ANSI/AWWA C303-17
(Revision of ANSI/AWWA C303-08)

American Water Works Association
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AWWA Standard

# Concrete Pressure Pipe, Bar-Wrapped Steel-Cylinder Type

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## AWWA Standard

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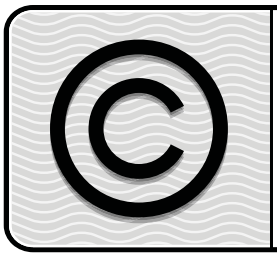

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# Contents

*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 ..... vii
I.A Background ..... vii
I.B History ..... vii
I.C Acceptance ..... viii
II Special Issues ..... ix
II.A Advisory Information on Product Application ..... ix
II.B Other Special Issues ..... ix
II.C Chlorine and Chloramine Degradation of Elastomers ..... ix
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** ..... 5

**4 Requirements**

4.1 Permeation ..... 6
4.2 Drawings and Data to Be Provided by the Purchaser ..... 7
4.3 Data to Be Submitted by the Manufacturer ..... 7
4.4 Materials ..... 8
4.5 Design ..... 11
4.6 Fabrication ..... 15
4.7 Fittings and Special Pipe ..... 25

**5 Verification**

5.1 Inspection and Testing by the Purchaser ..... 28
5.2 Tests ..... 29
5.3 Quality Assurance ..... 30

**6 Delivery**

6.1 Marking ..... 30
6.2 Transportation ..... 30
6.3 Affidavit of Compliance ..... 30

***Tables***

1 Thicknesses and Tolerances for Concrete or Cement–Mortar Linings ..... 12
2 Minimum Nominal Cylinder Thicknesses ..... 13
3 Circumferential Tolerances for Steel Cylinders ..... 13
4 Minimum Thickness of Sheet or Plate for Fittings ..... 25

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# Foreword

*This foreword is for information only and is not a part of ANSI*/AWWA C303.*

## I. Introduction.

I.A. *Background.* Bar-wrapped steel-cylinder concrete pressure pipe has been manufactured and used extensively for many years. The basic element of the pipe is a welded steel cylinder with steel joint rings welded to the ends, formed and tested in the same general manner as other types of steel-cylinder concrete pressure pipe. The cylinder is lined with centrifugally placed cement mortar or concrete that is ½ in. (13 mm) thick for pipe sizes up to and including 16 in. (400 mm), and ¾ in. (19 mm) thick for larger sizes. Continuous reinforcing bar is then helically wound, under measured tension, around the lined cylinder; and a mortar coating not less than ¾-in. (19-mm) thick measured from the outside of the reinforcing bars is placed using high-velocity impaction.

This standard describes bar-wrapped steel-cylinder concrete pressure pipe in sizes ranging from 10 in. through 72 in. (250 mm through 1,830 mm) in diameter, which is the prevailing range in sizes. The pipe is generally made in lengths ranging from 24 ft to 40 ft (7.5 m to 12.5 m). In this standard, however, the laying length for pipe 18 in. (450 mm) in diameter and smaller is restricted to a maximum of 36 ft (11 m). This type of pipe is used extensively for cross-country transmission mains, distribution feeder mains, water treatment plants, and other uses (see Section III, Use of This Standard).

I.B. *History.* The first edition of this standard, designated ANSI/AWWA C303-70, Reinforced Concrete Water Pipe—Steel Cylinder Type, Pretensioned, was approved by the AWWA Board of Directors Jan. 26, 1970. Federal Specification and Standard SS-P-381 (April 2, 1953), SS-P-381 (Sept. 14, 1955), and SS-P-381 (Dec. 14, 1967) preceded this standard and were used as the basis for AWWA C303. An addendum, designated ANSI/AWWA C303a-74, was subsequently approved Jan. 28, 1974. The third printing, issued July 27, 1973, included an erratum notice correcting errors in the original printing. The second edition, designated ANSI/AWWA C303-78, Reinforced Concrete Pressure Pipe—Steel Cylinder Type, Pretensioned, for Water and Other Liquids, was approved June 25, 1978. An addendum designated ANSI/AWWA C303a-81 was approved February 1981 and subsequently published. The third edition, designated ANSI/AWWA C303-87 with the same title as the second edition, was approved June 14, 1987. The fourth edition, designated ANSI/AWWA C303-95,

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Concrete Pressure Pipe, Bar-Wrapped Steel-Cylinder Type, was approved Jan. 22, 1995. Subsequent editions were approved on June 16, 2002, and Jan. 27, 2008. 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) 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

* 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.

