



**American Water Works
Association**

The Authoritative Resource for Safe Drinking WaterSM

ANSI/AWWA C303-02
(Revision of ANSI/AWWA C303-95)

AWWA Standard

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



Effective date: Jan. 1, 2003.

First edition approved by AWWA Board of Directors Jan. 26, 1970.

This edition approved June 16, 2002.

Approved by American National Standards Institute: Oct. 29, 2002.

6666 West Quincy Avenue
Denver, CO 80235-3098
T 800.926.7337
www.awwa.org

Advocacy
Communications
Conferences
Education and Training
► **Science and Technology**
Sections

Copyright © 2003 American Water Works Association, All Rights Reserved.



Documents

Document Sharing Hub

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. 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 W. 43rd St., Fourth Floor, New York, NY 10036; (212) 642-4900.

Science and Technology

AWWA unites the drinking water community by developing and distributing authoritative scientific and technological knowledge. Through its members, AWWA develops industry standards for products and processes that advance public health and safety. AWWA also provides quality improvement programs for water and wastewater utilities.

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 © 2002 by American Water Works Association
Printed in USA

Committee Personnel

The AWWA Standards Subcommittee that reviewed and developed this standard had the following personnel at the time:

Samir A. Arnaout, *Chair*

S.A. Arnaout, Hanson Pipe & Products Inc., Dallas, Texas	(AWWA)
Gerard Bizien, Hyprescon Inc., St. Eustache, Que.	(AWWA)
D.A. Fisseler, Ft. Worth Water Department, Ft. Worth, Texas	(AWWA)
M.M. Hicks, Montgomery Watson, Walnut Creek, Calif.	(AWWA)

The AWWA Standards Committee on Concrete Pressure Pipe, which reviewed and approved this standard, had the following personnel at the time of approval:

Lee B. Freese, *Chair*

Wayne R. Brunzell, *Vice-Chair*

David P. Prosser, *Secretary*

Consumer Members

R.R. Beavers, Des Moines Water Works, Des Moines, Iowa	(AWWA)
J.A. Economides, San Diego County Water Authority, San Diego, Calif.	(AWWA)
D.A. Fisseler, Ft. Worth Water Department, Ft. Worth, Texas	(AWWA)
R.P. Fuerst, Bureau of Reclamation, Denver, Colo.	(USBR)
A.L. Linard, Los Angeles Water & Power, Los Angeles, Calif.	(AWWA)
Theodore Niemann, Louisville Water Company, Louisville, Ky.	(AWWA)
D.A. Wiedyke, Clinton Township, Mich.	(AWWA)

General Interest Members

W.R. Brunzell, Brunzell Associates Ltd., Skokie, Ill.	(AWWA)
R.C. Edmunds, Jones Edmunds & Associates, Gainesville, Fla.	(AWWA)
W.D. Ensor, Gannett Fleming Inc., Newport News, Va.	(AWWA)

L.B. Freese, Freese & Nichols Inc., Fort Worth, Texas	(AWWA)
J.K. Haney, HDR Engineering Inc., Austin, Texas	(AWWA)
M.M. Hicks, Montgomery Watson Engineers, Walnut Creek, Calif.	(AWWA)
Conrad Hohener Jr., [*] Boyle Engineering Corporation, Newport Beach, Calif.	(AWWA)
R.Y. Konyalian, Huntington Beach, Calif.	(AWWA)
S.A. McKelvie, Parsons Brinckerhoff Inc., Boston, Mass.	(AWWA)
P.J. Olson, [†] Standards Engineer Liaison, AWWA, Denver, Colo.	(AWWA)
A.E. Romer, Boyle Engineering Corporation, Newport Beach, Calif.	(AWWA)
C.C. Sundberg, CH2M Hill, Bellevue, Wash.	(AWWA)
M.C. Young, [†] Bucher, Willis & Ratliff, Kansas City, Mo.	(AWWA)
M.S. Zarghamee, Simpson Gumpertz & Heger Inc., Arlington, Mass.	(AWWA)

