



**American Water Works
Association**

The Authoritative Resource on Safe Water®

ANSI/AWWA C904-06
First Edition

AWWA Standard

Cross-Linked Polyethylene (PEX) Pressure Pipe, ½ In. (12 mm) Through 3 In. (76 mm), for Water Service

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AWWA Standard

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Foreword

This foreword is for information only and is not part of ANSI/AWWA C904.

I. Introduction.

I.A. *Background.* This standard describes cross-linked polyethylene (PEX) pressure pipe for use primarily as service lines in the construction of underground water distribution systems.

This standard describes pipe and tubing made with a materials designation code of PEX 1006 in ASTM* F876. This standard describes pipe in sizes ½ in. through 3 in. (12 mm through 76 mm) with a standard dimension ratio of 9 (SDR9) and pressure class of 160 psi.

I.B. *History.* On June 18, 2002, the American Water Works Association (AWWA) Committee on Polyolefin Pressure Pipe and Fittings was approached to develop a standard describing PEX for water service applications. On June 15, 2004, the Polyolefin Committee unanimously approved and authorized the development of a new standard for PEX Pressure Pipe, ½ In. (12 mm) Through 3 In. (76 mm), for Water Service. A new PEX subcommittee was also formed at this time to begin development of this standard within AWWA. This first edition of C904 was approved by the AWWA Board of Directors on June 11, 2006.

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 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

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

†Persons outside the United States should contact the appropriate authority having jurisdiction.

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 Chemical 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 C904 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 all 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. Pipe Selection.

^{*}NSF International, 789 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 20001.

II.A.1 Selection of a pressure class. A pressure class of 160 psi (1,118 kPa) is recommended for general durability in handling and for use in typical AWWA water service installations. Lesser pressure classes may be appropriate for specific applications, but selection should be based on a detailed evaluation of factors, such as installation configuration (Sec. II.C), fitting type, joining methods, use of coiled or straight products, and potential for significant surge pressure.

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 surge pressure should not exceed 1.5 times the pressure class of the pipe. If surge pressures govern the selection of the pressure class, consideration should be given to removal of the surge pressures or to the incorporation of surge suppressors in the system.

II.A.2 Calculation of surge pressure. Surge pressure generated by velocity changes in PEX water service lines may be estimated using the formulas provided in this section. In addition, surges occurring either upstream in mains or downstream in a user's plumbing system should be considered for their effect on the service line.

The wave velocity and surge pressure that result from abrupt changes in the velocity of a column of water moving through a restrained pipe may be calculated using the following formulas:

$$\alpha = \frac{A_4}{\left[4 + \frac{K(SDR - 5)}{E} \right]^{1/2}} \quad (\text{Eq F.1})$$

$$P_s = \alpha \left(\frac{\Delta V}{A_5} \right) \quad (\text{Eq F.2})$$

Where:

- α = wave velocity, in ft/sec (m/sec)
- A_1 = 4,675 (1,433 for metric units)
- K = bulk modulus of water
= 294,000 lb/in.² (2,053.5 Mpa)
- SDR = standard dimension ratio (Sec. 3[3])
- E = modulus of elasticity of pipe material, for PEX 1006,
 E = 93,000 psi (630 Mpa) at 73.4°F (23°C)
- P_s = surge pressure, in psi (kPa) gauge