drive, P.O. Box 218340, Houston, TX 77218-8340.

†Technical Association of the Pulp and Paper Industry, 15 Technology Parkway South, Norcross, GA 30092.

Sec. 4.2 Materials and Workmanship

Materials provided shall meet the provisions of this standard. Work or material that fails to conform to the requirements of this standard may be rejected at any time prior to final acceptance thereof.

Materials shall comply with the requirements of the Safe Drinking Water Act and other federal, state, and local requirements. Legislation is subject to change, therefore, it is the manufacturer's and purchaser's responsibility to verify the current requirements of federal, state, and local regulations.

Sec. 4.3 Materials for Hot, Coal-Tar Enamel Coating Systems

4.3.1 *General.* This section describes the composition and physical properties of materials to be used for liquid adhesives, coal-tar enamel, innerwraps, outerwraps, and finish coats intended for use in hot-applied, coal-tar enamel, interior linings, and exterior protective coating systems for steel water pipelines. The liquid adhesive and coal tar shall be provided by the same manufacturer.

4.3.2 *Liquid adhesive.* Type A (coal-tar) and Type B (fast-drying, synthetic) and Type C (liquid epoxy resin) liquid adhesives are covered by this standard. Unless Type A liquid adhesive is specified by the purchaser, Type B or Type C liquid adhesive, which may be employed under all conditions when coal-tar enamel is specified, shall be used. At site locations where air emission regulations may restrict the use of Type A and B liquid adhesive, other resin-base liquid adhesives may be used as equivalent to the Type A, B, and C liquid adhesives covered in this standard, provided they, when topcoated with the appropriate coal tar enamel, meet the performance requirements of Table 1 and are approved by the purchaser. Consult the manufacturer for specific alternative surface preparation and application systems.

4.3.2.1 Type A (coal-tar) liquid adhesive. Coal-tar liquid adhesive shall consist only of processed coal-tar pitch and refined coal-tar oils, suitably blended to produce a liquid that may be applied cold by brushing or spraying and that will produce an effective bond between the metal and a subsequent coating of coal-tar enamel.

4.3.2.2 Type B (fast-drying, synthetic) liquid adhesive. Fast-drying, synthetic liquid adhesive shall consist of chlorinated rubber, synthetic plasticizer, and solvents. These constituents shall be suitably compounded to produce a liquid coating that can be readily applied cold by brushing or spraying and that will produce a suitable and effective bond between the metal and a subsequent coating of coal-tar enamel.

Table 1 Physical properties of coal-tar enamel

Test	Enamel Type I		Enamel Type II	
	Minimum	Maximum	Minimum	Maximum
Softening point; ASTM D36	220° F (104° C)	240° F (116° C)	220° F (104° C)	240° F (116° C)
Filler (ash); ASTM D2415, percent by weight	25	35	25	35
Filler fineness through 200 mesh; ASTM D546, percent by weight	90	—	90	—
Specific gravity at 77° F (25° C); ASTM D71	1.4	1.6	1.4	1.6
Penetration* at 77° F (25° C), 100-g weight for 5 sec; ANSI/AWWA C203, Sec. 5.3.2, 0.1 mm	5	10	10	20
Penetration at 115° F (46.1° C), 50-g weight for 5 sec; ANSI/AWWA C203, Sec. 5.3.2, 0.1 mm	12	30	15	55
High-temperature sag test at 160° F (71° C); ANSI/AWWA C203, Sec. 5.3.4	—	1/16 in. (1.6 mm)	—	1/16 in. (1.6 mm)
Low-temperature cracking test at -10° F (-23.3° C); ANSI/AWWA C203, Sec. 5.3.5	—	none	N/A	N/A
Low-temperature cracking test at -20° F (-28.9° C); ANSI/AWWA C203, Sec. 5.3.5	N/A	N/A	—	none
Impact test at 77° F (25° C) 650-g ball, 8-ft drop; ANSI/AWWA C203, Sec. 5.3.7	—	16 in. ² (10,323 mm ²)	—	10 in. ² (6,452 mm ²)
Direct impact, disbonded area	—	6 in. ² (3,871 mm ²)	—	2 in. ² (1,290 mm ²)
Indirect impact, disbonded area	—	no peeling	—	no peeling
Peel test;† ANSI/AWWA C203, see Sec. 5.3.6	—	no peeling	—	no peeling
Service temperature limitations;‡	—	no peeling	—	no peeling
Interior lining	—	90° F (32.2° C)	—	90° F (32.2° C)
Exterior coating	—	160° F (71.1° C)	—	160° F (71.1° C)

*For static conditions above 5° F (-15° C), use enamel with 5–10 penetration at 77° F (25° C); below 5° F (-15° C) and above 10° F (-23° C), use 10–15 penetration; and below -10° F (-23° C) and above -20° F (-29° C), use 15–20 penetration enamel. (Static conditions are those conditions under which the pipe is not being handled.)

†Type I enamel in the 5–10 penetration range at 77° F (25° C) shall be tested with liquid adhesive, Type B or C.

‡It is not intended that each lot of coating be tested against this standard. However, the manufacturer's recommendations for use must be consistent with the requirement.