

American Water Works Association

**ANSI/AWWA C701-02**

(Revision of ANSI/AWWA C701-88)



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**AWWA STANDARD**  
FOR  
**COLD-WATER METERS—TURBINE TYPE,**  
**FOR CUSTOMER SERVICE**



*Effective date: July 1, 2002.*

*First edition approved by AWWA Board of Directors May 24, 1923.*

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*Approved by American National Standards Institute April 22, 2002.*

**AMERICAN WATER WORKS ASSOCIATION**

6666 West Quincy Avenue, Denver, Colorado 80235

[www.awwa.org](http://www.awwa.org)

## AWWA Standard

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## Committee Personnel

The AWWA Subcommittee on Cold-Water Meters—Turbine Type, which developed this standard, had the following personnel at the time:

Thomas R. Curran, *Chair*

Donald J. Kullmann, *Vice-Chair*

|                                                               |        |
|---------------------------------------------------------------|--------|
| J.A. Capor, Monroeville Water Authority, Monroeville, Pa.     | (AWWA) |
| G.H. DeJarlais, Badger Meter Inc., Milwaukee, Wis.            | (AWWA) |
| Don Faber, Badger Meter Inc., Milwaukee, Wis.                 | (AWWA) |
| J.R. Grabinski, Dallas Water Utilities, Dallas, Texas         | (AWWA) |
| R.T. Huth, Water Specialties Corporation, Porterville, Calif. | (AWWA) |
| J.E. Jackson, Invensys Metering Systems, Texarkana, Texas     | (AWWA) |

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

Michael J. Kebles, *Chair*

### *Consumer Members*

|                                                                     |         |
|---------------------------------------------------------------------|---------|
| M.L. Aigen, Boston Water & Sewer Commission, Boston, Mass.          | (NEWWA) |
| Joe Alongi, Kansas City Water Services Department, Kansas City, Mo. | (AWWA)  |
| T.R. Curran, Monroeville Water Authority, Monroeville, Pa.          | (AWWA)  |
| W.M. Garfield, Arizona Water Company, Phoenix, Ariz.                | (AWWA)  |
| J.R. Grabinski, Dallas Water Utilities, Dallas, Texas               | (AWWA)  |
| R.C. Graff, Poway, Calif.                                           | (AWWA)  |
| K.W. Grant, Louisville Water Company, Louisville, Ky.               | (AWWA)  |
| Duane Griffin, City of Winnipeg, Winnipeg, Man.                     | (AWWA)  |
| C.R. Joyner, Washington Suburban Sanitary Commission, Laurel, Md.   | (AWWA)  |
| M.J. Kebles, Las Vegas Valley Water District, Las Vegas, Nev.       | (AWWA)  |
| M.A. Lucca, Santa Clara Valley Water District, San Jose, Calif.     | (AWWA)  |
| K.M. Poe, Memphis Light Gas & Water, Memphis, Tenn.                 | (AWWA)  |
| G.E. Raymond, Los Angeles Water & Power, Los Angeles, Calif.        | (AWWA)  |
| Sheldon Solotoff, Miami Dade Water & Sewer, Miami, Fla.             | (AWWA)  |
| R.A. Stehmeier, Milwaukee Water Works, Milwaukee, Wis.              | (AWWA)  |

### *General Interest Members*

|                                                               |        |
|---------------------------------------------------------------|--------|
| D.C. Beets, Cognyst Consulting, Cincinnati, Ohio              | (AWWA) |
| T.H. Gerardi, Bermad Inc., Ocala, Fla.                        | (AWWA) |
| T.W. Hodson, Ford Meter Box Company, Wabash, Ind.             | (AWWA) |
| A.L. McKnight, Denver Water, Denver, Colo.                    | (AWWA) |
| P.J. Olson, * Standards Engineer Liaison, AWWA, Denver, Colo. | (AWWA) |
| T.E. Pape, * Best Management Partners, El Cerrito, CA         | (AWWA) |
| Richard San Giacomo, R&D Engineering, P.C., Buffalo, N.Y.     | (AWWA) |