(noncarcinogens) and risk characterization methodology (carcinogens). Use of Annex A procedures may not always be identical, depending on the certifier.

ANSI/AWWA C303 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.**

II.A. *Advisory Information on Product Application.*

1. *Basis of design.* ANSI/AWWA C303 pertains to the manufacture and testing of the steel cylinder, bar reinforcement, joint rings, concrete or cement–mortar lining, and cement–mortar coating. Overall design of bar-wrapped steel-cylinder concrete pressure pipe is described in AWWA Manual M9, Concrete Pressure Pipe. The design of the steel cylinder thickness and bar reinforcement is primarily governed by internal pressure, including operating static and transient pressures. The design procedure described in AWWA Manual M9 is used to determine the thickness of the steel cylinder and the required bar reinforcement.

2. *Deflection control.* The pipe described in this standard will safely support normal and usual external loads when installed according to appropriate and adequate bedding and backfilling procedures. To ensure satisfactory performance and continued serviceability of the pipe, bedding and backfilling procedures must be followed that will enable the deflection of the pipe to be controlled and kept within the limits contained in AWWA Manual M9.

II.B. *Other Special Issues.* Other special issues, including thrust restraint and field welding of pipe joints, are addressed in AWWA Manual M9.

II.C. *Chlorine and Chloramine Degradation of Elastomers.* The selection of materials is critical for water service and distribution piping in locations where there is a possibility that elastomers will be in contact with chlorine or chloramines. Documented research has shown that elastomers such as gaskets, seals, valve seats, and encapsulations may be degraded when exposed to chlorine or chloramines. The impact of degradation is a function of the type of elastomeric material, chemical concentration, contact surface area, elastomer cross section, and environmental conditions, as well as temperature. Careful selection of and specifications for elastomeric materials and the specifics of their application for each water system component should be considered to

provide long-term usefulness and minimum degradation (swelling, loss of elasticity, or softening) of the elastomer specified.

**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.* Purchasers are advised that while this standard presents information on materials and procedures for manufacture of the pipe, it does not contain all of the engineering information needed to prepare a complete specification for a particular pipeline installation. A specific installation may require provisions more restrictive than those in the standards and most certainly will require additional design and installation features.

AWWA Manual M9 should be considered a supplement to this standard. Material in the manual should not be regarded as superseding any portion of this standard. The purpose of AWWA Manual M9 is to provide information concerning some of the various subjects to be considered in, and the minimum standard of practice for, the design and installation of concrete pressure pipelines.

The following information should be provided by the purchaser:

1. Standard used—that is, ANSI/AWWA C303, Concrete Pressure Pipe, Bar-Wrapped Steel-Cylinder Type, of latest revision.
2. Whether compliance with NSF/ANSI 61, Drinking Water System Components—Health Effects, is required.
3. Manner of storage and delivery, if required of the manufacturer.
4. Pipeline inside diameter, working pressure, surge pressure, field-test pressure, external loading conditions, and method of bedding and backfilling (Sec. 4.2.2).
5. If detailed drawings and schedules are to be submitted for review (Sec. 4.3.1 and 4.7.1).
6. If the manufacturer is not permitted to supply pipe from inventory (Sec. 4.3.1).
7. If a tabulated layout schedule will be required (Sec. 4.3.2).
8. Details of other federal, state or provincial, and local requirements (Sec. 4.4).
9. If any material or manufacturing test reports will be required (Sec. 4.4, 5.1.2, and 5.2).
10. Type of cement required if there is a preference (Sec. 4.4.1.1).
11. If submission of the type and amount of admixtures will be required (Sec. 4.4.4).
12. If submission of manufacturer's design calculations will be required (Sec. 4.5.2.1).