Producer Members

S.A. Arnaout, Hanson Pipe & Products Inc., Dallas, Texas	(AWWA)
H.H. Bardakjian, Ameron Concrete & Steel Pipe, Rancho Cucamonga, Calif.	(AWWA)
Gerard Bizien, Hyprescon Inc., St. Eustache, Que.	(AWWA)
Martin Doran, Lafarge Pressure Pipe, Stouffville, Ont.	(AWWA)
K.L. Heasley, Cretex Pressure Pipe Inc., South Beloit, Ill.	(AWWA)
S.R. Malcolm, Vianini Pipe Inc., Somerville, N.J.	(AWWA)
Giorgio Napoletani, [*] Vianini Pipe Inc., Somerville, N.J.	(AWWA)
D.P. Prosser, American Concrete Pressure Pipe, Reston, Va.	(ACPPA)
A.W. Tremblay, Price Brothers Company, Dayton, Ohio	(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.

SEC.	PAGE	SEC.	PAGE
<i>Foreword</i>		4	Requirements
I	Introduction..... vii	4.1	Permeation..... 6
I.A	Background..... vii	4.2	Drawings and Data to Be Provided by the Purchaser 7
I.B	History..... vii	4.3	Data to Be Submitted by the Manufacturer 7
I.C	Acceptance viii	4.4	Materials 8
II	Special Issues..... ix	4.5	Design..... 11
II.A	Deflection Control..... ix	4.6	Fabrication..... 14
II.B	Other Special Issues ix	4.7	Fittings and Special Pipe..... 23
III	Use of This Standard..... ix	5	Verification
III.A	Purchaser Options and Alternatives.. ix	5.1	Inspection and Testing by the Purchaser 26
III.B	Modification to Standard..... x	5.2	Tests 27
IV	Major Revisions x	6	Delivery
V	Comments xi	6.1	Marking..... 28
		6.2	Transportation 28
		6.3	Affidavit of Compliance..... 29
<i>Standard</i>		Tables	
1	General	1	Thicknesses and Tolerances for Concrete or Cement–Mortar Linings..... 12
1.1	Scope 1		
1.2	Purpose 2		
1.3	Application 2		
2	References 2		
3	Definitions 5		

SEC.	PAGE	SEC.	PAGE
2	Minimum Nominal Cylinder Thicknesses 13	4	Minimum Thickness of Sheet or Plate for Fittings.....24
3	Circumferential Tolerances for Steel Cylinders 13		

Foreword

This foreword is for information only and is not a part of 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 $\frac{1}{2}$ -in. (13-mm) thick for pipe sizes up to and including 16 in. (400 mm), and $\frac{3}{4}$ -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 $\frac{3}{4}$ -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 to 40 ft (7.5 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 Sec. III, Use of This Standard).

I.B. *History.* The first edition of this standard, designated AWWA C303-70, Standard for Reinforced Concrete Water Pipe—Steel Cylinder Type, Pretensioned, was approved by the AWWA Board of Directors Jan. 26, 1970. An addendum, designated AWWA C303a-74, was subsequently approved Jan. 28, 1974. The third printing, issued July 27, 1973, included an erratum notice that corrected errors in the original printing. The second edition, designated AWWA C303-78, Standard for Reinforced Concrete Pressure Pipe—Steel Cylinder Type, Pretensioned, for Water and Other Liquids, was approved June 25, 1978. In February 1981, an addendum designated AWWA C303a-81 was approved and subsequently published. The third edition, designated AWWA C303-87 with the same title, was approved on June 14,

1987. The fourth edition, designated AWWA C303-95, was approved on Jan. 22, 1995. This edition was approved on June 16, 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 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.

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

†American National Standards Institute, 25 W. 43rd St., Fourth Floor, New York, NY 10036-7406.

‡NSF International, 789 N. Dixboro Rd., Ann Arbor, MI 48105-9723.

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

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 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 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. *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, *Concrete Pressure Pipe*.

