

American Water Works Association
ANSI/AWWA C151/A21.51-02
(Revision of ANSI/AWWA C151/A21.51-96)



AWWA STANDARD
FOR
DUCTILE-IRON PIPE,
CENTRIFUGALLY CAST, FOR WATER



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AMERICAN WATER WORKS ASSOCIATION

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA C151/A21.51.

I. Introduction.

I.A. *Background.* The purpose of this standard is to provide information to specifiers and users of ductile-iron pipe on the minimum manufacturing requirements of this pipe. This standard includes requirements for laying lengths, dimensional and weight tolerances, marking, and plant tests. In addition to dimensional and weight tables, tables based on the design procedure in ANSI/AWWA C150/A21.50 are included on nominal thicknesses and standard classes of ductile-iron pipe required for various external load and internal pressure conditions as a convenience to the users of this standard.

Section III.A of this foreword lists certain purchaser options and alternatives that users of this standard should consider in purchaser specifications for ductile-iron pipe.

Although ANSI/AWWA C151/A21.51 is commonly referenced for ductile-iron pipe for services other than water, users are also directed to ASTM A746, Standard Specification for Ductile Iron Gravity Sewer Pipe, and ASTM A714, Standard Specification for Ductile-Iron Culvert Pipe.

I.B. *History.* American National Standards Committee A21 on Cast-Iron Pipe and Fittings was organized in 1926 under the sponsorship of the American Gas Association (AGA), the American Society for Testing and Materials (ASTM), the American Water Works Association (AWWA), and the New England Water Works Association (NEWWA). Between 1972 and 1984, the co-secretariats were AGA, AWWA, and NEWWA, with AWWA serving as administrative secretariat. In 1984, the committee became an AWWA committee with the name of AWWA Standards Committee A21 on Ductile-Iron Pipe and Fittings. In 1988, NEWWA withdrew as a separate secretariat; however, it continues to maintain its representation on the AWWA Committee A21.

The present scope of AWWA Committee A21 activity is the development of standards and manuals addressing ductile-iron pressure pipe for water and other liquids, and ductile-iron and gray-iron fittings for use with such pipe. These standards and manuals include design, dimensions, materials, coatings, linings, joints, accessories, and methods of inspection and testing.

The work of AWWA Committee A21 is conducted by subcommittees. The scope of Subcommittee 1, Pipe, includes the periodic review of all current Committee A21 standards for pipe, the preparation of revisions and new standards when needed, and other matters pertaining to pipe standards.

The first edition of ANSI/AWWA C151/A21.51, Standard for Ductile-Iron Pipe for Water and Other Liquids, was issued in 1965, and revisions were issued in 1971, 1976, 1981, 1986, 1991, and 1995. Subcommittee 1 reviewed the 1995 edition and submitted a proposed revision to AWWA Committee A21 in 2001. This edition was approved on Jan. 20, 2002.

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 all 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, ANSI[†]/NSF[‡] 60, Drinking Water Treatment Chemicals—Health Effects, and ANSI/NSF 61, Drinking Water System Components—Health Effects.

*Persons in Canada, Mexico, and non-North American countries should contact the appropriate authority having jurisdiction.

[†]American National Standards Institute, 25 W. 43rd St., Fourth Floor, New York, NY 10036.

[‡]NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105-9723.

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 ANSI/NSF 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 ANSI/NSF 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.

AWWA C151 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.

II. Special Issues.

II.A. Advisory Information on Product Application. Unless otherwise provided in the purchaser's specifications, all pipe and accessories shall comply with this standard. Pipe and accessories not complying with this standard shall be replaced by the supplier at the agreed point of delivery. The supplier shall not be liable for shortages or damaged pipe after the pipe is accepted at the agreed point of delivery, except as recorded on the delivery receipt or similar document by the carrier's agent.

III. Use of This Standard. AWWA has no responsibility for the suitability or compatibility of the provisions of this standard to any intended application by any user. Accordingly, each user of this standard is responsible for determining that the standard's provisions are suitable for and compatible with that user's intended application.

