



**American Water Works
Association**

The Authoritative Resource on Safe Water®

ANSI/AWWA C950-13
(Revision of AWWA C950-07)

AWWA Standard

Fiberglass Pressure Pipe



Effective date: April 1, 2013.

First edition approved by AWWA Board of Directors Jan. 25, 1981.

This edition approved Jan. 20, 2013.

Approved by American National Standards Institute Jan. 30, 2013.

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. This standard does not supersede or take precedence over or displace any applicable law, regulation, or codes of any governmental authority. 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 Official Notice section of *Journal - American Water Works Association*. The action becomes effective on the first day of the month following the month of *Journal - American Water Works Association* 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 ANSI approval. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036; (212) 642-4900, or emailing info@ansi.org.

ISBN-13, print: 978-1-58321-916-4
ISBN-10, print: 1-58321-916-1

eISBN-13, electronic: 978-1-61300-213-1
eISBN-10, electronic: 1-61300-213-0

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 © 2013 by American Water Works Association
Printed in USA

Committee Personnel

The AWWA Subcommittee on Revision of C950, which developed this revision, had the following personnel at the time:

Richard C. Turkopp, *Chair*

S.D. Curran, Fiberglass Tank & Pipe Institute, Houston, Texas	(AWWA)
L. Bowles, US Bureau of Reclamation, Denver, Colo.	(BUREC)
N.E. Kampbell, Rehabilitation Resource Solutions LLC, Hilliard, Ohio	(AWWA)
D.P. Kozman, American Water Services, Hilliard, Ohio	(AWWA)
A.M. May, Alfred M. May Consulting Services, Little Rock, Ark.	(SPI)
T.J. McGrath, Simpson Gumpertz & Heger Inc., Waltham, Mass.	(AWWA)
L.E. Pearson, Consultant, Vero Beach, Fla.	(SPI)
P.A. Sharff, Simpson Gumpertz & Heger Inc., Waltham, Mass.	(AWWA)
R.C. Turkopp, Hobas Pipe USA, Houston, Texas	(SPI)

The AWWA Standards Committee on Thermosetting Fiberglass Reinforced Plastic Pipe, which reviewed and approved this standard, had the following personnel at the time of approval:

Phillip A. Sharff, *Chair*

General Interest Members

S.J. Abrera Jr., South Pasadena, Calif.	(AWWA)
J.P. Biro, Houston, Texas	(AWWA)
D.M. Flancher,* Standards Engineer Liaison, AWWA, Denver, Colo.	(AWWA)
M.W. Grimm,* The Cadmus Group, Happy Valley, Ore.	(AWWA)
J.K. Jeyapalan, Dr. Jeyapalan & Associates, New Milford, Conn.	(AWWA)
R.A. Johnson, Russcor Engineering, Naples, Fla.	(AWWA)
N.E. Kampbell, Rehabilitation Resource Solutions LLC, Hilliard, Ohio	(AWWA)
T.J. McGrath,† Simpson Gumpertz & Heger Inc., Waltham, Mass.	(AWWA)
R.S. Morrison, Jason Consultants, Washington, D.C.	(AWWA)
L.E. Pearson, Vero Beach, Fla.	(AWWA)
P.A. Sharff, Simpson Gumpertz & Heger Inc., Waltham, Mass.	(AWWA)

* Liaison, nonvoting

† Alternate

Producer Members

S.D. Curran, Fiberglass Tank & Pipe Institute, Houston, Texas	(AWWA)
W. McCann, RF & H, Jacksonville, Fla.	(AWWA)
M.J. Warner, Ameron International, Phoenix, Ariz.	(AWWA)
R.C. Turkopp, Hobas Pipe USA, Houston, Texas	(SPI)
S.A. Khan,* Amiantit Fiberglass, Dammam, Saudi Arabia	(AWWA)
M. Turk,* Future Pipe Industries Inc., Houston, Texas	(AWWA)

