ANSI/AWWA C909-16
(Revision of ANSI/AWWA C909-09)

American Water Works Association

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AWWA Standard

Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. (100 mm) and Larger

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AWWA Standard

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Committee Personnel

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

Bill Whidden, *Chair*
Robert P. Walker, *Vice-Chair*

General Interest Members

J.P. Castronovo, Blue Ridge, Ga.	(AWWA)
A.J. Ciechanowski, NSF International, Ann Arbor, Mich.	(NSF)
A. Chastain-Howley,* Black & Veatch, Arlington, Texas	(AWWA)
S.J. Cook, Black & Veatch, Virginia Beach, Va.	(AWWA)
S. Ferry, Microbac Laboratories Inc., Boulder, Colo.	(AWWA)
J. Hebenstreit, Underwriters Laboratories LLC, Northbrook, Ill.	(UL)
S.C. Macleod,† Underwriters Laboratories Inc., Melville, N.Y.	(UL)
M.T. Marino, CRA Infrastructure & Engineering Inc., Buffalo, N.Y.	(AWWA)
T.J. McCandless,* Standards Engineer Liaison, AWWA, Denver, Colo.	(AWWA)
S.A. McKelvie,† HDR Engineering Inc., Boston, Mass.	(AWWA)
J.R. Paschal, Paschal Engineering LLC, Howell, Mich.	(AWWA)
C. Schwartzentruber, PENG, Kitchener, Ont., Canada	(AWWA)
J.K. Snyder, Snyder Environmental Engineering Associates, Audubon, Pa.	(AWWA)
W.R. Whidden, Woolpert, Winter Park, Fla.	(AWWA)

Producer Members

R.R. Bishop, Diamond Plastic Corporation, Grand Island, Neb.	(AWWA)
L.J. Gill, IPEX Inc., Mississauga, Ont., Canada	(AWWA)
M. Glasgow,† North American Pipe Corporation, Ashland City, Tenn.	(AWWA)
S.B. Gross, North American Pipe Corporation, Wayne, Pa.	(AWWA)
G. Gundel,† Specified Fittings Inc., Bellingham, Wash.	(AWWA)
J.F. Houle, Uni-Bell PVC Pipe Association, McKinney, Texas	(AWWA)
M. Huynh, J-M Manufacturing Company Inc.—DBA JM Eagle, Los Angeles, Calif.	(AWWA)

* Liaison, nonvoting
† Alternate

T. Marti,* Underground Solutions, Warrendale, Pa. (AWWA)
J. Riordan, HARCO Fittings, Lynchburg, Va. (AWWA)
L.D. Schmidt,† Diamond Plastics Corporation, Grand Island, Neb. (AWWA)
B. Sukolsky, Specified Fittings Inc., Bellingham, Wash. (AWWA)
R.P. Walker, Underground Solutions Inc., Southlake, Texas (AWWA)

User Members

D.R. Andrews, Belleview, Fla. (AWWA)
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L.M. Bowles, Bureau of Reclamation, Denver, Colo. (USBR)
J.F. Caldwell, Sharpsburg, Ga. (AWWA)
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A. Korell, City of North Bay, North Bay, Ont., Canada (AWWA)
T.E. Layton, Orange County Utilities, Orlando, Fla. (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.

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA C909.*

I. Introduction.

I.A. *Background.* Molecularly oriented polyvinyl chloride (PVCO) pressure pipe has been installed in Europe since the early 1970s, and in North America since 1991. The longitudinal molecular structure of polyvinyl chloride (PVC) is reoriented to a circumferential direction using heat and pressure. The manufacturing process begins by conventionally extruding a starting stock pipe. This starting stock piece is roughly half the diameter and twice the wall thickness of the finished PVCO pipe (e.g., starting stock with a nominal 3-in. [75-mm]† diameter and a 0.40-in. [10.2-mm] wall thickness becomes a finished PVCO pipe with a nominal 6-in. [150-mm] diameter and a 0.20-in. [5.1-mm] wall thickness). The starting stock piece is heated and then circumferentially expanded to its final dimensions. By circumferentially expanding the starting stock piece, a new molecular orientation is achieved. This new orientation increases physical and mechanical properties of the pipe. Tensile strength, and hence the hydrostatic design basis (HDB), is substantially increased from 4,000 psi to 7,100 psi (27.6 MPa to 49.0 MPa).

This standard pertains to 4-in. (100-mm) and larger PVCO pressure pipe made from class 12454 material. The PVCO pressure pipe is designed to provide an HDB of 7,100 psi with ductile-iron-pipe-equivalent (DI) outside diameter (OD) dimensions. Previous editions have referenced cast-iron-pipe-equivalent (CI) outside diameters. DIOD and CIOD are one and the same (equal). The reference to DIOD is to maintain consistency with other AWWA standards. The wall thicknesses are sufficient to provide pressure classes 165 psi, 235 psi, and 305 psi while maintaining a long-term safety factor of 2.0.

Design considerations are provided in AWWA Manual M23, *PVC Pipe—Design and Installation*, which provides detailed information on PVCO pipe covered by ANSI/AWWA C909. Recommended installation guidance is provided in ANSI/AWWA C605.

