

American Water Works Association
AWWA C704-92
(Revision of ANSI/AWWA C704-70 [R84])



AWWA STANDARD
FOR
**PROPELLER-TYPE METERS FOR
WATERWORKS APPLICATIONS**



Effective date: Nov. 1, 1992.

First edition approved by AWWA Board of Directors July 21, 1949.

This edition approved Jan. 26, 1992.

AMERICAN WATER WORKS ASSOCIATION

6666 West Quincy Avenue, Denver, Colorado 80235

Copyright (C) 1998 American Water Works Association, All Rights Reserved.

AWWA Standard

This document is an American Water Works Association (AWWA) standard. It is not a specification. AWWA standards describe minimum requirements and do not contain all of the engineering and administrative information normally contained in specifications. The AWWA standards usually contain options that must be evaluated by the user of the standard. Until each optional feature is specified by the user, the product or service is not fully defined. AWWA publication of a standard does not constitute endorsement of any product or product type, nor does AWWA test, certify, or approve any product. The use of AWWA standards is entirely voluntary. AWWA standards are intended to represent a consensus of the water supply industry that the product described will provide satisfactory service. When AWWA revises or withdraws this standard, an official notice of action will be placed on the first page of the classified advertising section of *Journal AWWA*. The action becomes effective on the first day of the month following the month of *Journal AWWA* publication of the official notice.

American National Standard

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review, and users are cautioned to obtain the latest editions. Producers of goods made in conformity with an American National Standard are encouraged to state on their own responsibility in advertising and promotional materials or on tags or labels that the goods are produced in conformity with particular American National Standards.

CAUTION NOTICE: The American National Standards Institute (ANSI) approval date on the front cover of this standard indicates completion of the ANSI approval process. This American National Standard may be revised or withdrawn at any time. ANSI procedures require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of publication. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute Inc., 11 West 42nd St., New York, NY 10036 (212) 642-4900.

Copyright © 1992 by American Water Works Association
Printed in USA

Committee Personnel

The AWWA Subcommittee on Current-Type Meters had the following personnel at the time of approval:

James W. Smith, *Chair*
D.J. Kullmann, *Vice-Chair*
R.T. Huth
W.M. Kremkau
J.P. Sullivan Jr.

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

Donald E. Jackson, *Chair*
James W. Smith, *Vice-Chair*
Donald J. Kullmann, *Secretary*

Consumer Members

G.A. Delgado, Department of Water and Power, Los Angeles, Calif.	(AWWA)
R.C. Graff, Water Utilities Department, San Diego, Calif.	(AWWA)
K.W. Grant, Louisville Water Company, Louisville, Ky.	(AWWA)
B.C. Grimm, Memphis Light, Gas, and Water Division, Memphis, Tenn.	(AWWA)
R.E. Howell, Utility Services Department, Port St. Lucie, Fla.	(AWWA)
Ron Hyde, Fort Worth Water Department, Fort Worth, Texas	(AWWA)
D.E. Jackson, Branford, Conn.	(AWWA)
T.E. Kjartanson, City of Winnipeg Waterworks, Winnipeg, Man.	(AWWA)
W.M. Kremkau, Washington Suburban Sanitary Commission, Hyattsville, Md.	(AWWA)
Jean-Pol Mahieu, Kansas City Water Department, Kansas City, Mo.	(AWWA)
R.L. Miller, Arizona Water Company, Casa Grande, Ariz.	(AWWA)
D.S. Morrow, Denver Water Department, Denver, Colo.	(AWWA)
King Moss II, Dallas Water Utility, Dallas, Texas	(AWWA)
L.E. Orr, Water and Wastewater Department, Phoenix, Ariz.	(AWWA)
E.M. Poaches Jr., Philadelphia Water Department, Philadelphia, Pa.	(AWWA)
L.M. Scott, Lincoln Water System District Shop, Lincoln, Neb.	(AWWA)
L.E. Simmonds, East Bay Municipal Utilities District, Oakland, Calif.	(AWWA)
J.W. Smith, Gary-Hobart Water Corporation, Gary, Ind.	(AWWA)
R.A. Stehmeir, Milwaukee Water Works, Milwaukee, Wis.	(AWWA)
J.P. Sullivan, Commissioners of Public Works, Charleston, S.C.	(AWWA)
J.P. Sullivan Jr., Boston Water and Sewer Commission, Boston, Mass.	(NEWWA)

General Interest Members

E.E. Baruth,* Standards Engineer Liaison, AWWA, Denver, Colo.	(AWWA)
A.F. Hess,* Council Liaison, Regional Water Authority, New Haven, Conn.	(AWWA)
K.R. Johnson, Seattle, Wash.	(AWWA)
R.N. Koch, Roncoke Associates, Sewickley, Pa.	(AWWA)
R.C. McPherson, Rochester, N.Y.	(AWWA)
Richard San Giacomo, R & D Engineering & Land Surveying, P.C., Buffalo, N.Y.	(AWWA)
D.A. Wheadon, Brown & Caldwell, Provo, Utah	(AWWA)