User Members

P.A. Fragassi, Winthrop Harbor, Ill.	(AWWA)
L. Bowles, US Bureau of Reclamation, Denver, Colo.	(BUREC)

* Nonvoting member

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
Foreword		4.4	Materials 7
I	vii	4.5	Pipe Dimensions 7
I.A	vii	4.6	Pressure Classes 13
I.B	vii	4.7	Stiffness Classes 14
I.C	vii	4.8	Long-Term Ring-Bending Strain 14
II	ix	4.9	Joint Types and Requirements 14
II.A	ix	5	Verification
	ix	5.1	Inspection and Testing 16
III	ix	5.2	Rejection and Retesting 26
III.A	ix	6	Delivery
	ix	6.1	Marking 27
III.B	ix	6.2	Shipping 27
	ix	6.3	Affidavit of Compliance 27
III.C	x		
IV	x	Tables	
V	x	1	Dimensions for Inside Diameter Series Pipe 8
		2	Metric Dimensions for Inside Diameter (ID) Series Pipe 9
		3	Dimensions for Outside Diameter (OD) Series Pipe With Steel-Pipe Equivalent (IPS) ODs 10
		4	Dimensions for Outside Diameter (OD) Series Pipe With Cast-Iron (Ductile-Iron)-Pipe Equivalent ODs 11
		5	Metric Dimensions for Outside Diameter (OD) Series Pipe 12
Standard			
1			
1			
1.1	1		
1.2	1		
1.3	2		
2	2		
3	3		
4			
4.1	5		
4.2	6		
4.3	6		

6	Metric Dimensions for Outside Diameter (OD) Series Pipe With Ductile-Iron Pipe Equivalent ODs	13	10.B	Minimum Hoop Tensile Strength Requirements (from Eq 2) (N/mm of width).....	22
7	Hydrostatic Leak Test Pressure Requirements	17	11.A	Minimum Axial Strength Requirements (lbf /in. of circumference).....	23
8	Minimum Pipe Stiffness Requirements for 5 Percent Deflection.....	18	11.B	Minimum Axial Strength Requirements (N/mm of circumference).....	24
9	Ring Deflection Without Damage or Structural Failure	18	12	Beam Strength Requirements	25
10.A	Minimum Hoop Strength Requirements (from Eq 2) (lbf/in. of width).....	21	13	Minimum Axial Compressive Strength Requirements	26

Foreword

This foreword is for information only and is not a part of ANSI/AWWA C950.

I. Introduction.

I.A. *Background.* This standard provides direction and guidance in selecting and purchasing fiberglass pipe for use as pressure pipe in water distribution (including services) and transmission systems for both aboveground and belowground installations.

This standard describes 1-in. through 156-in. (25-mm through 4,000-mm) diameter pressure pipes. The primary materials used are thermosetting polyester or epoxy resins, glass-fiber reinforcement, and, if used, aggregate. There are nine pressure classes, which range from 50 psi through 450 psi (345 kPa through 3,103 kPa), in 50-psi (345-kPa) increments. Stiffness classes described are 9, 18, 36, and 72 psi (62, 124, 248, and 496 kPa). This standard may be used to the extent applicable for other sizes, pressure classes, and stiffness classes.

I.B. *History.* In June 1971, the AWWA Engineering and Construction Technical and Professional Committee organized the Reinforced Plastics Committee to evaluate both the use of reinforced plastics in the water-supply industry and the need for appropriate AWWA standards. The Reinforced Plastics Committee found sufficient use and interest to support a recommendation that a standard be developed for fiberglass pipe. The Standards Council authorized the formation of the Standards Committee on Thermosetting Fiberglass Reinforced Plastic Pipe in October 1972, and committee organization was completed in December 1974. The first edition of the standard was approved by the AWWA Board of Directors on Jan. 25, 1981. Subsequent editions were approved on June 23, 1988; Jan. 22, 1995; June 17, 2001; and Jan. 21, 2007. This edition was approved on Jan. 20, 2013

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 American Water Works Association Research Foundation (AwwaRF, now Water Research Foundation) 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.