13. If submission for approval of welder qualifications (Sec. 4.6.2 and 4.6.3) and welding procedure specifications will be required (Sec. 4.6.3).

14. If details of specials and fittings are to be provided by the manufacturer (Sec. 4.7.1).

15. If the purchaser desires to inspect the material, pipe, and fittings at the manufacturer's plant (Sec. 5.1.1).

16. If any material or manufacturing test reports will be required (Sec. 5.1.4).

17. If steel test specimens will be required (Sec. 5.2.6).

18. If an affidavit of compliance will be required (Sec. 6.3).

19. If pipeline conveys potentially aggressive waters, such as low-pH water or wastewater with $H_2S$.

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

1. A subsection on "Basis of Design" (Sec. II.A, Item 1) was added to Section II of the foreword, on Special Issues, which describes the distinction between ANSI/AWWA C303 (manufacture and testing) and AWWA Manual M9 (overall design).

2. Commentary on chlorine and chloramine degradation of elastomers (Sec. II.C) has been added to the foreword under Section II, Special Issues.

3. ASTM references have been updated under Section 2, References.

4. A definition for *mean internal diameter* has been added to Section 3, Definitions.

5. The term of *transient conditions* has been changed to *transient pressure*, with a modification of the definition (Section 3).

6. Language on permeation, Sec. 4.1, has been updated to include references to potable water, wastewater, and reclaimed water service.

7. The minimum yield strength of steel for cylinders for pipe and fittings (Sec. 4.4.5.1) and steel for joint rings (Sec. 4.4.7.1) has changed from 30,000 psi (207 MPa) to 36,000 psi (248 MPa).

8. The thickness tolerance criteria for steel plate and sheet have been modified; see Sec. 4.4.5.6.

9. Criteria for test reports, ozone resistance, and water immersion have been added (Sec. 4.4.8.8, 4.4.8.9, and 4.4.8.10, respectively).

10. Visual inspection criteria have been added to Sec. 4.6.3 on welding procedures.

11. Criteria for the water absorption test for cured mortar coating samples have been modified (Sec. 4.6.7.3).

12. Criteria for specific defects have been added to Sec. 4.6.10 on repair of concrete or mortar.

13. Criteria for epoxy linings have been added to Sec. 4.7.2.4 on lining and coating of fittings.

14. Criteria for rejected material or pipe in Sec. 5.1.6 on rejection have been updated.

**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

# Concrete Pressure Pipe, Bar-Wrapped Steel-Cylinder Type

## SECTION 1: GENERAL

### Sec. 1.1 Scope

This standard describes the manufacture of concrete pressure pipe, reinforced with a steel cylinder that is helically wrapped with mild steel bar reinforcement, in sizes ranging from 10 in. through 72 in. (250 mm through 1,830 mm), inclusive, and for working pressures up to 400 psi (2,760 kPa). Larger pipe sizes and pipe accommodating higher pressures have been manufactured based on the concepts of this standard. With agreement by the purchaser and the manufacturer, pipe may be manufactured to larger sizes and for higher pressures than indicated herein. This standard does not include requirements for design, handling, delivering, laying, field testing, or disinfecting of pipe and fittings. See AWWA Manual M9, *Concrete Pressure Pipe*, for that information, as well as certain supplementary design considerations related to thrust restraint, subaqueous installations, and installation in corrosive environments.

1.1.1 *Essential requirements.* The pipe shall have the following principal features: a welded steel cylinder with sized steel joint rings welded to the ends; a lining of concrete or cement mortar centrifugally applied within the steel cylinder and spigot ring; reinforcement consisting of continuous steel bar helically wound tightly around the outside of the cylinder and securely fastened by welding to the