



American Water Works
Association

ANSI/AWWA C906-07
(Revision of ANSI/AWWA C906-99)

The Authoritative Resource on Safe Water®

AWWA Standard

Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission



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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 polyethylene (PE) pressure pipe and fittings in diameters ranging from 4 through 63 in. (100 through 1,600 mm) for use primarily in the construction and rehabilitation of underground water distribution systems.

This document describes pipes and fittings made from PE materials with standard PE code designations PE 2406, PE 3406, and PE 3408. Pipes are classified in accordance with standard pipe dimension ratios (DRs) (i.e., the ratio of pipe outside diameter to pipe minimum wall thickness) that range from 7.3 to 32.5. The resultant combinations of PE material designations and DRs yield pipe with pressure classes (PC) ranging from 40 to 254 psig (276 to 1,750 kPa).

Three standard pipe diameter systems are described, as follows:

- Outside diameters in accordance with the iron pipe size (IPS) system (ANSI B36.10).
- Outside diameters in accordance with the ductile iron sizing system (DIOD) (ANSI/AWWA C110/A21.10).
- Outside diameters in accordance with the International Standards Organization (ISO) sizing system (ISO 161/1).

However, this standard also includes provision for specifying pipe with custom diameters and diameter 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 the responsibility for developing this standard in the fall of 1988. The first edition of C906 was approved by the AWWA Board of Directors on June 21, 1990,

and the second edition was approved on June 20, 1999. This edition was approved Jan. 21, 2007.

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) 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 or accredit certification organizations within their jurisdiction. Accreditation of certification organizations may vary from jurisdiction to jurisdiction.

*Persons outside the US should contact the appropriate authority having jurisdiction.

†NSF International, 789 N. Dixboro Road, Ann Arbor, MI 48113.

‡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 20418.

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 C906 does not address additives requirements (i.e., substances that can be extracted from the pipe by flowing potable water). 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 transmission of potable 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.

This standard restricts the materials used for the manufacture of polyethylene pipe to three standard PE code designations: PE 2406, PE 3406, and PE 3408. These three materials provide two series of pressure class ratings, one for PE 2406 or PE 3406 material and one for PE 3408 material. This standard describes 10 dimension ratios for nominal pipe sizes ranging from 4 in. (100 mm) through 63 in. (1,600 mm). Actual outside pipe diameters conform to the outside diameter dimensions of iron pipe sizes (IPS), ductile-iron pipe sizes (DIOD), or to those outside diameters established by the International Organization for Standardization (ISO).

Although this standard generally presents adequate information for ordering pipe that meets project working pressure requirements, it does not include information to guide the designer in the determination of wall thicknesses, pipe flexibility requirements, and installation conditions to meet external loading conditions. The AWWA manual M55: *PE Pipe Design and Installation* provides this information. In addition, consultation with PE pipe manufacturers is recommended.

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. 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 used—that is, ANSI/AWWA C906, Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission, of latest edition.

2. Whether compliance with NSF/ANSI 61 Drinking Water System Components—Health Effects, is required, in addition to the requirements of the Safe Drinking Water Act.

3. Details of other federal, state, local, and provincial requirements (Sec. 4.2.1).

4. Pipe.

- a. Standard code designation of the PE material (Sec. 4.2.1 and Table 1).

- b. Color or color coding.

- c. Nominal size, outside diameter base (IPS, DIOD, or ISO), dimension ratio (DR), and pressure class (PC); length of individual pieces, and total linear feet for each different item to be provided. For special sizes, the purchaser should establish, in consultation with the pipe manufacturer, the actual outside diameter, the actual dimension ratio, and the actual wall thickness.

5. Fittings.

- a. Standard code designation of the PE material (Sec. 4.2.1 and Table 1).

- b. Description of fitting (e.g., tee, elbow, and so forth), nominal size(s) at point of fusion, whether molded or fabricated, and pressure class (PC).

6. Fusion conditions. To ensure optimum efficiency of fusion when joining the product(s) being purchased, the purchaser should request from the manufacturer a list of the recommended fusion parameters, and documentation that these parameters 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 classifi-

cation of the existing PE pipe (see Table 1 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.

7. Additional requirements. The following requirements may also be specified in the purchase contract:

- a. Special quality-assurance testing (Sec. 5).
- b. Plant inspection by purchaser (Sec. 5).
- c. Special markings (Sec. 6.1).
- d. Shipping (Sec. 6.2).
- e. Affidavit of compliance (Sec. 6.3).

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

IV. **Major Revisions.** Major changes made to the standard in this revision include the following:

1. Materials language has been added (Sec. III.A.2 and Sec. 4.2.1).
2. Design and installation materials have been deleted from the standard as they are now covered in AWWA M55 (Sec. 2, 4.5.2, 4.5.3, 4.5.4, and 4.5.5).
3. Design information not yet incorporated in AWWA M55 has been moved from Sec. 4.6.2 to appendix B.

V. **Comments.** If you have any comments or questions about this standard, please call the AWWA Volunteer and Technical Support Group at 303.794.7711, FAX 303.795.7603, write to the group at 6666 West Quincy Avenue, Denver, CO 80235-3098, or e-mail standards@awwa.org.

