ANSI/AWWA **C713-24**

(Revision of ANSI/AWWA C713-19)

AWWA Standard

Cold-Water Meters—Fluidic-Oscillator Type

Effective date: June 1, 2025.

First edition approved by Board of Directors Jan. 16, 2005.
This edition approved Oct. 14, 2024.
Approved by American National Standards Institute Nov. 18, 2024.

American Water Works Association

Approved American National Standard ANSI

STANDARD Since 1881

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. This standard does not supersede or take precedence over or displace any applicable law, regulation, or code of any governmental authority. AWWA standards are intended to represent a consensus of the water industry that the product described will provide satisfactory service. When AWWA revises or withdraws this standard, an official notice of action will be placed in the Official Notice 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 that person 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 ANSI approval. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute, 1180 Avenue of the Americas, 10th Floor, New York, NY 10036; 212.642.4900, or e-mailing info@ansi.org.

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including scanning, recording, or any information or retrieval system. Reproduction and commercial use of this material is prohibited, except with written permission from the publisher. Please send any requests or questions to permissions@awwa.org.

ISBN, print: 978-1-64717-250-3

ISBN, electronic: 978-1-61300-773-0

DOI: http://doi.org/10.12999/AWWA.C713.24

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including scanning, recording, or any information or retrieval system. Reproduction and commercial use of this material is prohibited, except with written permission from the publisher.

Copyright © 2024 by American Water Works Association
Printed in USA

Copyright © 2024 by American Water Works Association. All Rights Reserved

Committee Personnel

The AWWA Standards Subcommittee on Cold-Water Meters—Fluidic-Oscillator Type, which developed this standard, had the following personnel at the time of approval:

Thomas A. Kelly Jr., *Chair*

A. Hendey Sr., Hendey Meter, Beaumont, Calif.
M.C. Johnson, Utah Water Research Laboratory, Utah State University, Logan, Utah
T.A. Kelly Jr., Meter Consultant, Martinsburg, W.Va.
R.N. Koch, Master Meter Inc., Pittsburgh, Pa.
M.L. Mastic, MARS Company, Ocala, Fla.
J.R. Scarborough III, Neptune Technology Group Inc., Tallassee, Ala.
S.M. Swanson, Sensus, Uniontown, Pa.
J. Szewczyk, Sensus | Xylem, Uniontown, Pa.
W.J. Vetter, Master Meter Inc., Mansfield, Tex.

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

Craig C. Hannah, *Chair*
Michael L. Mastic, *Vice-Chair*
Monte R. Merkel, *Secretary*

General Interest Members

J.E. Cray, Wright-Pierce, Andover, Mass.
D. Faber, Faber & Associates, Terra Alta, W.Va.
R.C. Graff, Poway, Calif.
J.G. Gunn (*alternate*), Johnson Controls Inc., Victor, N.Y.
C.C. Hannah, Johnson Controls Inc., Lubbock, Tex.
D.E. Hood, M.E. Simpson Company Inc., Valparaiso, Ind.
A.M. Horbovetz (*alternate*), M.E. Simpson Company Inc., Valparaiso, Ind.
M.C. Johnson, Utah Water Research Laboratory, Utah State University, Logan, Utah
T.A. Kelly Jr., Meter Consultant, Martinsburg, W.Va.
F.S. Kurtz (*liaison, nonvoting*), Standards Engineer Liaison, AWWA, Denver, Colo.
M.L. Mastic, MARS Company, Ocala, Fla.
M.R. Merkel, SL-serco Inc., Evansville, Ind.

Copyright © 2024 by American Water Works Association. All Rights Reserved

K.C. Molli, Industry Consultant, Menomonee Falls, Wis.
R.A. Richter, National Institute of Standards and Technology, Gaithersburg, Md.