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

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.* 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 items should be included in the purchaser's specifications:

1. Standard used—that is, AWWA C303, Standard for Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type, of latest revision.
2. Manner of storage and delivery, if required of the manufacturer.
3. Working pressure, surge pressure, field-test pressure, external loading conditions, and method of bedding and backfilling (Sec. 4.2.2).
4. If detailed drawings and schedules are to be submitted for review (Sec. 4.3.1 and 4.7.1).
5. If the manufacturer is not permitted to supply pipe from inventory (Sec. 4.3.1).
6. If a tabulated layout schedule will be required (Sec. 4.3.2).
7. If any material or manufacturing test reports will be required (Sec. 4.4, 5.1.2, and 5.2).
8. Type of cement required if there is a preference (Sec. 4.4.1.1).
9. If submission of the type and amount of admixtures will be required (Sec. 4.4.4).
10. If submission of manufacturer's design calculations will be required (Sec. 4.5.2.1).
11. If submission for approval of welder qualifications (Sec. 4.6.2 and 4.6.3) welding procedure specifications will be required (Sec. 4.6.3).
12. If details of specials and fittings are to be provided by the manufacturer (Sec. 4.7.1).
13. If the purchaser desires to inspect the material, pipe, and fittings at the manufacturer's plant (Sec. 5.1.1).
14. If any material or manufacturing test reports will be required (Sec. 5.1.4).
15. If steel test specimens will be required (Sec. 5.2.6).
16. If an affidavit of compliance will be required (Sec. 6.3).

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 format has been changed to reflect current AWWA standard style.
2. The prevailing range in pipe diameters has been changed to 10 in. through 72 in. (250 mm through 1,830 mm).
3. Autogenous healing has been added to the definitions (Sec. 3).
4. A second test cylinder size has been added (Sec. 4.6.5.3).
5. The portland-cement slurry concentration and application rate for use with the circumferential bar reinforcement have been revised (Sec. 4.6.6.3).
6. A section on cracks in pipe wall has been added (Sec. 4.6.9).
7. A section on repair of concrete or mortar has been added (Sec. 4.6.10).

V. Comments. If you have any comments or questions about this standard, please call the AWWA Volunteer & Technical Support Group, (303) 794-7711 ext. 6285, FAX (303) 795-7603, or write to the group at 6666 W. Quincy Ave., Denver, CO 80235.

This page intentionally blank.



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 information on these topics.

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 steel joint ring at each end of the cylinder; a coating of dense mortar covering the cylinder and bars, except for the necessarily exposed surfaces of the spigot joint ring; and a self-centering joint with a preformed gasket of rubber, so designed that the joint will be watertight under all conditions of service.

Sec. 1.2 Purpose

The purpose of this standard is to provide purchasers, manufacturers, and constructors with the minimum requirements for concrete pressure pipe, bar-wrapped, steel-cylinder type, including fabrication and testing requirements.

Sec. 1.3 Application

This standard can be referenced in specifications for purchasing and receiving concrete pressure pipe, bar-wrapped, steel-cylinder type. This standard can be used as a guide for manufacturing concrete pressure pipe with a steel cylinder that is helically wrapped with bar reinforcement. The stipulations of this standard only apply when this document has been referenced to bar-wrapped, steel-cylinder concrete pressure pipe.

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 this standard. In any case of conflict, the requirements of this standard shall prevail. When specific standards are cited without dates, the designation shall be construed to refer to the latest revision under the same standard number or to superseding standards under a new number.

AISI* Manual 210 — Alloy, Carbon and High Strength Low Alloy Steels, Semi-finished for Forging, Hot Rolled Bars; Cold Finished Steel Bars; Hot Rolled Deformed and Plain Concrete Reinforcing Bar.

ANSI/AWS D1.4—Structural Welding Code—Reinforcing Steel.

ANSI/AWS D1.3—Structural Welding Code—Sheet Steel.

ANSI/AWS D1.1—Structural Welding Code—Steel.

*American Iron and Steel Institute, 1101 17th St. N.W., Suite 1300, Washington, DC 20036-4708.