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

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, 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 C950 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.

* 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, N.W., Washington, DC 20001.

II. Special Issues.

II.A. *Nominal Metric Pipe Sizes, Dimensions, and Tolerances.* Nominal metric pipe sizes, dimensions, and tolerances were obtained from ISO and CEN product standards for fiberglass pipes.

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.* The following items should be covered by the purchaser:

1. Standard used—that is, ANSI/AWWA C950, Fiberglass Pressure Pipe, of latest revision.
2. Specific service and installation considerations.
3. Lineal feet of each pressure and stiffness class and size.
4. Details of other federal, state or provincial, and local requirements (Sec. 4.4.1).
5. Pipe diameter size and series (Sec. 4.5.1).
6. Pressure classes (Sec. 4.6).
7. Stiffness classes (Sec. 4.7).
8. Whether plant inspection is required (Sec. 5.1.1).

The purchaser may also specify the following:

1. Line layout showing pressure zones, including applicable design and transient pressures within zones and points of change between zones.
2. Cell classification (Sec. 4.3).
3. Standard laying lengths (Sec. 4.5.2).
4. Joint configuration (Sec. 4.9).

III.B. *Manufacturer Options and Alternatives.* The following items should be provided by the manufacturer:

1. Nominal wall thickness.
2. Weight.
3. Total quantity of jointing materials and field allowances.
4. Cell classification (Sec. 4.3).
5. Stiffness class (Sec. 4.7).
6. Joint details (Sec. 4.9).

When requested by the purchaser, it is understood the manufacturer will also supply the following:

1. Special design calculations.
2. Special lengths (Sec. 4.5.2).

3. Special preparations needed for shipment (Sec. 6.2).

4. Affidavit of compliance (Sec. 6.3).

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

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

1. Wording changes to clarify “production run” and materials permitted.

2. The mandatory hydrotesting diameter was increased from 54 in. to 96 in.

3. The hydrotesting pressure for diameters greater than 54 in. is 1.5× to better reflect current equipment capabilities available in the industry.

V. Comments. If you have any comments or questions about this standard, please call AWWA Engineering & Technical Services at 303.794.7711, FAX at 303.795.7603, write to the group at 6666 West Quincy Avenue, Denver, CO 80235-3098; or email standards@awwa.org.



**American Water Works
Association**

The Authoritative Resource on Safe Water®

AWWA Standard

Fiberglass Pressure Pipe

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes the fabrication and the testing of nominal 1-in. through 156-in. (25-mm through 4,000-mm) fiberglass pipe and joining systems for use in both aboveground and belowground water systems. Service and distribution piping systems and transmission piping systems are included.

Both glass-fiber-reinforced thermosetting-resin pipe (RTRP) and glass-fiber-reinforced polymer-mortar pipe (RPMP) are fiberglass pipes. Epoxy-resin and polyester-resin systems are described, and commercial-grade glass-fiber is specified as the reinforcement material in the pipe wall. Liner materials incorporated include thermosetting or thermoplastic resin, reinforced or unreinforced, with or without fillers. Pressure classes described are 50, 100, 150, 200, 250, 300, 350, 400, and 450 psig (345, 689, 1,034, 1,379, 1,724, 2,069, 2,414, 2,759, and 3,103 kPa). Stiffness classes described are 9, 18, 36, and 72 psi (62, 124, 248, and 496 kPa). This standard may be used to the extent applicable for other diameters, pressure classes, and stiffness classes. For information on design, hydraulics, and installation, refer to AWWA Manual M45, *Fiberglass Pipe Design*.

Sec. 1.2 Purpose

The purpose of this standard is to provide the minimum requirements for fiberglass pressure pipe, including design, fabrication, and testing requirements.