ANSI/AWWA C302-04
(Revision of ANSI/AWWA C302-95)

American Water Works Association

The Authoritative Resource for Safe Drinking Water℠

AWWA Standard

Reinforced Concrete Pressure Pipe, Noncylinder Type

ANSI American National Standards Institute

Effective date: May 1, 2004.
First edition approved by AWWA Board of Directors Sept. 4, 1951.
This edition approved Jan. 18, 2004.
Approved by American National Standards Institute Mar 11, 2004.

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

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.

Committee Personnel

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

Wayne R. Brunzell, *Chair*

H.H. Bardakjian, Ameron Concrete & Steel Pipe, Rancho Cucamonga, Calif. (AWWA)

W.R. Brunzell, Brunzell Associates Ltd., Skokie, Ill. (AWWA)

R.P. Fuerst, Bureau of Reclamation, Denver, Colo. (AWWA)

S.A. McKelvie, Parsons Brinckerhoff Quade, Boston, Mass. (AWWA)

A.W. Tremblay, Price Brothers Company, Dayton, Ohio (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*
David P. Prosser, *Secretary*
Wayne R. Brunzell, *Vice-Chair*

Consumer Members

R.R. Beavers, Des Moines Water Works, Des Moines, Iowa (AWWA)

B.M. Bradish, Newport News Public Utilities Department, Newport News, Va. (AWWA)

J.A. Economides, San Diego County Water Authority, San Diego, Calif. (AWWA)

D.A. Fisseler, Fort Worth Water Department, Fort Worth, Texas (AWWA)

James Keith, Bureau of Reclamation, Denver, Colo. (BUREC)

Theodore Niemann, Louisville Water Company, Louisville, Ky. (AWWA)

Milad Taghavi, Los Angeles Water & Power, Los Angeles, Calif. (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, Skipper Engineering 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, Consulting Engineer, Huntington Beach, Calif. (AWWA)
S.A. McKelvie, Parsons Brinckerhoff Quade, Boston, Mass. (NEWWA)
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 Corporation, Kansas City, Mo. (AWWA)
M.S. Zarghamee, Simpson Gumpertz & Heger Inc., Arlington, Mass. (AWWA)

Producer Members

J.O. Alayon, Atlantic Pipe Corporation, San Juan, Puerto Rico (AWWA)
S.A. Arnaout, Hanson Pipe & Products Inc., Dallas, Texas (AWWA)
H.H. Bardakjian, Ameron Concrete & Steel Pipe Systems,
Rancho Cucamonga, Calif. (AWWA)
Gerard Bizien, Hyprescon Inc., St. Eustache, Que. (AWWA)
Martin Doran, Lafarge Pressure Pipe, Stouffville, Ont. (AWWA)
S.R. Malcolm, Vianini Pipe Inc., Somerville, N.J. (AWWA)
D.P. Prosser, American Concrete Pressure Pipe Association, 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.

This page intentionally blank.

Foreword

This foreword is for information only and is not a part of ANSI/AWWA C302.

I. Introduction.

I.A. *Background.* Reinforced concrete pressure pipe of the noncylinder type has been used extensively since the turn of the century. This type of pipe is made with one or more cages of steel reinforcing bars or wire encased in concrete. The concrete is usually placed by vertical or centrifugal casting methods. Rubber gasketed joints may have either steel or concrete bell and spigot surfaces. The pipe is manufactured in sizes ranging from 12 in. (300 mm) to more than 144 in. (3,660 mm) in diameter and is generally made in 8-ft (2.5-m) through 24-ft (7.5-m) laying lengths.

Reinforced concrete pressure pipe, noncylinder type, is designed for the specific combination of internal pressure and external load required for a project, in accordance with the procedures outlined in AWWA Manual M9, *Concrete Pressure Pipe*. This pipe is normally limited in working pressure to a maximum of 55 psi (380 kPa) and is used for low-pressure transmission lines in irrigation, industrial, and domestic water supply systems, and other applications (see Sec. III).

Design criteria and examples along with installation recommendations and other related data pertaining to this pipe are covered in AWWA Manual M9.

I.B. *History.* In April 1943, the AWWA Board of Directors authorized the preparation of "Tentative Emergency Specifications for Concrete Pressure Pipe." These tentative specifications, which covered several types of pipe in a single document, served a useful purpose during World War II but are now obsolete and have been withdrawn.

The first edition of this standard was approved as tentative on Sept. 4, 1951, and made a standard on May 5, 1953. The second edition was made a standard on July 19, 1957. Substantial changes, including the addition of limiting stresses for combined loading design, were incorporated into the third edition, which was made a standard on Jan. 27, 1964.

The fourth edition, dated Jan. 28, 1974, included several significant changes. Format and terminology were modified to generally conform to ANSI/AWWA C301, Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids, and section titles were added. The scope of sizes was changed to include 12-in. (300-mm) through 144-in. (3,660-mm) pipe with certain

length restrictions as a function of diameter. Provisions for concrete admixtures were included along with modifications of curing parameters. Design requirements and reference appendixes were added.