Producer Members

R.A. Barillas (*alternate*), Badger Meter, Milwaukee, Wis.
T.D. Bianchi, Neptune Technology Group Inc., Tallassee, Ala.
C. Brunson (*alternate*), Neptune Technology Group Inc., Tallassee, Ala.
M.D. Cole, Meter Technology Werks, Tampa, Fla.
D.J. Devane, Zenner USA, Leeds, Ala.
M. Drake (*alternate*), Metron-Farnier LLC, Boulder, Colo.
R. Gallon (*alternate*), Zenner USA, Banning, Calif.
L. Gregory (*alternate*), RG3 Meter Company, Longview, Tex.
A. Hendey Sr., Hendey Meter, Beaumont, Calif.
B. Kaffenberger, Itron, Liberty Lake, Wash.
R.N. Koch, Master Meter Inc., Pittsburgh, Pa.
J.A. McCraven, Mueller Systems, Cleveland, N.C.
J. Olson, Badger Meter, Milwaukee, Wis.
J. Pintok, RG3 Meter Company, Lake Mary, Fla.
M. Shamley, Metron-Farnier LLC, Boulder, Colo.
J.R. Solanes (*alternate*), Meter Technology Werks, Tampa, Fla.
S.M. Swanson, Sensus, Uniontown, Pa.
J. Szewczyk (*alternate*), Sensus | Xylem, Uniontown, Pa.
W.J. Vetter (*alternate*), Master Meter Inc., Mansfield, Tex.

User Members

M.J. Aragon, Denver Water, Denver, Colo.
M.C. Bowen, City of Columbus, Division of Water, Columbus, Ohio
J. Conover Jr., City of Sacramento, Sacramento, Calif.
G.M. Gehringer (*alternate*), New Jersey American Water, Delran, N.J.
A.J. Haas, Arizona Water Company, Phoenix, Ariz.
P.A. Hayes, Mammoth Community Water District, Mammoth Lakes, Calif.
D.M. Hill, American Water, Voorhees, N.J.
N.D. Kaufman, Truckee Donner Public Utility District, Truckee, Calif.
P. Kostelec, Dallas Water Utilities, Dallas, Tex.
A. Land, Dallas Water Utilities, Dallas, Tex.

Copyright © 2024 by American Water Works Association. All Rights Reserved

S.U. Mills-Wright (*liaison, nonvoting*), Standards Council Liaison, Dallas Water Utilities, Dallas, Tex.

R. Molhoek, Desert Water Agency, Palm Springs, Calif.

G.J. Oakley, Philadelphia Water Department, Philadelphia, Pa.

C. Patterson, Washington Suburban Sanitary Commission, Laurel, Md.

B. Schade, WaterOne, Lenexa, Kans.

R. Sloan, Birmingham Water Works Board, Birmingham, Ala.

D. Strub, Austin Water Utility, Austin, Tex.

Copyright © 2024 by American Water Works Association. All Rights Reserved

This page intentionally blank.

Copyright © 2024 by American Water Works Association. All Rights Reserved

Contents

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

SEC.		PAGE
Foreword		
I	Introduction	ix
I.A	Background	ix
I.B	History	ix
I.C	Acceptance	ix
II	Special Issues	xii
II.A	Fire Flow	xii
II.B	Chlorine and Chloramine Degradation of Elastomers	xii
III	Use of This Standard	xiii
III.A	Purchaser Options and Alternatives	xiii
III.B	Modification to Standard	xiv
IV	Major Revisions	xiv
V	Comments	xiv
Standard		
1	**General**	
1.1	Scope	1
1.2	Purpose	1
1.3	Application	1
2	**References**	2
3	**Definitions**	3
4	**Requirements**	
4.1	Materials	4
4.2	General Design	7
4.3	Detailed Design	9
4.4	Marking	13
5	**Verification**	
5.1	Notice of Nonconformance	13
6	**Delivery**	
6.1	Packaging and Shipping	13
6.2	Affidavit of Compliance	13
Appendix		
A	Supplemental Information	15
A.1	Units of Measure	15
A.2	Register Dial Types	15
A.3	Tests	15
A.4	Testing Equipment	17
A.5	Registration Accuracy	17
A.6	Periodic Tests	18
A.7	Meter Storage	19
A.8	Installation	19
Tables		
1	Characteristics of Fluidic-Oscillator Meters	7
2	Dimensional Design Limits for Meters and External Connections	8
3	Flange Dimensions	10
4	Maximum Indication on Initial Dial and Minimum Register Capacity	11
A.1	Most Frequently Used Intervals Between Meter Tests	18

Copyright © 2024 by American Water Works Association. All Rights Reserved

This page intentionally blank.