### *Producer Members*

|                                                                        |        |
|------------------------------------------------------------------------|--------|
| Martin Cole, ABB Water Meters, Acala, Fla.                             | (AWWA) |
| G.H. DeJarlais, † Badger Meter Inc., Milwaukee, Wis.                   | (AWWA) |
| Don Faber, Badger Meter Inc., Milwaukee, Wis.                          | (AWWA) |
| L.W. Fleury Jr., Mueller Group Inc., Smithfield, R.I.                  | (AWWA) |
| P.T. Grayson, † ABB Water Meters Inc., Ocala, Fla.                     | (AWWA) |
| R.N. Koch, Master Meter, Sewickley, Pa.                                | (AWWA) |
| D.J. Kullmann, Neptune Technology Group Inc., Roswell, Ga.             | (AWWA) |
| Matt Laird, Metron-Farnier LLC, Boulder, Colo.                         | (AWWA) |
| D.C. Pinney, Sensus Technologies Inc., Orlando, Fla.                   | (AWWA) |
| Jerry Potter, † Master Meter Inc., Longview, Texas                     | (AWWA) |
| F.S. Salser Jr., Floyd S. Salser Jr. & Assoc. Mars Company Ocala, Fla. | (AWWA) |
| Paul Sandhu, Sparling Instruments Company Inc., El Monte, Calif.       | (AWWA) |
| Mark Shamley, † Metron-Farnier LLC, Boulder, Colo.                     | (AWWA) |
| Thierry Swinson, † Neptune Technology Group Inc., Tallassee, Ala.      | (AWWA) |
| Matt Thomas, † Hersey Meters, Cleveland, N.C.                          | (AWWA) |
| G.M. Voss, McCrometer, Division of Ketema, Hemet, Calif.               | (AWWA) |

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\*Liaison, nonvoting

†Alternate

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# Foreword

*This foreword is for information only and is not a part of AWWA C701.*

## I. Introduction.

I.A. *Background.* A booklet published in Hamburg, Germany, in 1790 by Benjamin Gottlob Hoffman described a form of current meter developed by Reinard Woltman that may be considered to be the first practical meter for measuring flowing air and water. Originally, it was thought that the meter could not be adapted for use in enclosed pipe. However, through substantial changes in design and construction, the present current meter evolved.

I.B. *History.* The first AWWA standard specifications for water meters of various types were published in 1923. These were revised in later years, and the first standard that dealt solely with current-type meters was approved as tentative on Jan. 14, 1946, with the designation 7M.2-T. It was approved as standard on July 25, 1947, and given the designation AWWA C701-47, Standard Specifications for Cold-Water Meters—Current Type. The standard was revised in 1970 and designated as AWWA C701-70, Standard for Cold-Water Meters—Turbine Type, for Customer Service. It was approved by the AWWA Board of Directors on Jan. 26, 1970. Subsequent editions of C701 were approved on June 30, 1978, and June 19, 1988. This edition was approved January 20, 2002.

Between 1923 and 1947, the propeller-type current meter was developed for pump-station discharge, irrigation, and main-line measurement. This meter differs from the original design in that it does not use a measuring cage around the turbine. The propeller operates directly within the pipeline itself or within the main meter body. The propeller-type meters had operating characteristics different from current-type meters. These differences led to the development of AWWA C704-50, Standard Specifications for Cold-Water Meters—Current Type, Propeller Driven. This standard was revised in 1970 and designated as AWWA C704-70, Standard for Cold-Water Meters—Propeller Type for Main Line Applications. The 1970 version was reaffirmed without revision in 1975 and 1984 and revised in 1992.

The 1978 revision of AWWA C701 included an added distinction between class I and class II types of turbine meters. Class I meters are those previously covered by AWWA C701-70 and class II meters are the newer in-line high-velocity type characterized by lower head loss, greater low-flow sensitivity, and tighter accuracy

tolerances over a wider flow range. Details of the performance differences are listed in Table 1 of AWWA C701.

The 2002 revision of AWWA C701 expanded Table 1 for class I meters to show the operating characteristics for low-velocity horizontal type meters and vertical shaft-type meters separately.

**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<sup>†</sup>/NSF<sup>‡</sup> 60, Drinking Water Treatment Chemicals—Health Effects, and ANSI/NSF 61, Drinking Water System Components—Health Effects.
4. Other references, including AWWA standards, *Food Chemicals Codex*, *Water Chemicals Codex*,<sup>§</sup> and other standards considered appropriate by the state or local agency.

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

<sup>†</sup>American National Standards Institute, 25 West 43rd St., 4th Floor, New York, NY 10036-7406.

<sup>‡</sup>NSF International, 789 N. Dixboro Rd., Ann Arbor, MI 48105-9723.

<sup>§</sup>Both Publications available from National Academy of Sciences, 2102 Constitution Ave. N.W., Washington, DC 20418.

Various certification organizations may be involved in certifying products in accordance with ANSI/NSF 60 (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 C701-02 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.** This standard has no applicable information for this section.

