



**American Water Works
Association**

The Authoritative Resource on Safe Water®

AWWA C200-05
(Revision of ANSI/AWWA C200-97)

AWWA Standard

Steel Water Pipe—6 In. (150 mm) and Larger



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6666 West Quincy Avenue
Denver, CO 80235-3098
T 800.926.7337
www.awwa.org

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AWWA Standard

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Committee Personnel

The Steel Water Pipe-Manufacturer's Technical Advisory Committee (SWPMTAC) Task Group on updating AWWA C200 had the following personnel at the time:

Dennis Dechant, *Chair*
Henry H. Bardakjian, *Vice-Chair*

H.H. Bardakjian, Ameron Concrete & Steel Pipe, Rancho Cucamonga, Calif.	(AWWA)
R.J. Card, Victaulic Depend-o-Lok Inc., Atlanta, Ga.	(AWWA)
B.D. Keil, Continental Pipe Manufacturing Company, Pleasant Grove, Utah	(SPFA)
M. Mintz, M-Square Associates Inc., Elmont, N.Y.	(AWWA)
R.S. Panter, Georgia Tubular Products, Cartersville, Ga.	(AWWA)
G.F. Ruchti, American SpiralWeld Pipe Company, Punta Gorda, Fla.	(AWWA)
R.N. Satyarthi, Baker Coupling Company Inc., Los Angeles, Calif.	(AWWA)
B. Terrell, RTLC Piping Products Inc., Kosse, Texas	(AWWA)
M. Topps, Glynwed Pipe Systems, Hixson, Tenn.	(AWWA)
B.F. Vanderploeg, Northwest Pipe Company, Portland, Ore.	(AWWA)
D.R. Wagner, Consultant, St. Louis, Mo.	(AWWA)
N. Williams, National Welding Corporation, Midvale, Utah	(AWWA)

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

John H. Bambei Jr., *Chair*
George J. Tupac, *Vice-Chair*
Dennis Dechant, *Secretary*

General Interest Members

W.R. Brunzell, Brunzell Associates Ltd., Skokie, Ill.	(AWWA)
R.L. Coffey, Kirkham Michael Consulting Engineers, Omaha, Neb.	(AWWA)
H.E. Dunham, Montgomery Watson Harza, Bellevue, Wash.	(AWWA)
K.G. Ferguson,* Montgomery Watson Harza, Las Vegas, Nev.	(AWWA)
S.N. Foellmi, Black & Veatch Corporation, Irvine, Calif.	(AWWA)

* Alternate

J.W. Green, Alvord Burdick & Howson, Lisle, Ill.	(AWWA)
K.D. Henrichsen, HDR Engineering Inc., Denver, Colo.	(AWWA)
M.B. Horsley, * Black & Veatch Corporation, Overland Park, Kan.	(AWWA)
J.K. Jeyapalan, Pipeline Consultant, New Milford, Conn.	(AWWA)
R. Ortega, Lockwood Andrews & Newman, Houston, Texas	(AWWA)
A.E. Romer, Boyle Engineering Corporation, Newport Beach, Calif.	(AWWA)
H.R. Stoner, Consultant, North Plainfield, N.J.	(AWWA)
C.C. Sundberg, CH2M Hill Inc., Bellevue, Wash.	(AWWA)
G.J. Tupac, G.J. Tupac & Associates Inc., Pittsburgh, Pa.	(AWWA)
J.S. Wailes, † Standards Engineer Liaison, AWWA, Denver, Colo.	(AWWA)
W.R. Whidden, Post Buckley Schuh & Jernigan, Orlando, Fla.	(AWWA)
M.C. Young, † Bucher Willis & Ratliff Corporation, Kansas City, Mo.	(AWWA)

Producer Members

H.H. Bardakjian, Ameron International, Rancho Cucamonga, Calif.	(AWWA)
R.J. Card, Victaulic Depend-o-Lok Inc., Atlanta, Ga.	(AWWA)
R.R. Carpenter, American Cast Iron Pipe Company, Birmingham, Ala.	(MSS)
D. Dechant, Northwest Pipe Company, Denver, Colo.	(AWWA)
B.D. Keil, Continental Pipe Manufacturing Company, Pleasant Grove, Utah	(SPFA)
J.L. Luka, * American Spiral Weld Pipe Company, Columbia, S.C.	(AWWA)
B. Vanderploeg, * Northwest Pipe Company, Portland, Ore.	(AWWA)
J.A. Wise, Canus International Sales Inc., Maple Ridge, B.C.	(AWWA)

User Members

G.A. Andersen, New York City Department of Environmental Protection, Little Neck, N.Y.	(AWWA)
J.H. Bambei Jr., Denver Water Department, Denver, Colo.	(AWWA)
D.W. Coppes, Massachusetts Water Resources Authority, Southborough, Mass.	(NEWWA)

* Alternate

† Liaison, nonvoting

R.V. Frisz, US Bureau of Reclamation, Denver, Colo.	(BUREC)
T.R. Jervis, Greater Vancouver Regional District, Burnaby, B.C.	(AWWA)
T.J. Jordan, Metropolitan Water District of Southern California, La Verne, Calif.	(AWWA)
T.A. Larson, Tacoma Public Utilities, Tacoma, Wash.	(AWWA)
G.P. Stine, San Diego County Water Authority, San Diego, Calif.	(AWWA)
M. Taghavi, Los Angeles Dept. of Water & Power, Los Angeles, Calif.	(AWWA)
J.V. Young, City of Richmond, Richmond, B.C.	(AWWA)

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Foreword

This foreword is for information only and is not a part of AWWA C200.