Copyright © 2024 by American Water Works Association. All Rights Reserved

Foreword

This foreword is for information only and is not a part of ANSI/AWWA C713.*

I. Introduction

I.A. *Background.* Fluidic-oscillator meters covered by this standard represent a measurement technique that differs from those used in other AWWA standards. The basis for volume measurement is a transducer element that utilizes fluidic oscillation in place of the moving mechanical element required in most traditional cold-water volumetric meters.

Flowing water enters the transducer, and a converging entrance nozzle forms a jet flow. Two diverging walls produce opposing forces on the jet flow due to the Coandă† effect and cause the jet to oscillate. Each oscillation corresponds to a specific volume of water flowing through the meter, and these are electronically detected, integrated, and displayed on the register.

I.B. *History.* While the knowledge of fluidic principles is quite old, it was not until the 1960s that fluidic devices began to be used commercially in measurement and control applications. Because of high costs, fluidic-oscillator meters were initially used in both gas and liquid industrial measurement. Within the last 10 or 15 years, advances in electronics have made reductions in size and power requirements possible and have made fluidic-oscillator meters commercially feasible for residential water use measurement.

This standard was developed by AWWA Subcommittee 380.10, which was originally formed on June 10, 2000, to develop a standard for solid-state meters of capacity and application similar to ANSI/AWWA C700.

On June 15, 2002, the work of the subcommittee was redirected to develop a standard for fluidic-oscillator meters. The first edition of the standard was approved by the AWWA Board of Directors on Jan. 16, 2005. Subsequent editions were approved on Jan. 17, 2010, Jan. 24, 2015, and Oct. 28, 2019. This edition was approved on Oct. 14, 2024.

I.C. *Acceptance.* In May 1985, the US Environmental Protection Agency (USEPA) entered into a cooperative agreement with a consortium led by NSF

* American National Standards Institute, 1180 Avenue of the Americas, 10th Floor, New York, NY 10036.

† The Coandă effect is the observed tendency of a stream of fluid emerging from a nozzle to follow a nearby curved or flat surface. The effect was discovered in the 1930s by Henri-Marie Coandă.

Copyright © 2024 by American Water Works Association. All Rights Reserved

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 Water Research Foundation (formerly 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. Specific policies of the state or local agency.
2. Four standards developed under the direction of NSF: NSF/ANSI/CAN[¶] 60, Drinking Water Treatment Chemicals—Health Effects; NSF/ANSI/CAN 61, Drinking Water System Components—Health Effects; NSF/ANSI/CAN 372, Drinking Water System Components—Lead Content; and NSF/ANSI/CAN 600, Health Effects Evaluation and Criteria for Chemicals in Drinking Water.
3. 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/CAN 61. Individual states or local agencies have authority to accept or accredit certification organizations within their jurisdictions. Accreditation of certification organizations may vary from jurisdiction to jurisdiction.

NSF/ANSI/CAN 600 (which formerly appeared in NSF/ANSI/CAN 60 and 61 as Annex A, "Toxicology Review and Evaluation Procedures") 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 NSF/ANSI/CAN 600 procedures may not always be identical, depending on the certifier.

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

[§] Persons outside the United States should contact the appropriate authority having jurisdiction.

[¶] Standards Council of Canada, 55 Metcalfe Street, Suite 600, Ottawa, ON K1P 6L5 Canada.

[**] Both publications available from The National Academies Press, 500 Fifth Street NW, Washington, DC 20001.

Copyright © 2024 by American Water Works Association. All Rights Reserved

In 1991, under the Safe Drinking Water Act (SDWA), the USEPA published a federal regulation known as the Lead and Copper Rule (LCR) to minimize lead and copper in drinking water. Numerous revisions to the LCR have taken place since 1991. On Jan. 15, 2021, the USEPA issued the Lead and Copper Rule Revisions (LCRR). On Dec. 6, 2023, the USEPA proposed additional changes in the Lead and Copper Rule Improvements (LCRI). A key provision in the LCRI proposal was to lower the lead action level from 15 ppb to 10 ppb. The LCRI was made final on Oct. 8, 2024.

