ANSI/AWWA C205-18
(Revision of ANSI/AWWA C205-12)

American Water Works Association

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AWWA Standard

Cement–Mortar Protective Lining and Coating for Steel Water Pipe—4 In. (100 mm) and Larger—Shop Applied

Effective date: Apr. 1, 2018.
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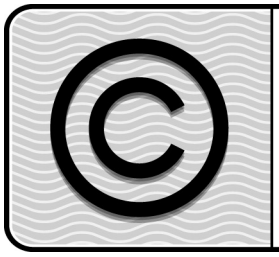
AWWA Standard

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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. xiii
I.A Background xiii
I.B History xiii
I.C Acceptance xiv
II Special Issues xv
II.A Soft, Aggressive Waters xv
II.B Intermittent Operations xv
II.C Flow Velocity xv
II.D Strain Limitations xv
II.E Weld-After-Backfill xv
II.F Cement–Mortar-Lining Thickness ... xvi
III Use of This Standard. xvi
III.A Purchaser Options and Alternatives xvi
III.B Modification to Standard xvii
IV Major Revisions xvii
V Comments xvii

Standard

1 General

1.1 Scope 1
1.2 Purpose 2
1.3 Application 2

2 References 2

SEC. PAGE

3 Definitions 3

4 Requirements

4.1 General 4
4.2 Material 5
4.3 Surface Preparation 6
4.4 Cement–Mortar Lining 6
4.5 Cement–Mortar Coating 10
4.6 Cement–Mortar Overcoat 14
4.7 Field Joints 17

5 Verification

5.1 Sampling and Testing Cement Mortar for Linings 18
5.2 Testing Cement Mortar for Coatings 19
5.3 Calibration of the Manufacturer's Equipment 20
5.4 Inspection and Testing by Purchaser 20
5.5 Basis for Rejection 21

6 Delivery

6.1 General 21
6.2 Plastic End Covers 21
6.3 Affidavit of Compliance 22

Table

1 Cement–Mortar-Lining Thickness ... 7

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA C205.*

I. Introduction.

I.A. *Background*. Cement–mortar-lined-and-coated steel pipe was first used in the United States in the late 1800s. Some of the first pipelines were in service for almost a century by the time the first national standard was written. However, it was not until the 1920s that a practical method of plant-applied cement–mortar lining was developed. The first plant-applied linings were installed by standing the pipe on end, placing a tapered plug with a rope attached to the leading end inside the pipe, placing enough cement mortar on top of the plug to coat the pipe, and then pulling the plug up through the pipe. Improvements in the lining process were developed, and the centrifugal process for plant-applied cement–mortar lining emerged.

Cement–mortar-lined and cement–mortar-coated steel pipe combines the physical strength of steel with the protective qualities of cement mortar. The lining, applied centrifugally, creates a smooth, dense finish that protects the pipe from tuberculation and provides a measure of corrosion protection. The smooth interior surface provides a high flow coefficient for the design life of the pipeline under normal operating conditions. In addition, the cement–mortar coating results in a tough, durable, and rugged coating that forms an alkaline environment where oxidation or corrosion of the steel is inhibited.

I.B. *History*. The first edition of this standard, designated 7A.7-41, Standard Specifications for Cement–Mortar Protective Coating for Steel Water Pipe of Sizes 30 Inches and Over, was approved by the AWWA Board of Directors on June 26, 1941. Before that, a tentative draft had been published in the January 1940 *Journal - American Water Works Association* for review and comment.

The first edition provided a section for the field application of cement–mortar lining, which was deleted by action of the Board of Directors effective June 30, 1951. Pending the promulgation of AWWA C602, Cement–Mortar Lining of Water Pipelines—4 In. (100 mm) and Larger—in Place, the ninth, tenth, and eleventh printing of 7A.7 (AWWA C205) continued to carry the withdrawn section.

The next edition, published in 1962, was a major revision and provided for pipe sizes of 4 in. (100 mm) and larger. The standard was subsequently revised in 1971, 1980, 1985, 1989, 1995, 2000, 2007, and 2012. This edition was approved on Jan. 20, 2018.

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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.

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.

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

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

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

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

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ANSI/AWWA C205 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. The purchaser of cement–mortar linings or coatings is cautioned about the following concerns:

II.A. *Soft, Aggressive Waters*. Soft, aggressive waters, as well as prolonged contact with heavily chlorinated water, may be injurious to cement–mortar linings. When this environment is anticipated, further studies may be necessary to determine the suitability of this type of lining.

II.B. *Intermittent Operations*. Cement–mortar linings are best suited for pipelines that are continuously filled with water. When cement–mortar-lined pipelines are operated under prolonged empty conditions, special precautions may have to be taken to prevent excessive drying out of the cement–mortar lining.

II.C. *Flow Velocity*. Cement–mortar linings perform best when flow velocities are in normal ranges. When the flow velocity exceeds approximately 20 ft/s (6.1 m/s), special studies may be required to determine the suitability of this type of lining material.

II.D. *Strain Limitations*. Consideration should be given to limiting the maximum strains (or stresses) developed in the steel cylinder of cement–mortar-lined or cement–mortar-coated steel water pipe from internal pressure to ensure the long-term design life of the system.

