

ANSI/AWWA

C906-21

(Revision of ANSI/AWWA C906-15)

AWWA Standard

Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks

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American Water Works
Association



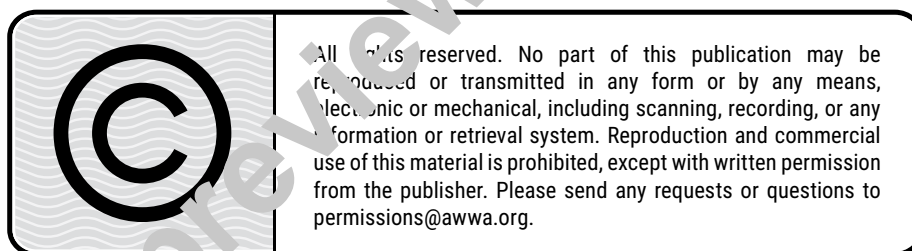
AWWA Standard

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA C906.*

I. Introduction.

I.A. *Background.* This standard describes outside diameter (OD) controlled polyethylene (PE) pressure pipe and fittings in diameters ranging from 4 through 65 in. (100–1,650 mm) for use primarily in the construction and rehabilitation of water distribution and transmission systems.

This document describes pipes and fittings made from PE materials with standard PE material designation code PE4710. Pipes are classified in accordance with pipe dimension ratios (DRs) ranging from 7.0 to 21. The resultant combinations of PE4710 and DRs yield pipe with pressure classes (PCs) ranging from 100 to 335 psig (690–2,310 kPa) for water, wastewater, and reclaimed water at 80°F (27°C) and lower temperatures. PC ratings are reduced for higher service temperatures. See AWWA M55 for information about the use of PE pipe at higher service temperatures. Consult with the Special Issues section (Sec. II.C) about the use of PE pipe with different disinfectant types and concentrations, and refer to AWWA M75 for use of elastomers in waterworks pipes, valves, and fittings.

Three standard pipe-diameter systems are described, as follows:

1. Inch OD in accordance with iron pipe size (IPS) system (ANSI B36.10).
2. Inch OD equivalent to ductile-iron pipe OD (DIOD) in accordance with the ductile-iron pipe sizing system (ANSI/AWWA C150/A21.50).
3. Metric OD equivalents.

This standard also includes a provision for specifying pipe with custom diameters, wall thicknesses, and dimension ratios.

I.B. *History.* In 1984, the Standards Committee on Thermoplastic Pressure Pipe appointed a subcommittee to prepare a standard covering 4 in. (100 mm) and larger diameter polyethylene (PE) pressure pipe and fittings. The first proposed draft was submitted to the Thermoplastic Pressure Pipe Committee by letter ballot in May 1986.

The Thermoplastic Pressure Pipe Committee was subsequently dissolved, and its standards responsibilities were divided between two new AWWA standards committees: the PVC Pressure Pipe and Fittings Committee and the Polyolefin Pressure Pipe and Fittings Committee. The Polyolefin Pressure Pipe and Fittings Committee assumed

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

the responsibility for developing this standard in the fall of 1988. The first edition of ANSI/AWWA C906 was approved by the AWWA Board of Directors on June 21, 1990. Subsequent editions were approved on June 20, 1999; Jan. 21, 2007; and Jan. 24, 2015. This edition was approved June 10, 2021.

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). 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/CAN[§] 60, Drinking Water Treatment Chemicals—Health Effects, and NSF/ANSI/CAN 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/CAN 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/CAN 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.

[§] Standards Council of Canada, 55 Metcalfe Street, Suite 600, Ottawa, ON K1P 6L5 Canada.

[¶] Both publications available from National Academy of Sciences, 500 Fifth Street, NW, Washington, DC 20418.