The ANSI-approved national standard, NSF/ANSI/CAN 372, Drinking Water System Components—Lead Content, was published in 2010. On Jan. 4, 2011, legislation was signed revising the definition for "lead free" within the Safe Drinking Water Act (SDWA) as it pertains to "pipe, pipe fittings, plumbing fittings, and fixtures." The changes went into effect on Jan. 4, 2014. In brief, the revised provisions to the SDWA require that these products meet a weighted average lead content of not more than 0.25 percent. In 2020, the USEPA set a Sept. 1, 2023, deadline for products to meet the new lead content requirements outlined in the "Lead Free" Rule. This new rule outlines that manufacturers are required to be certified to NSF/ANSI/CAN 372.

A majority of US states require ANSI-accredited certification to NSF/ANSI/CAN 61, and many other states either require or recommend compliance with NSF/ANSI/CAN 61.

The USEPA, Health Canada, and other state and local regulatory agencies have been taking steps to limit per- and polyfluoroalkyl substances, or PFAS, in drinking water. In March 2023, for example, USEPA proposed legally enforceable levels for six different PFAS. These are PFOA, PFOS, PFNA, PFHxS, PFBS, and HFPO-DA (also known as GenX chemicals). USEPA also finalized an MCL for a combination of PFHxS, PFNA, HFPO-DA, and PFBS.

On Apr. 26, 2024, the USEPA finalized primary drinking water standards (MCLs) for these six PFAS compounds. This final National Primary Drinking Water Regulation (NPDWR) requires public water systems to take the following actions:

1. Public water systems must monitor for these PFAS and have three years to complete initial monitoring (by April 2027), followed by ongoing compliance monitoring. Water systems must also provide the public with information on the levels of these PFAS in their drinking water beginning in 2027.

2. Public water systems have five years (by April 2029) to implement solutions that reduce these PFAS if monitoring shows that drinking water levels exceed these MCLs.

Copyright © 2024 by American Water Works Association. All Rights Reserved

3. Beginning in 2029, public water systems that have PFAS in drinking water which violates one or more of these MCLs must take action to reduce levels of these PFAS in their drinking water and must provide notification to the public of the violation.

Water meter manufacturers should avoid using materials where these PFAS compounds are intentionally added as part of the material formation of meter components that come in contact with potable water. As of the effective date of this ANSI/AWWA C713-24 standard (June 1, 2025), these final MCL criteria are expected to be directly adopted in NSF/ANSI/CAN 600 as new health effects criteria for NSF 61, and a task group under the NSF 61 Joint Committee has begun to investigate expanding the scope of PFAS testing for drinking water system components within NSF/ANSI/CAN 61.

ANSI/AWWA C713 does not address additives requirements. 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 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. *Fire Flow.* The meters described in this standard are not designed to be used in water service piping intended to extinguish fire. Requirements for meters used for residential fire sprinkler applications that meet the requirements of NFPA[††] 13D in single- and two-family dwellings and manufactured homes, sizes ¾ in. (20 mm) through 2 in. (50 mm), are found in ANSI/AWWA C714.

II.B. *Chlorine and Chloramine Degradation of Elastomers.* The selection of materials is critical for water service and distribution piping in locations where there is a possibility that elastomers will be in contact with chlorine or chloramines. Documented research has shown that elastomers such as gaskets, seals, valve seats, and encapsulations may be degraded when exposed to chlorine or chloramines. The impact of degradation is a function of the type of elastomeric material, chemical concentration, contact surface area, elastomer cross section, and environmental conditions including temperature. Careful selection of and specifications for elastomeric materials and the specifics of their application for each water system component should be considered to

[††] National Fire Protection Association, One Batterymarch Park, Quincy, MA 02169-7471.

Copyright © 2024 by American Water Works Association. All Rights Reserved

provide long-term usefulness and minimum degradation (swelling, loss of elasticity, or softening) of the elastomer specified.