Producer Members

G.D. Anderson, Sensus Technologies Inc., Uniontown, Pa.	(AWWA)
A.N. Dellerson, Sparling Instruments Company Inc., El Monte, Calif.	(AWWA)
P.J. Ferguson, Hays, Division of Romac Industries, Lowell, N.C.	(AWWA)
L.W. Fleury Jr., Hersey Products Inc., Cranston, R.I.	(AWWA)
T.H. Gerardi,† Kent Meters Inc., Ocala, Fla.	(AWWA)
P.T. Grayson, Kent Meters Inc., Ocala, Fla.	(AWWA)
R.T. Huth, Water Specialties Corporation, Porterville, Calif.	(AWWA)
M.N. Kavouklis,† Hersey Products Inc., Cranston, R.I.	(AWWA)
J.H. Kennedy,† Badger Meter Inc., Dallas, Texas	(AWWA)
D.J. Kullmann, Schlumberger Industries, Atlanta, Ga.	(AWWA)
W.C. Myers,† Master Meter Inc., Bullard, Texas	(AWWA)
G.J. Nolte, Precision Meters Inc., Orlando, Fla.	(AWWA)
Jerry Potter, Master Meter Inc., Longview, Texas	(AWWA)
Clay Spence,† McCrometer, Division of Ketema, Hemet, Calif.	(AWWA)
D.H. Strobel, Badger Meter Inc., Milwaukee, Wis.	(AWWA)
Glenn Voss, McCrometer, Division of Ketema, Hemet, Calif.	(AWWA)

*Liaison, nonvoting

†Alternate

Contents

SEC.	PAGE	SEC.	PAGE
Foreword			
I	History of Standard vii	3.4	Pressure Requirement 5
II	Acceptance vii	3.5	External Case Closure Fasteners 5
III	Information Regarding Use of This Standard viii	3.6	Accessibility 5
IV	Modification to Standard ix	3.7	Registration Accuracy 7
V	Major Revisions ix	3.8	Markings 7
Standard			
1	General	4	Detailed Design
1.1	Scope 1	4.1	Tubes or Cases 7
1.2	Definitions 1	4.2	Flow-Tube or Main-Case Connections 7
1.3	References 1	4.3	Companion Flanges 7
1.4	Affidavit of Compliance 3	4.4	Registers 8
1.5	Basis for Rejection 3	4.5	Register Boxes 10
2	Materials	4.6	Propellers 10
2.1	General 3	4.7	Seal-Wire Holes 10
2.2	Flow Tubes or Main Cases 4	Appendix	
2.3	Register Boxes and Covers 4	A	Supplemental Information
2.4	Propellers 4	A.1	Units of Measurement 11
2.5	Propeller Shafts/Spindles 4	A.2	Tests
2.6	Propeller Shaft/Spindle Bearings and Bushings 4	A.2.1	Capacity and Pressure-Loss Tests 11
2.7	Flow-Straightening Vanes and Liners 4	A.2.2	Pressure Tests 12
2.8	External Case Closure Fasteners 5	A.2.3	Accuracy Tests 12
2.9	Companion Flanges 5	A.3	Testing Equipment 12
3	General Design	A.4	Registration Accuracy
3.1	Size 5	A.4.1	Excessive Wear 12
3.2	Capacity 5	A.4.2	Temperature Extremes 13
3.3	Length, Width, and Height 5	A.4.3	Corrosion 13
		A.4.4	Improper Installation 13

SEC.		PAGE	SEC.		PAGE
A.4.5	Material in Suspension	13			
A.4.6	Entrained Air	13			
A.5	Periodic Tests	14			
A.6	Meter Storage.....	14			
A.7	Placing Meter in Service	14			
Tables					
1	Propeller Meters for Waterworks Applications	6			
2	Propeller Meter Dimensions	6			
3	Main-Case Connections or Meter Installation Types	8			
4	Companion Flange Dimensions	9			
5	Maximum Indication on Initial Dial and Minimum Register Capacity	9			
A.1	Average Recommended Intervals Between Meter Tests	14			

Foreword

This foreword is for information only and is not a part of AWWA C704.

I. History of Standard. Current-type water meters were first developed for measuring flowing air and water. A booklet, published in Hamburg, Germany, in 1790 by Benjamin Gottlob Hoffman, described a form of current meter developed by Reinhard Woltman, which seems to be the first practical meter for the purpose. It was originally developed to measure stream flow and was not considered adaptable for use in a closed pipe. However, since then it has been changed materially in design, construction, and use and adapted for closed pipelines.