II.E. *Weld-After-Backfill*. Weld-after-backfill is the sequence of assembling a lap-welded joint, welding the outside (if required), applying the exterior coating, backfilling the pipe, and then welding the inside joint at a later time (where inside welding is safe and practical). Welding inside field joints after backfill may damage or compromise the performance of shop-applied and field-applied dielectric coatings. Prior to specifying or approving weld-after-backfill, consult with the manufacturers regarding recommended products, installation, and backfill procedures required for the weld-after-backfill sequence. At the request of the purchaser, the manufacturer shall provide testing or historical information to verify that the exterior coating complies with this standard after completion of welding.

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II.F. *Cement–Mortar-Lining Thickness*. Properly applied cement mortar will inherently have some variations of thickness. The mortar-lining thickness may be slightly less than the minimum thickness at localized areas provided the average thickness is not outside of the thickness tolerances given in Table 1 of the 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*. When purchasing protective cement–mortar lining or coating for steel water pipe under the provisions of this standard, the following items (including specific details where applicable) should be specified by the purchaser:

1. Standard used—that is, ANSI/AWWA C205, Cement–Mortar Protective Lining and Coating for Steel Water Pipe—4 In. (100 mm) and Larger—Shop-Applied, of latest revision.

2. Whether compliance with NSF/ANSI 61, Drinking Water System Components—Health Effects, is required.

3. If interior lining only, exterior coating only, or both lining and coating are required.

4. Footage, inside diameter after lining, lengths of pipe sections, steel-wall thickness, type of joint, and information regarding fittings.

5. Details of other federal, state or provincial, and local requirements (Sec. 4.1.3).

6. Whether reinforcing wire should be galvanized (Sec. 4.2.1.1).

7. Type of wire-fabric reinforcement required, if limited to a single type (Sec. 4.2.1.2).

8. Type of cement required, if other than Type I, Type II, or Type V (Sec. 4.2.2.1).

9. Whether application of a primer at holdbacks is required (Sec 4.2.7).

10. Lining options or restrictions, if any, such as thickness of lining, thickness tolerances, and length of lining holdback (Sec. 4.4.2).

11. Coating options or restrictions, if any, such as type of undercoat (Sec. 4.5.1), length of coating holdback (Sec. 4.5.3), thickness of mortar coating (Sec. 4.5.3), minimum thickness (Sec. 4.5.3), type of reinforcement (Sec. 4.5.5), and method of curing (Sec. 4.5.9).

12. Whether cement–mortar overcoat is required (Sec. 4.6), and whether cement–mortar overcoat in a single application is allowed (Sec. 4.6.5.1, 4.6.5.2, and 4.6.6.1).

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13. If cement–mortar overcoat cracks between 1⁄16 in. (1.6 mm) and 1⁄8 in. (3.2 mm) in width require repair (Sec. 4.6.8.2).

14. If additional testing of cement mortar for linings is required (Sec. 5.1.1).

15. The basis of payment for additional testing specified or ordered by the purchaser (Sec. 5.1.1).

16. If an affidavit of compliance is required (Sec. 6.3).

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

IV. Major Revisions. The major revisions to this edition of the standard are summarized as follows:

1. Sec. 4.2.3.3, Mortar-Lining Fine Aggregate: The allowable maximum fine aggregate size for nominal lining thicknesses greater than 3⁄8 in. was changed from 100 percent passing a US Standard Sieve No. 4 to 100 percent passing a 3⁄8-in. mesh sieve.

2. The metric conversion in Table 1, Cement–Mortar-Lining Thickness, for tolerance was revised to the nearest 1 mm to be consistent with the precision provided by the nonmetric unit tolerance of 1⁄16 in.

3. Sec. 5.1.2, Cement–Mortar Test Cylinders, and Sec. 5.1.3, Centrifugal Test Cylinders, were revised to emphasize that the cement–mortar samples for the test cylinders shall be prepared or removed from the production mix.

4. Sec. 5.1.4, Curing Test Cylinders, was revised to include storage of test samples.

5. Sec. 5.1.5, Testing, was clarified so testing methods for the compressive strength of cylindrical concrete specimens are per ASTM C39/C39M, and more clarification was added for the exclusion of the certification requirements of ASTM C1077 if testing is done at the manufacturer's testing facility.

6. A new section, Sec. 5.5, Basis for Rejection, was added.

7. Sec. 6.2, Plastic End Covers, was revised and a sentence was added to address removal of end covers prior to installation.

8. 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 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

Cement–Mortar Protective Lining and Coating for Steel Water Pipe—4 In. (100 mm) and Larger—Shop-Applied

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes the material, application, and curing of shop-applied cement–mortar protective linings and coatings for steel water pipe and fittings and field jointing of cement–mortar-lined-and-coated steel water pipe and fittings.

1.1.1 *Pipe-lining application methods*. The inside of pipe shall receive a cement–mortar lining applied by centrifugally spinning or by a method known to provide equivalent results.

1.1.2 *Fitting-lining application methods*. The application of cement–mortar linings to miters, angles, bends, reducers, and other special sections the shape of which precludes application by the spinning process shall be accomplished by mechanical placement, pneumatic placement, or hand application and finished to produce a smooth, dense surface.

1.1.3 *External coating*. The outside of pipe and specials shall receive a reinforced cement–mortar coating applied by mechanical placement, pneumatic placement, or a method known to provide equivalent results.

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