I. Introduction.

I.A. *Background.* This standard covers butt-welded, straight seam or spiral seam steel pipe, 6 in. (150 mm) and larger, for transmission and distribution of water, including fabrication of pipe, requirements of welding operations, permissible variations of weight and dimensions, preparation of ends, fabrication of specials, inspection, and test procedures.

I.B. *History.* The first AWWA steel pipe standards issued were 7A.3 and 7A.4, published in 1940. Standard 7A.4 pertained to steel pipe smaller than 30 in. (750 mm) in diameter, and 7A.3 pertained to steel pipe 30 in. (750 mm) in diameter and larger. Subsequently, in recognition that some pipe used in water utility service was manufactured in steel mills rather than in a fabricator's shop, two new AWWA standards were issued in 1960. AWWA C201 replaced 7A.3 and pertained to all pipe, regardless of diameter, manufactured in a fabricator's shop from steel sheet or plate. The physical and chemical properties are properties of the sheet or plate from which the pipe is made. The properties are a function of the steel mill practice and are not affected significantly by fabricating procedures. AWWA C202 replaced 7A.4 and pertained to mill pipe, which is normally produced in a production pipe mill. The specified physical and chemical properties are those of the completed pipe. Physical testing is performed on the pipe rather than on the steel from which it originates. In many cases, the physical properties are significantly affected by the pipe-manufacturing procedure. AWWA C201 was revised in 1966, and AWWA C202 was revised in 1964. Both AWWA C201 and AWWA C202 were superseded by AWWA C200-75, approved by the AWWA Board of Directors on Jan. 26, 1975.

AWWA C200 includes all types and classes of steel pipe, 6 in. (150 mm) in diameter and larger, used in water utility service, regardless of the pipe manufacturing source. With adequate quality assurance, pipe manufactured in a fabricator's shop or in a steel pipe mill is suitable for water utility service. Pipe produced in a pipe mill according to one of the ASTM* standards cited in AWWA C200 will be subjected to specific quality-control procedures so that no further testing is required by AWWA C200.

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

Shop-fabricated pipe made from materials and in accordance with the quality-control measures stipulated in AWWA C200 will be of high quality.

By reference, AWWA C202 (which pertained to mill-type steel water pipe) included API* 5L and API 5LX pipe grades manufactured to API standards for high-pressure applications. With the inclusion of ASTM A570/A570M and ASTM A572/A572M high-strength steels in AWWA C200, API high-pressure pipe was omitted from AWWA C200 as being redundant. However, API 5L and API 5LX pipe grades fully met all requirements of AWWA C200 and could be used for water utility applications if dictated by availability or other economic considerations.

AWWA C200-75 introduced design criteria for determination of wall thickness to meet internal pressure conditions. This facilitated the selection of the optimum combination of thickness and material for steel pipe.

Revisions in ANSI/AWWA C200-86 included clarification of forming for lap joint ends and gasketed ends and testing of O-ring gaskets. ANSI/AWWA C200-91 was approved by the AWWA Board of Directors on June 23, 1991. ANSI/AWWA C200-97 was approved by the AWWA Board of Directors on Feb. 2, 1997. This edition was approved by the AWWA Board of Directors on June 12, 2005.

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.

*American Petroleum Institute, 1220 L Street N.W., Washington, DC 20005.

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

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.

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.

AWWA C200 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.*

Basis of design. AWWA C200 pertains to the manufacture and testing of the steel-pipe cylinder. Overall design of steel pipelines is described in AWWA Manual M11, *Steel Water Pipe—A Guide for Design and Installation*. Coatings that protect against corrosion are referenced in Sec. 4.5.

*NSF International, 789 North 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.

The determination of the wall thickness of steel pipe is affected by (1) internal pressure, including operating static and transient pressures; (2) external loads, including trench loading and earth fill; (3) special physical loading, such as continuous-beam loading with saddle supports or ring girders, vacuum conditions, type of joint used, and variations in operating temperature; and (4) practical considerations for handling, shipping, lining and coating, or similar operations.