*Both publications available from National Academy of Sciences, 2102 Constitution Avenue NW, Washington, DC 20418-0006.

III.A. *Purchaser Options and Alternatives.* The following items should be covered in the purchaser's specifications:

1. Standard used—that is, ANSI/AWWA C151, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water, of latest revision.
2. Size, joint type, thickness or class, and laying length (see tables).
3.
 - a. Special joints (Sec. 4.2.1).
 - b. Specifying ductile-iron gland, if required (Sec. 4.2.1).
4. Certification by manufacturer (Sec. 5.1.1.2).
5. Inspection by purchaser (Sec. 5.1.2).
6.
 - a. Elimination of outside coating (Sec. 4.3.1).
 - b. Elimination of cement–mortar lining (Sec. 4.3.2). Experience has indicated that asphaltic inside coating is not complete protection against loss in pipe capacity caused by tuberculation. Cement–mortar linings are recommended for most waters.
 - c. Special coatings and linings (Sec. 4.3.3).
7. Special marking on pipe (Sec. 4.6).
8. Orientation of impact-test specimen cut from pipe wall (Sec. 5.2.2.2).
9. Written transcripts of foundry records (Sec. 5.4).
10. Additional tests (Sec. 5.5).

III.B. *Modification to Standard.* Any modification to the provisions, definitions, or terminology in this standard must be provided in the purchaser's specifications.

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

1. The format has been changed to AWWA standard style.
2. The acceptance clause (Sec. I.C) has been revised to approved wording.
3. Definitions for bell, socket, spigot, accessory, restrained joint, and lot were added.
4. Defective specimens and retests (Sec. 5.6) were clarified.

V. Comments. If you have any comments or questions about this standard, please call the AWWA Volunteer & Technical Support Group, (303) 794-7711 ext. 6283, FAX (303) 795-7603, or write to the group at 6666 W. Quincy Ave., Denver, CO 80235.



AWWA STANDARD FOR DUCTILE-IRON PIPE, CENTRIFUGALLY CAST, FOR WATER

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes 3-in. through 64-in. (76-mm* through 1,600-mm) ductile-iron pipe, centrifugally cast, for water, with push-on joints or mechanical joints. Requirements for pipe according to this standard are discussed in the text and are shown in Tables 1 through 7 and Figures 1, 2, and 3. This standard may be used for pipe with other types of joints as may be agreed on at the time of purchase.

Sec. 1.2 Purpose

The purpose of this standard is to provide the minimum requirements for ductile-iron pipe, centrifugally cast, for water.

Sec. 1.3 Application

This standard can be referenced in specifications for ductile-iron pipe, centrifugally cast, for water. The stipulations of this standard apply when this document has been referenced and then only to ductile-iron pipe, centrifugally cast, for water.

*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.

SECTION 2: REFERENCES

This standard references the following documents. In their latest editions, these documents 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.

AASHTO^{*} T-99—Standard Method of Test for the Moisture-Density Relations of Soils Using a 5.5 lb (2.5 kg) Rammer and a 12 in. (305 mm) Drop.

ASTM[†] D2487—Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

ASTM D3282—Standard Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

ANSI[‡]/AWWA C104/A21.4—Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

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

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

ANSI/AWWA C600—Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.

ANSI/AWWA C800—Standard for Underground Service Line Valves and Fittings.

ASTM E8—Standard Test Methods for Tension Testing of Metallic Materials.

ASTM E23—Standard Test Methods for Notched Bar Impact Testing of Metallic Materials.

SECTION 3: DEFINITIONS

The following definitions shall apply in this standard:

^{*}American Association of State Highway and Transportation, 444 N. Capital St., N.W., Washington, DC 20001.

[†]American Society for Testing Materials, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959.

[‡]American National Standards Institute Inc., 25 W. 43rd St., Fourth Floor, New York, NY 10036-7406.