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

ANSI/AWWA C906 does not address additives requirements. 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.* This standard presents criteria related to the manufacture and purchase of polyethylene pressure pipe to be used in the distribution and transmission of potable water, wastewater, and reclaimed water in either buried or aboveground applications. Pipe provided according to the provisions of this standard may also be suitable for insertion into existing pipelines for rehabilitation and for the transmission of other liquids.

II.B. *Design and Installation Information.* This standard describes the requirements for the production of pipe and fitting. This standard does not include information about PE pipe design and installation. AWWA M55, *PE Pipe—Design and Installation*, provides detailed information on polyethylene engineering properties, manufacturing, testing, inspection, hydraulics, pressure rating, external loads, heat fusion and mechanical joining, fittings, transportation, handling, storage, installation (open cut, trenchless, and marine), hydrotesting and commissioning, maintenance and repairs, model specification, earthquake applications, case studies, and PE4710 pipe data. Purchasers may write specifications that exceed the requirements of this standard to accommodate a specific application. Consultation with PE pipe manufacturers is recommended for applications where the service temperature is greater than 100°F (38°C).

II.C. *Considerations for HDPE Oxidative Resistance.* Consistent with the practice of other pipe and material standards, strength ratings in this standard are not reduced for potential in-service degradation mechanisms such as internal or external corrosion and oxidation.

ASTM* F2263 is the mandatory test method used to assess the long-term internal oxidative stability of PE materials in potable water applications based on accelerated testing and modeling. ASTM F2263 was updated in 2014 to reflect how testing is

* ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

currently being performed. ASTM F2263 test results are used to project the relative performance of various PE pipe compounds in chlorinated water applications. ASTM F2263 is a test method and does not include performance criteria for PE tubes. ASTM D3350 was updated in 2014 to provide for the classification of PE resin performance under oxidative conditions. Consistent with ANSI/AWWA C901 (2017 and 2021), the materials requirements incorporating ASTM F2263 and D3350 have been added in Sec. 4.

For potable water applications, the standard specifies PE compounds with oxidative resistance classification CC3, which ensures adequate design life under the vast majority of disinfectant applications where chlorine and chloramine are used as secondary disinfectants as shown in PPI TN-44 and HDPEapp.com. (NOTE: This standard does not include consideration of chlorine dioxide as a secondary disinfectant, which is estimated to be used in less than 1 percent of North American utilities. Seek additional guidance from the pipe supplier if chlorine dioxide is the planned disinfectant practice. See Jana Laboratories, *Usage and Effects of Chlorine Dioxide on PE Plumbing and Water Distribution Systems in North America*, prepared for the Plastics Pipe Institute, July 2010.)

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. Refer to AWWA M55 for details.

III.A. Purchaser Options and Alternatives. Some items in this standard are optional, requiring identification of the selected option(s) such as material type, color, and size. When specifying products described in this standard, the purchaser should provide specific information regarding the following:

1. Standard use — that is, ANSI/AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks, of latest edition.
2. Whether compliance with NSF/ANSI/CAN 61, Drinking Water System Components—Health Effects, is required.
3. Relevant details of federal, state, provincial, territorial, and local requirements (Sec. 4.2.1).
4. When specifying pipe described in this standard, the purchaser should provide specific information regarding the following:
 - a. Standard materials designation code PE4710 (Table 1).
 - b. Color or color coding.