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

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AWWA Standard

Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes polyethylene (PE) pressure pipe made from materials conforming to standard PE code designations PE 2406, PE 3406, and PE 3408. The pipe is primarily intended for use in transporting potable water in either buried or aboveground installations. The standard describes 10 dimension ratios (DRs) for nominal pipe sizes ranging from 4 in. (100 mm) through 63 in. (1,600 mm). Pipe outside diameters (ODs) conform to the outside diameter dimensions of iron pipe (OD-based, IPS), to those established by the International Organization for Standardization (ISO), or to those established for DI equivalent ODs (DIOD).

Pressure classes range from 40 psi (276 kPa) to 198 psi (1,365 kPa) for both PE 2406 and PE 3406 materials, and from 51 psi (352 kPa) to 254 psi (1,751 kPa) for PE 3408 material.

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, 4 in. (100 mm) through 63 in. (1,600 mm), for water distribution and transmission.

Sec. 1.3 Application

This standard can be referenced for purchasing and receiving PE pressure pipe and fittings, 4 in. (100 mm) through 63 in. (1,600 mm), for water distribution and transmission. The stipulations of this standard apply when this document has been referenced and then only to PE pressure pipe and fittings, 4 in. (100 mm) through 63 in. (1,600 mm), for water distribution and transmission.

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 the standard. In any case of conflict, the requirements of this standard shall prevail.

ANSI*/AWWA C111/A21.11—ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Fittings.

ANSI/AWWA C150/A21.50—ANSI Standard for Thickness Design of Ductile-Iron Pipe.

ANSI/AWWA C207—Steel Pipe Flanges for Waterworks Service—Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).

ANSI B16.1—Cast Iron Pipe Flanges and Flanged Fittings.

ANSI B16.47—Large Diameter Steel Flanges: NPS 26 Through NPS 60.

ANSI B16.5—Pipe Flanges and Flanged Fittings.

ANSI B36.10—Welded and Seamless Wrought Steel Pipe.

ASTM D618—Standard Practice for Conditioning Plastics and Electrical Insulating Materials for Testing.

ASTM D638—Standard Test Method for Tensile Properties of Plastics.

ASTM D1238—Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.

*American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036.

ASTM D1598—Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.

ASTM D1599—Standard Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.

ASTM D1603—Standard Test Method for Carbon Black in Olefin Plastics.

ASTM D2122—Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.

ASTM D2290—Standard Test Method for Apparent Tensile Strength of Ring or Tubular Plastics and Reinforced Plastics by Split Disk Method.

ASTM D2657—Standard Specification for Heat Fusion Joining of Polyolefin Pipe and Fittings.

ASTM D2683—Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

ASTM D2837—Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

ASTM D2839—Standard Test Method for Use of a Melt Index Strand for Determining Density of Polyethylene.

ASTM D3261—Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

ASTM D3350—Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

ASTM D4218—Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.

ASTM F412—Standard Terminology Relating to Plastic Piping Systems.

ASTM F1055—Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.

AWWA Manual M55, PE Pipe—Design and Installation.

ISO 161/1—Thermoplastics Pipes for the Conveyance of Fluids—Nominal Outside Diameters and Nominal Pressures—Part 1 Metric Series.

PPI* TR-3—Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials.

AWWA Standards Committee Report on Design and Installation of Polyethylene Pipe in accordance with ANSI/AWWA C906.

*The Plastics Pipe Institute, 1825 Connecticut Avenue N.W., Suite 680, Washington, DC 20009.

SECTION 3: DEFINITIONS

The following definitions shall apply in this standard:

1. *Constructor*: The party that provides the work and materials for placement or installation.

2. *Design factor (DF)*: The factor that is used to reduce the hydrostatic design basis (HDB) to arrive at the hydrostatic design stress (HDS) from which the pressure class (PC) is calculated. Unless otherwise noted, the design factor used in this standard is 0.5.

NOTE: Because the effective strength of PE materials depends on the duration of stress application and temperature, the effective safety factor when using a DF of 0.5 will vary with end-use conditions. For the PE materials described in this standard, the effective safety factor against transient and sustained pressures is at least 2:1. The actual value is generally larger and depends on the magnitude of the applied transient and sustained pressures, as well as on the operating temperature.

3. *Dimension ratio (DR)*: The ratio of a pipe's specified outside diameter to its specified minimum wall thickness.

The average specified outside diameter is used for establishing pipe DR using inch-pound units. With metric units, the minimum specified outside diameter is used.

4. *Hydrostatic design basis (HDB)*: The categorized long-term strength in the circumferential or hoop direction as established from long-term pressure tests in accordance with PPI TR-3 and the methodology contained in ASTM D2837.

5. *Hydrostatic design stress (HDS)*: The maximum allowable working hoop stress in the pipe wall when the pipe is subjected to sustained long-term hydrostatic pressure. The HDS in this standard is established by multiplying the HDB by the design factor (DF), 0.5, for water applications.

6. *Lot*: A shipment of resin material that is included under one material certification.

7. *Manufacturer*: The party that manufactures, fabricates, or produces materials or products.

8. *Polyethylene plastics*: Thermoplastic extrusion and molding materials prepared by polymerization of no less than 85 percent ethylene and no less than 95 percent of total olefins by weight, plus the addition of compounding ingredients.