1. *Accessory*: A component of a pipe joint, such as gasket, bolt, gland, lubricant, etc.
2. *Bell*: The flared end of a pipe into which a spigot end is inserted.
3. *Ductile iron*: A cast ferrous material in which a major part of the carbon content occurs as free graphite in a substantially nodular or spheroidal form.
4. *Lot*: A batch or group of pipe that is statistically similar because of time of manufacture, or chemical, mechanical, or thermal processing.
5. *Manufacturer*: The party that manufactures, fabricates, or produces materials or products.
6. *Mechanical joint*: The gasketed and bolted joint as detailed in the latest revision of ANSI/AWWA C111/A21.11.
7. *Purchaser*: The person, company, or organization that purchases any materials or work to be performed.
8. *Push-on joint*: The single rubber-gasket joint as described in the latest revision of ANSI/AWWA C111/A21.11.
9. *Restrained joint*: A pipe joint designed to resist forces that act to separate a joint, such as thrust caused by internal pressure, external pulling forces, etc.
10. *Socket*: The inside of a bell formed to accept a gasket that provides the watertight seal of the joint. The socket may also be configured to facilitate restraint mechanisms.
11. *Spigot*: The plain end of a pipe that is inserted in a socket or bell end.

SECTION 4: REQUIREMENTS

Sec. 4.1 Permeation

The selection of materials is critical for water service and distribution piping in locations where there is likelihood the pipe will be exposed to significant concentrations of pollutants comprised of low molecular weight petroleum products or organic solvents or their vapors. Research has documented that pipe materials, such as polyethylene, polybutylene, polyvinyl chloride, and asbestos cement and elastomers, such as used in jointing gaskets and packing glands, may be subject to permeation by lower molecular weight organic solvents or petroleum products. If a water pipe must pass through such a contaminated area or an area subject to contamination, consult

with the manufacturers regarding permeation of pipe walls, jointing materials, and so forth, **before** selecting materials for use in that area.

Sec. 4.2 General Requirements

4.2.1 *Mechanical or push-on joint requirements* Pipe with mechanical joints or push-on joints shall conform to the applicable dimensions and weights stated in this standard and to the applicable requirements of the latest revision of ANSI/AWWA C111/A21.11. Unless otherwise required by the purchaser, the mechanical-joint glands shall be ductile or gray iron in accordance with ANSI/AWWA C111/A21.11, and bolts shall conform to the requirements of the same standard. Pipe with other types of joints shall comply with the joint dimensions and weights agreed on at the time of purchase, but, in all other respects, the pipe shall fulfill the requirements of this standard.

4.2.2 *Laying-length requirements.* The nominal laying length of the pipe shall be as stated in Tables 1, 2, 3, and 4 of this standard. A maximum of 20 percent of the total number of pipe of each size specified in an order may be provided in lengths that are as much as 24 in. (600 mm) shorter than the nominal laying length; an additional 10 percent may be provided in lengths that are as much as 6 in. (150 mm) shorter than the nominal laying length.

Sec. 4.3 Coatings and Linings

4.3.1 *Outside coating.* The outside coating used under normal conditions shall be an asphaltic coating approximately 1 mil (25 μ m) thick. The coating shall be applied to the outside of all pipe, unless otherwise specified. The finished coating shall be continuous and smooth, neither brittle when cold nor sticky when exposed to the sun, and shall be strongly adherent to the pipe.

4.3.2 *Cement-mortar linings.* The lining for use under normal conditions shall be a cement-mortar lining in accordance with the latest revision of ANSI/AWWA C104/A21.4, unless otherwise specified.

4.3.3 *Special coatings and linings.* For special conditions, other types of coatings and linings may be available. Special coatings and linings shall be specified by the purchaser. One special lining for pipe that is not cement-mortar lined is an asphaltic material as thick as practicable, at least 1 mil (25 μ m), that conforms to all appropriate requirements for seal coat, as described in the latest revision of ANSI/AWWA C104/A21.4.