The fifth edition, dated June 14, 1987, included general format changes and several minor technical revisions for aggregates. Provisions for pozzolanic materials as a cement replacement under controlled conditions were introduced. Maximum levels for soluble chloride ion (Cl^-) content in the concrete mix were established. The criteria for curing the pipe were upgraded.

The sixth edition, dated Jan. 22, 1995, was rewritten to reflect the current AWWA standard style. The yield strength and testing frequency of steels was specified. Requirements for spacing of circumferential reinforcement and cage placement supports were added and requirements for rubber gaskets were expanded. The minimum pipe wall thickness requirements were extended for pipe sizes up to 144 in. (3,660 mm). A section on the design of fittings was added. The design procedures for this pipe that had been in appendix A were moved to AWWA Manual M9.

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.

3. 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 C302 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. Special issues are addressed in AWWA Manual M9, *Concrete Pressure Pipe*.

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.

---

*NSF International, 789 N. Dixboro Rd., Ann Arbor, MI 48113.

†American National Standards Institute, 25 W. 43rd St., 4th Floor, New York, NY 10036.

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

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

1. Standard used, that is, ANSI/AWWA C302, Standard for Reinforced Concrete Pressure Pipe, Noncylinder Type, of latest revision.
2. The working pressure, surge pressure, field test pressure, depth and weight of earth cover, trench bedding condition, and live load for which the pipe is to be designed (Sec. 4.2.2).
3. If detailed drawings and schedules are to be submitted for review (Sec. 4.3.1 and Sec. 4.7.1).
4. If the manufacturer is not permitted to supply pipe from inventory (Sec. 4.3.1).
5. If a tabulated layout schedule will be required (Sec. 4.3.2).
6. Type of cement required, if there is a preference (Sec. 4.4.1.1).
7. If submission of the type and amount of admixtures will be required (Sec. 4.4.5).
8. If submission of manufacturer's design calculations for approval before manufacturing any pipe will be required.
9. If either steel or concrete bell and spigot joint, or double spigot and sleeve joint of steel and concrete will be required (Sec. 4.5.3.1).
10. If submission for approval of welder qualification (Sec. 4.6.2) and welding procedure specifications (Sec. 4.6.3) will be required.
11. Fittings details (Sec. 4.7.1).
12. If the purchaser desires to inspect the material, pipe, and fittings at the manufacturer's plant (Sec. 5.1.1).
13. If any material or manufacturing test reports will be required (Sec. 5.1.2).
14. If steel test specimens will be required (Sec. 5.2.3).
15. If welds in reinforcements will be required (Sec. 5.2.5).
16. If hydrostatic pressure testing of pipe at the manufacturer's yard will be required (Sec. 5.3.1).
17. 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 in the purchaser's specifications.

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

1. Supplier has been added to the definitions (Sec. 3).
2. The interval between specific gravity measurements and other tests on fine and coarse aggregate has been changed from six months to annually (Sec. 4.4.2 and Sec. 4.4.3).
3. The information on sampling, testing, and thickness of steel for fittings have been made separate sections and expanded upon (Sec. 4.4.6.5 and Sec. 4.4.6.6).
4. Reinforcement cages have been designated as either circular or elliptical in shape (Sec. 4.5.2).
5. The welder qualification requirements have been expanded to include additional welding codes (Sec. 4.6.2).
6. A new section for Welding Procedure Specifications has been added (Sec. 4.6.3).
7. The requirements for making concrete test cylinders during fabrication have been modified (Sec. 4.6.5.5).
8. The temperature requirements of the concrete during accelerated curing have been clarified (Sec. 4.6.6.2).
9. An extensive section on cracks in the piping has been added (Sec. 4.6.7).
10. The section on defective concrete or mortar has been rewritten (Sec. 4.6.8).
11. Maximum duration of the soaking period prior to hydrostatic pressure tests has been reduced to 48 hours (Sec. 5.3.2).
12. Information on required pipe markings has been added (Sec. 6.1).

V. Comments. If you have any comments or questions about this standard, please call the AWWA Volunteer and Technical Support Group (303) 794-7711, FAX (303) 795-7603, or write to the group at 6666 West Quincy Avenue, Denver, CO 80235-3098, or by e-mail at standards@awwa.org.

This page intentionally blank.

American Water Works Association

ANSI/AWWA C302-04
(Revision of ANSI/AWWA C302-95)

AWWA Standard

Reinforced Concrete Pressure Pipe, Noncylinder Type

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes the manufacture of circumferentially reinforced concrete pressure pipe, without a steel cylinder and not prestressed, in sizes from 12 to 144 in. (300 to 3,660 mm) inclusive and for working pressures not exceeding 55 psi (380 kPa) and working plus surge pressures not exceeding a total pressure of 65 psi (450 kPa). This type of pipe is designed for the internal pressure, external loads, and bedding conditions designated by the purchaser. Pipe of diameters larger than 144 in. (3,660 mm) have been manufactured based on the concepts of this standard. This standard does not include requirements for design, handling, delivery, laying, field testing, or disinfection of pipe. 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 reinforcing cage or cages of steel rods, bars, wire, or welded wire reinforcement; a wall of concrete covering the reinforcing cage or cages inside and outside the steel cylinder; and a joint with a preformed rubber gasket(s) of circular