**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.

**III.A. Purchaser Options and Alternatives.** This standard provides for several options and alternatives that the purchaser must specify if choosing to exercise the options or if there is a preference among the alternatives. In addition, several items must be specified by the purchaser to describe completely the type, size, quantity, and other characteristics of the meters required. Such items, options, and alternatives are summarized in the following list. The purchaser should review each item in the list and then make the appropriate provisions in the specifications to describe specific requirements.

1. Standard used—that is AWWA C701, Standard for Cold-Water Meters—Turbine Type, for Customer Service, of latest revision.

2. Meter class—class I (low-velocity horizontal type or vertical-shaft type) or class II (Sec. 1.1).

3. Whether an affidavit of compliance (Sec. 6.3) and certificate of testing for accuracy (appendix A.3.3) are required.

4. If specific warranty provisions will be required.

5. The purchaser should state whether compliance with ANSI/NSF 61 Drinking Water System Components—Health Effects, is to be required, in addition to the requirements of the Safe Drinking Water Act. If this certification is to be required, the purchaser's specification shall read, "This product shall be certified as suitable for contact with drinking water by an accredited certification organization in accordance with ANSI/NSF Standard 61, Drinking Water Systems Components—Health Effects.

6. Whether main casings are to be made of copper alloy or of cast iron or fabricated steel treated for corrosion resistance (Sec. 4.1.2), and whether there is a preference for the materials specified for the various meter components (Sec. 4.1.3 through Sec. 4.1.10.).

7. Size of meter (Sec. 4.2.1 and Tables 1 and 2) and quantity required.

8. Type of connections for 1 ½-in. (40-mm) and 2-in. (50-mm) meters, whether couplings (tailpieces) are to be provided on meters with spuds, and whether round or oval flanges are required on flanged meters (Sec. 4.3.3).

9. Whether companion flanges, gaskets, bolts, and nuts (Sec. 4.3.4) are to be provided with flanged meters.

10. Details of register (Sec. 4.3.5) to be provided, including

- a. unit of measure—US gallons, cubic feet, cubic meters, or other.
- b. position—permanently sealed or open.
- c. test hand—with or without sweep test hand.

11. Whether a direct-reading remote register or an encoder-type register is required (Sec. 4.3.6).

12. Special materials required, if any, to resist corrosion if water is highly aggressive (appendix A.5.3).

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

**IV. Major Revisions.** The major revisions 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) and the definitions of parties (Sec. 3) have been revised to approved wording.
3. “Soft” metric equivalents have been added in the text and tables.
4. The scope of the standard has been expanded to include sizes  $\frac{3}{4}$ -in. (20-mm) through 20-in. (500-mm) (Sec. 1.1).
5. The References section has been updated (Sec. 2).
6. The Choice of materials section has been revised (Sec. 4.1.1).
7. Sec. 4.1.2, Main casings, has been expanded to include strainer main casings and fabricated steel has been added as a material with which main cases can be made.
8. Sec. 4.1.2.1, Strainer screen, has been added.
9. Sec. 4.1.4, Measuring cages or chambers, cast-iron and fabricated steel, have been added as materials with which the measuring cages or chambers can be made.
10. Table 1 has been expanded to include the operating characteristics for low velocity horizontal-type meters and vertical shaft-type meters separately. It has also been expanded to show the operating characteristics for  $\frac{3}{4}$  in. (20 mm) and 1 in. (25 mm) sizes of the class I vertical-shaft type turbine meters and 1½-in. (40-mm), 14-in. (350-mm), 16-in. (400-mm), 18-in. (450-mm), and 20-in. (500-mm) sizes for the class II In-line (high-velocity) type turbine meters. The corresponding text has been updated to include these sizes as well.
11. Table 2, Meter dimensions for class I and class II turbine-type meters, has been expanded to include dimensions for sizes  $\frac{3}{4}$  in. (20 mm), 1 in. (25 mm), 14 in. (350 mm), 16 in. (400 mm), 18 in. (450 mm), and 20 in. (500 mm). The corresponding text has been updated to include these sizes as well.
12. Table 3, Meter connections—companion flange dimensions, has been expanded to include dimensions for sizes  $\frac{3}{4}$  in. (20 mm), 1 in. (25 mm), 14 in. (350 mm), 16 in. (400 mm), 18 in. (450 mm) and 20 in. (500 mm). The corresponding text has been updated to include these sizes as well.
13. An alternative flange material, ANSI/AWWA C207, steel plate flange, class D, has been added for main-case connections for 3-in. (80-mm) through 20-in. (500-mm) sizes (Sec. 4.3.3.3) and for companion flanges for 3-in. (80-mm) through 20-in. (500-mm) sizes (Sec. 4.3.4.2).