Additional information may be found in ANSI/AWWA C110, C153, C900, C905, and C907 for use with the PVCO pipes covered by ANSI/AWWA C909. Fabricated PVC fittings for use with ANSI/AWWA C909 are included in ANSI/AWWA C900

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

† Metric conversions given in this standard are direct conversions of US customary units and are not those specified in International Organization for Standardization (ISO) standards.

and C905. Ductile-iron mechanical-joint fittings for use with ANSI/AWWA C909 are covered by ANSI/AWWA C110 and C153.

I.B. *History.* This is the fourth edition of ANSI/AWWA C909. In 1994, the PVC Pipe and Fittings Committee appointed a subcommittee to develop a standard for PVCO pressure pipe. The first edition of ANSI/AWWA C909 was approved by the AWWA Board of Directors in 1998. Subsequent editions were approved in 2002 and 2009. This edition was approved on Jan. 16, 2016.

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. 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

* Persons outside the United States should contact the appropriate authority having jurisdiction.
† NSF International, 789 North 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.

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.

ANSI/AWWA C909 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 material presented in this standard will be addressed in the third edition of AWWA Manual M23, which is currently in revision. The material published here ensures that users of this standard will have continuous access to the most up-to-date design information. The second edition of AWWA Manual M23 published in 2002 and this standard will not be compatible until the third edition of AWWA Manual M23 is revised and published. Where M23 (2002) does not match, the intent of this standard takes precedence, and design matters in the second edition of AWWA M23 that are inconsistent with this standard should be discussed with the manufacturer.

II.A. *Pipe Selection.*

II.A.1. Selection of Pressure Class. The minimum pressure class of the pipe selected should be equal to or greater than the system working pressure. The sum of the system working pressure and occasional surge pressure should not exceed 1.60 times the pressure class of the pipe. If surge pressures are severe, consideration should be given to removal of the cause of surge pressures or to the incorporation of surge suppressors in the system.

II.B. *Gasket Materials.*

II.B.1. Selection of Gasket Materials. 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 by Water Research Foundation (formerly American Water Works Association Research Foundation [AwwaRF]) 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.

II.B.2. Minimal Degradation. A pipe gasket having the compressed hardness of an elastomer with a large mass relative to the exposed surface area experiences minimal degradation. This was validated in a research paper reported in *Journal AWWA*,* where the pipe gasket degradation in a 110-mg/L chloramine solution was found to be negligible.

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. Although this standard generally presents adequate information to order pipe to meet working pressure requirements, it does not include information to guide the designer in determining wall thicknesses, pipe flexibility requirements, and installation conditions to meet external loading conditions. Pipe designers should refer to AWWA Manual M23, *PVC Pipe—Design and Installation* (third edition forthcoming). In addition, consultation with pipe manufacturers is recommended.

III.A. *Purchaser Options and Alternatives.* The following items should be provided by the purchaser:

1. Standard used—that is, ANSI/AWWA C909, Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. (100 mm) and Larger, of latest revision.
2. Details of other federal, state or provincial, and local requirements (Sec. 4.2.1).
3. Whether compliance with NSF/ANSI 61, Drinking Water System Components—Health Effects, is required (Sec. 4.2.4).
4. Pipe details.
    a. Nominal size (for example, 4 in. [100 mm]).
    b. Pressure class (see Table 1).
    c. Linear feet of each pressure class for each nominal pipe size to be provided.
    d. Whether drawings and calculations shall be provided by the manufacturer.

* Volume 96, Number 4, April 2004, pp. 153–160.

5. Standard lengths (Sec. 4.3.3.3).

6. Plant inspection. If plant inspections are desired, provisions must be specified in the purchase documents (Sec. 5.3).

a. Production notice. The manufacturer should be required to give adequate advance notice of when and where production of ordered materials will start.

b. Inspection aids. The manufacturer should be required to make available, without charge, to the purchaser's inspector, the tools and assistance that are necessary for inspection and handling of materials.

c. Inspection limitations. To exclude inspection of proprietary manufacturing processes, the manufacturer should be required to give advance notice to the purchaser.

7. Shipping and delivery (Sec. 6.2).

8. Affidavit of compliance requirements (Sec. 6.3).

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

IV. Major Revisions. The major revisions to this edition include the following:

1. Increased scope from 4 in. to 24 in. to 4 in. and larger (Sec. 1.1).

2. Exchanged design factor with safety factor in equation used to calculate pressure class (Sec. 4.5.1).

3. Pipe burst strength test frequency increased for nominal pipe sizes greater than 12 in. (Sec. 5.1.4).

V. Comments. If you have any comments or questions about this standard, please contact 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

Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. (100 mm) and Larger

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard pertains to molecularly oriented polyvinyl chloride (PVCO) pressure pipe that is manufactured from starting stock pipe made from ASTM D1784 cell class 12454 material. The starting stock materials are then oriented through circumferential expansion to provide a hydrostatic design basis (HDB) of 7,100 psi (49.0 MPa). The pipe is primarily intended for use in transporting potable water, wastewater, and reclaimed water in buried installations. Pipe outside diameters (ODs) conform to those established for ductile-iron (DI)-equivalent ODs (DIODs). Pressure classes range from 165 psi to 305 psi (1,140 kPa to 2,100 kPa) in sizes 4 in. (100 mm) and larger.

Sec. 1.2 Purpose

The purpose of this standard is to provide purchasers, manufacturers, and suppliers with the minimum requirements for PVCO pressure pipe, 4 in. (100 mm) and larger, for potable water, wastewater, and reclaimed water service.