The first effort to standardize current-type meters for customer service in the United States resulted in the formulation of AWWA Standard Specifications for Cold-Water Meters—Current Type, in 1923. These were revised on July 25, 1947, as AWWA C701-47—Standard Specifications for Cold Water Meters—Current Type. During the period between 1923 and 1947, a different version of current-type meters was developed for use in special applications such as pump station discharge and main line measurement. The only difference in construction features between the two types is the original design for use in customers' service lines contains a removable measuring cage in which a turbine operates, and the later type does not. Instead, a propeller operates either directly within the pipeline itself or within the main meter body. This change in design results in differences in operating ranges, friction losses, and capacities of the two types. Due to development of the second type, AWWA Specification for Current Type Meters—Propeller Drive, C704, was adopted as tentative in 1949, and was made a standard in 1950.

Confusion results from having two standards for what is essentially the same type of meter, and considerable judgment is required in the selection of one or the other. The AWWA Meter Committee, in the 1970 revisions of AWWA C701 and AWWA C704, attempted to make the two standards more compatible in order to better assist the user in selection. This revision of AWWA C704 was approved by the AWWA Board of Directors on Jan. 26, 1992. The dates of approval and numerical designations of all past editions of AWWA C704 are listed below.

Designation	Date of Approval
7M.5-T	July 21, 1949
7M.5-1950/C704-50	May 25, 1950
AWWA C704-70	Jan. 26, 1970
AWWA C704-70(R75)	Jan. 26, 1975
AWWA C704-70(R84)	Jan. 29, 1984

II. 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 consortium included the American Water Works Association Research Foundation (AWWARF), the Conference of State Health and Environmental Managers (COSHEM), the American Water Works Association (AWWA), and the Association of State Drinking Water Administrators (ASDWA). The consortium is responsible for the cooperative effort of manufacturers, regulators, product users, and other interested parties that develop and maintain the NSF standards.

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.
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.

Appendix 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 appendix A procedures may not always be identical, depending on the certifier.

AWWA C704-92 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.

III. Information Regarding Use of This Standard. When placing orders for meters manufactured to conform to this standard, it is necessary for the purchaser to supply specific supplementary information regarding the following:

1. Standard used—that is, AWWA C704-92, Standard for Propeller-Type Meters for Waterworks Applications.
2. An affidavit of compliance (Sec. 1.4) and certificate of testing for accuracy and capacity (Sec. A.2.3 and Sec. A.2.1) from the supplier or manufacturer if required.
3. Size of meter (Sec. 3.1) and quantity required.

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

†American National Standards Institute Inc., 11 W. 42nd St., New York, NY 10036.

‡NSF International, 3475 Plymouth Rd., Ann Arbor, MI 48106.

§Both publications available from National Academy of Sciences, 2102 Constitution Ave. N.W., Washington, DC 20418.

4. Type of end connections, including threaded, flanged, plain-end, grooved-end, welding-saddle, saddle-type, or fire hydrant connections (Sec. 4.2).

5. Whether companion flanges, gaskets, bolts, and nuts (Sec. 4.3 and Sec. 2.8) are to be furnished with flanged meters.

6. Whether meters are to be furnished with open or hermetically sealed registers; with units of measure, including US gallons, cubic feet, cubic metres, or other units (Sec. 4.4); with a center sweep-test hand (Sec. 4.4.1.5); or with an instantaneous flow-rate indicator reading in US gallons per minute, cubic feet per second, cubic metres per hour, litres per second, or other units.

7. If seal-wire holes are to be omitted (Sec. 4.7).

8. Whether flow tube or main casing is to be cast iron or fabricated steel (Sec. 2.2).

9. The modification of registration accuracy if test water temperature exceeds 100°F (38°C).

10. If water is highly aggressive, special materials required to resist corrosion (Sec. A.4.3).

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

V. Major Revisions. The major changes to AWWA C704-70(R84) in this revision are

1. Section 1.3, References, was added.

2. Section 1.5, Basis for Rejection, added the statement that meters not complying with all requirements of this standard shall be rejected. The warranty requirement was eliminated.

3. Section 2 contains new terminology and references to ANSI,* ASTM,† and AWWA standards on materials for components of propeller-type meters.

4. Section 1.2, Definitions, was added.

5. The appendix was updated.

6. The title of AWWA Standard C704 was changed.

7. Soft metric units of measurement were added.

8. Deleted 5-in. (125-mm) meter size.

9. Added 42-in. (1050-mm) through 72-in. (1800-mm) meter sizes (in 6-in. [150-mm] increments).

10. Modified dimensions of 2-in. (50-mm) through 36-in. (900-mm) size meters.

11. Added saddle-type meters.

12. Added materials of construction for propellers and flow-straightening vanes and liners.

13. Deleted copper alloy as a material of construction for flow tubes, casings, fasteners, and companion flanges.

14. Added general and detailed design sections.

15. Deleted requirement that 2-in. (50-mm) and 3-in. (75-mm) meters shall have flow-straightening vanes.

16. Increased meter operating temperature to 100°F (38°C) from 80°F (27°C).

17. Added recommended procedure for placing meter in service.

*American National Standards Institute Inc., 11 W. 42nd St., New York, NY 10036.

†American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.