- c. Nominal size, OD basis (IPS, DIOD, or metric equivalent), DR, PC, length of individual pieces, and total linear feet for each different item to be provided. For custom sizes, the purchaser should establish, in consultation with the pipe manufacturer, the actual OD, the actual DR, and the actual wall thickness.
 5. When specifying fittings described in this standard, the purchaser should provide specific information regarding the following:
 - a. Standard materials designation code PE4710 (Table 1).
 - b. Description of fitting (e.g., tee, elbow), nominal size(s) at point of fusion, whether molded or fabricated, and PC.
 6. Fusion joining: To ensure optimum efficiency of heat fusion or electrofusion, the purchaser should request and comply with the recommended fusion parameters, recommended product and environmental conditions for joining, and documentation that these parameters and conditions have been validated by appropriate testing. If the purchased piping is to be fused with existing PE piping, the purchaser should inform the manufacturer of the cell classification or materials designation code of the existing PE pipe (see prior editions of AWWA C906 and ASTM D3350) and obtain from the manufacturer a list of the validated fusion parameters that may be used to join the purchased piping to the existing piping. Additional information on fusion joining and operator qualification is available in ASTM F2620 and F3190; similarly, information on electrofusion joining and operator qualification is available in ASTM F1290, ASTM F1055, MAB-1*, and MAB-2.
 7. The following additional requirements may also be specified in the purchase contract:
 - a. Quality-assurance testing (Sec. 5).
 - b. Plant inspection by purchaser (Sec. 5.7).
 - c. Special markings (Sec. 6.1).
 - d. Shipping (Sec. 6.2).
 - e. Affidavit of compliance (Sec. 6.3).
- III.B. *Modification to Standard.* Any modification of the provisions, definitions, or terminology in this standard must be provided by the purchaser.

* Municipal Advisory Board / The Plastics Pipe Institute, 105 Decker Court, Suite 825, Irving, Texas 75062.

IV. Major Revisions. Major changes in this revision include the following:

1. Non-PE4710 resins have been removed from the scope (Sec. 1.1) and throughout the standard. Other resins are no longer used in the manufacture of pipe for the water sector.
2. The foreword Special Issues section on oxidative resistance was rewritten (Sec. II.C.).
3. The definitions for design factor, hydrostatic design basis (HDB), standard dimension ratio (SDR), and virgin PE compound have been updated. Definitions for PE4710, PE compound, potable water, reclaimed water, safety factor, sample, specimen, and wastewater have been added (Sec. 3).
4. Addition of chlorine category requirement CC3 for potable water applications in the materials section (Sec. 4.2.1.2).
5. UV stabilizer information has been updated (Sec. 4.2.2).
6. Pipe sizes of 5, 7, 13, and 21.5 in. have been removed from Tables 3 and 6, and DRs 32.5, 26, 19, 15.5, 9.3, and 7.3 have been removed from Tables 5, 6, and 7.
7. Tensile tests have been grouped and clarified (Sec. 4.3.7).
8. Ductility tests have been grouped and clarified (Sec. 4.3.8).
9. AWWA Basis of Rejection language has been added (Sec. 5.8).
10. Required markings related to cell class designation and oxidative resistance classification for pipe (Sec. 6.1.2) and fittings (Sec. 6.1.3) have been updated.
11. End caps or other suitable prevention has been added to shipping requirements (Sec. 6.2).
12. The appendix on surge pressures, fatigue life, and flow capacity has been rewritten (Appendix A).
13. Additional bibliographic sources regarding permeation have been included (Appendix B).
14. Bibliographic sources for additional HDPE pipe information have been added (Appendix C).

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



**American Water Works
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(Revision of ANSI/AWWA C906-15)

AWWA Standard

Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes polyethylene (PE) pressure pipe and fittings made from materials conforming to standard PE materials designation code PE4710.* The pipe and fittings are primarily intended for use in transporting potable water, wastewater, and reclaimed water in either buried (open-cut and trenchless), marine, or aboveground installations. The standard describes multiple dimension ratios (DRs) for nominal pipe and fitting sizes ranging from 4 in. through 65 in. (100–1,650 mm). Pipe and fitting outside diameters (ODs) conform to the outside diameter dimensions of iron pipe (IPS) or to equivalent ODs for ductile-iron (DIOD) pipe.

Sec. 1.2 Purpose

The purpose of this standard is to provide purchasers, manufacturers, and suppliers with the minimum requirements for PE pressure pipe and fittings,

* Earlier editions of ANSI/AWWA C906 included other PE material designations. For removed designations, refer to previous editions of ANSI/AWWA C906, ASTM D3350, PPI TR-3, and PPI TR-4.