ANSI/AWWA C701-07
(Revision of ANSI/AWWA C701-02)

American Water Works Association

The Authoritative Resource on Safe Water®

*AWWA Standard*

# Cold-Water Meters—Turbine Type, for Customer Service



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## AWWA Standard

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AWWA unites the entire water community by developing and distributing authoritative scientific and technological knowledge. Through its members, AWWA develops industry standards for products and processes that advance public health and safety. AWWA also provides quality improvement programs for water and wastewater utilities.

# Committee Personnel

The AWWA Subcommittee on Current-Type Meters, which developed this standard, had the following personnel at the time:

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# Contents

*All AWWA standards follow the general format indicated subsequently. Some variations from this format may be found in a particular standard.*

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# Foreword

*This foreword is for information only and is not a part of ANSI/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 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 ANSI/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, June 19, 1988, and Jan. 20, 2002. This edition was approved Jan. 21, 2007.

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 ANSI/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 and 2002.

The 1978 revision of ANSI/AWWA C701 included an added distinction between class I and class II types of turbine meters. Class I meters are those previously covered by ANSI/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 ANSI/AWWA C701.

The 2002 revision of ANSI/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 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, local, and provincial 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, local, or provincial 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

*Persons outside the United States 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 20001.

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 C701 does not address additives requirements. Thus, users of this standard should consult the appropriate state, local, or provincial 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.** This standard has no applicable information for this section.

**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.* 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. The following items should be specified by the purchaser:

1. Standard used—that is ANSI/AWWA C701, Cold-Water Meters—Turbine Type, for Customer Service, of latest revision.
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. If specific warranty provisions will be required.
4. Meter class—class I (low-velocity horizontal type or vertical-shaft type) or class II (Sec. 1.1).
5. Details of other federal, state, or provincial and local requirements (Sec. 4.1).
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 1½-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, or cubic meters.
    b. position—permanently sealed or open.
    c. test hand—with or without sweep test hand.
    d. register type—mechanical display type or electronic display type.

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

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

13. 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 by the purchaser.

**IV. Major Revisions.** The major revisions to the standard in this edition include the following:

1. Reference to the discontinued ASTM D2135 has been removed from the references section (Section 2) and from the materials section for measuring turbines (Section 4.1.5).

2. Definitions for electronic display type and mechanical display type have been added (Section 3).

3. UNS C89520 and UNS C89836 have been listed as acceptable materials in the materials section for meter and strainer main casings (Sec. 4.1.2).

4. The flow rates in Table 1 for class II-type meters have been updated for the Safe Maximum Operating Capacity, the Maximum Rate for Continuous Duty, and the Normal Test Flow Limits (Table 1).

5. The section on registers has been expanded to describe electronic display-type registers (Sec. 4.3.5 and subsections).

**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.

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*AWWA Standard*

# Cold-Water Meters—Turbine Type for Customer Service

## SECTION 1: GENERAL

### Sec. 1.1 Scope

This standard describes the various classes of cold-water turbine meters in sizes ¾ in. (20 mm) through 20 in. (500 mm) for water supply customer service, mainline metering, and custody transfer of water among purveyors, and the materials and workmanship employed in their fabrication. The turbine meters described in this standard are divided into class I and class II meters. Both classes of meters register by recording the revolutions of a turbine set in motion by the force of flowing water striking its blades.

*Class I.* Class I meters are the vertical-shaft and low-velocity, horizontal-shaft models.

*Class II.* Class II meters are the in-line, horizontal-axis, high-velocity-type turbines characterized by lower head loss and a wider normal operating flow range than class I models.

### Sec. 1.2 Purpose

The purpose of this standard is to provide the minimum requirements for cold-water, turbine-type meters, including materials and design.