The design techniques described in AWWA Manual M11 are used to determine minimum wall thicknesses of steel pipe. The purchaser may establish and specify the wall thickness determined to be satisfactory for all conditions, including internal pressure. Selection of design stresses and deflection limits should be made with regard to the properties of the lining and coating materials used. Alternatively, the purchaser may establish and specify the minimum wall thickness that will satisfy all conditions of external pressure and trench loadings and special physical loadings. The manufacturer is allowed to select materials and manufacturing processes within the limitations of this standard to produce pipe to the wall thickness required to additionally satisfy specified internal pressure. The purchaser should specify the internal design pressure and show the depth of cover over the pipe together with installation conditions. The manufacturer should select and provide pipe having a wall thickness that meets the requirements of the internal design pressure and external load design. This thickness should govern if it is greater than the minimum thickness specified by the purchaser. To meet the requirements of internal design pressure, the pipe wall thickness is determined by using the following formula:

$$t = \frac{PD}{2S} \quad (\text{Eq F.1})$$

Where:

- t = design nominal wall thickness for the specified internal design pressures. Thickness and weight tolerances for pipe shall be governed by the requirements of the specification to which the plates or sheets are ordered (in. [mm])
- P = internal design pressure (psi [kPa])—specified by the purchaser
- D = outside diameter of the steel pipe cylinder (in. [mm])
- S = design stress (psi [kPa]), not to exceed the purchaser-specified percentage of the minimum yield point of the steel selected by the manufacturer

Application. This standard describes the requirements for steel water pipe for use in water transmission and distribution under normal circumstances. It is the responsibility of the purchaser for each project to determine if any unusual circumstances related to the project require additional provisions that are not included in the standard. Such special conditions might affect design, manufacture, quality control, corrosion protection, or handling requirements.

Brittle fracture precautions. Under certain conditions where a restrained pipeline with welded lap joints has a pipe wall thickness in excess of ½ in. (12.7 mm) and the pipeline is to be operated at high stress levels at temperatures below 40°F (5°C), the purchaser should take precautions to prevent brittle fracture, which can result from a combination of notches and high stress concentrations at the joints. Precautions may include specifying a steel with adequate notch toughness and transition temperature and fabrication techniques that would reduce the possibility of brittle fracture.

Testing of special sections. Section 5.2.2.1 provides for nondestructive testing of the seams of specials. This testing should be adequate for normal conditions previously discussed under Application. Section 5.2.2.3 describes test methods that may be necessary if, in the opinion of the purchaser, unusually severe conditions exist, such as surge or transient pressures that cause stresses exceeding 75 percent of yield. This special testing must be specified by the purchaser.

Roundness of pipe. The roundness of pipe during handling, shipping, joint makeup, and backfilling should be covered in the purchaser's specifications. Pipe may have to be studded so it will remain round during transportation, installation, and backfilling.

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. The purchaser should state whether compliance with NSF/ANSI 61, Drinking Water System Components—Health Effects, is to be required, in addition to the requirements of the Safe Drinking Water Act. The following items should be included in the the purchaser's specifications:

1. Standard used—that is, AWWA C200, Standard for Steel Water Pipe—6 In. (150 mm) and Larger, of latest revision.
2. A description or drawings indicating the diameter and total quantity of pipe required for each diameter.

3. Internal design pressure.
4. Design stress in the pipe wall at the specified internal design pressure as a percentage of the minimum yield point of the steel.
5. Minimum wall thickness required by considerations other than internal design pressure, such as allowable deflection; depth of cover; and, if aboveground, distance between supports.
6. Permeation requirements (Sec. 4.1).
7. Details of other federal, state, local, and provincial requirements (Sec. 4.2.1).
8. The drawings and calculations to be provided by the manufacturer if required (Sec. 4.3 and 4.4).
9. Protective coating (Sec. 4.5).
10. Toughness requirements (Footnote—Table 1).
11. Specification of pipe or steel if there is a preference (Sec. 4.6), or desired physical properties for “ordering to chemistry only” (Section 3 and Sec. 4.7.2).
12. Manual welding (Sec. 4.11.3).
13. Qualification code for manual welders if different from Sec. 4.11.3.1.
14. Length of pipe sections, random or specified lengths (Sec. 4.12.4).
15. Type of pipe ends (description or drawings) (Sec. 4.13).
16. Drawings of butt straps and instructions as to whether butt straps are to be supplied separately or attached to the pipe (Sec. 4.13.5).
17. Requirements for reports of tests of rubber-gasket materials (Sec. 4.13.6.3).
18. All special sections, indicating for each component part the dimensions or standard designation (Sec. 4.15) and the grade of material required (Sec. 4.16).
19. Instructions regarding inspection at place of manufacture (Sec. 5.1).
20. Minimum hydrostatic test pressure if different from Sec. 5.2.1.
21. Method of nondestructive testing to be used for special sections (Sec. 5.2.2.1) or, in the case of severe service conditions, the requirements for hydrostatic testing of special sections (Sec. 5.2.2.3).
22. Requirements for marking, line diagrams, or laying schedules (Sec. 6.1).
23. Special handling requirements and allowable out-of-roundness (Sec. 6.2).
24. Affidavit of compliance if required (Sec. 6.3).

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