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 following information should be provided by the purchaser:

1. Standard used—that is, ANSI/AWWA C713, Standard for Cold-Water Meters—Fluidic-Oscillator Type, of latest revision.

2. Whether compliance with NSF/ANSI/CAN 61, Drinking Water System Components—Health Effects; NSF/ANSI/CAN 372, Drinking Water System Components—Lead Content; or an alternative lead content criterion is required.

3. Details of federal, state, provincial, territorial, and local requirements (Sec. 4.1).

4. Whether the main case shall be of conventional double-case construction or of modified double-case construction (Sec. 4.1.2), and if there is a preference.

5. If meters are to be furnished with cast-iron, stainless-steel, copper-alloy, or suitable engineering plastic top or bottom covers (Sec. 4.1.5.1 and Sec. 4.1.5.2), and if there is a preference.

6. If meters are to be furnished with breakable bottom covers (frost-protection devices) (Sec. 4.1.5.2). Breakable bottom covers are only to be used for meter sets properly equipped to handle functioning failed frost bottoms that can flood surroundings with pressurized water when thawing occurs.

7. If meters are to be furnished with full polymer liners (Sec. 4.1.5.2).

8. Size of meters (Sec. 4.2.1) and number of units required.

9. If meters are to be furnished with coupling nuts and tailpieces (Sec. 4.3.2.1) and whether they are to be copper alloy or suitable engineering plastic (Sec. 4.1.7).

10. If 1½-in. (40-mm) and 2-in. (50-mm) meters are to be furnished with flanged ends or threaded (spud) ends (Sec. 4.3.2.2).

11. If flanged meters are to be furnished with companion flanges, gaskets, bolts, and nuts (Sec. 4.3.2.2).

12. If meters are to be furnished with direct-reading registers, pulse-output registers, or encoder-type registers (Sec. 4.3.3).

13. If compliance with ANSI/AWWA C707, Standard for Encoder-Type Remote-Registration Systems for Cold-Water Meters, is to be required for meters that will be connected to encoder-type remote systems (Sec. 4.3.3.2).

Copyright © 2024 by American Water Works Association. All Rights Reserved

14. Whether meter batteries shall be replaceable or nonreplaceable (Sec. 4.3.7), and if there is a preference.

15. If an affidavit of compliance (Sec. 6.2) and certificate of testing for accuracy (Sec. A.3.3) are required.

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. Updated information on the USEPA Lead and Copper Rule and regulatory status of per- and polyfluoroalkyl substances, or PFAS, in drinking water has been added to foreword Sec. I.C Acceptance.

2. Material references to ASTM standards have been updated throughout the standard.

3. Information on meter installation methods has been modified (Sec. A.8.3 and Sec. A.8.4). Meter installation methods are covered in more detail in AWWA Manual M6.

V. Comments. If you have any comments or questions about this standard, please call AWWA Engineering and Technical Services at 303.794.7711, write to the department at 6666 West Quincy Avenue, Denver, CO 80235-3098; or email at standards@awwa.org.

Copyright © 2024 by American Water Works Association. All Rights Reserved

American Water Works Association

ANSI/AWWA C713-24
(Revision of ANSI/AWWA C713-19)

AWWA Standard

Cold-Water Meters—Fluidic-Oscillator Type

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes cold-water fluidic-oscillator meters with brass main cases in sizes ½ in. (13 mm)* through 2 in. (50 mm), and the materials and workmanship employed in their fabrication. The basis for volume measurement is a transducer element that senses and utilizes fluidic oscillation rather than a moving measurement element, as required in traditional cold-water volumetric meters.

Sec. 1.2 Purpose

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

Sec. 1.3 Application

This standard can be referenced in specifications for purchasing and receiving cold-water meters—fluidic-oscillator type. This standard can be used as a guide for manufacturing this type of meter. The stipulations of this standard apply when this

* Metric conversions given in this standard may be either rounded, truncated, or direct conversions of the US customary units and are not necessarily those specified in International Organization for Standardization (ISO) Standards.

Copyright © 2024 by American Water Works Association. All Rights Reserved