ANSI/AWWA **B703-24**

(Revision of ANSI/AWWA B703-19)

AWWA Standard

Fluorosilicic Acid

Effective date: June 1, 2025.
First edition approved by Board of Directors July 30, 1954.
This edition approved Oct. 14, 2024.
Approved by American National Standards Institute Oct. 1, 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. 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 writing to the American National Standards Institute, 1180 Avenue of the Americas, 10th Floor, New York, NY 10036; calling 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-13, print: 978-1-64717-248-0

ISBN-13, electronic: 978-1-61300-771-6

DOI: http://doi.org/10.12999/AWWA.B703.24

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 Committee on Fluorides, which reviewed and approved this standard, had the following personnel at the time of approval:

Theresa Jean Boehmer, *Chair*

General Interest Members

T.J. Boehmer, Centers for Disease Control and Prevention, Atlanta, Ga.
K. Duchon, Consultant, Decatur, Ga.
N.J. Edman (*liaison, nonvoting*), Standards Group Liaison, AWWA, Denver, Colo.
L. Hans (*liaison, nonvoting*), Standards Council Liaison, Fort Collins, Colo.
E.A. Moreno, Gentle Family Dentists, West Liberty, Iowa
M.L. Wentink, Nebraska Department of Environment and Energy, North Platte, Neb.

Producer Members

T.L. Fitzgerald, PMG Fitz LLC, St. Peters, Mo.
J.W. Fulcher, Univar Specialties, Downers Grove, Ill.
R.L. Horne, Pennco, Inc., San Felipe, Tex.

User Members

P. Devlin, Peterborough Utilities Group, Peterborough, Ont.
M.B. Gilton, Turlock, Calif.
L.J. Hammes, West Des Moines Water Works, West Des Moines, Iowa
D.J. Huggins, City of London Water Operations, London, Ont.
J.S. Trotter, Ellettsvile, Ind.

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	vii
I.A	Background	vii
I.B	History	viii
I.C	Acceptance	viii
II	Special Issues	x
II.A	Storage, Handling, and Safety Precautions	x
III	Use of This Standard	xi
III.A	Purchaser Options and Alternatives	xi
III.B	Modification to Standard	xii
IV	Major Revisions	xii
V	Comments	xii
Standard		
1	**General**	
1.1	Scope	1
1.2	Purpose	1
1.3	Application	1
2	**References**	2
3	**Definitions**	2
4	**Requirements**	3
4.1	Physical Requirements	3
4.2	Chemical Requirements	3
4.3	Impurities	3
5	**Verification**	
5.1	Sampling and Laboratory Examination	5
5.2	Test Procedures	6
5.3	Notice of Nonconformance	10
6	**Delivery**	
6.1	Marking	10
6.2	Packaging and Shipping	11
6.3	Affidavit of Compliance or Certified Analysis	12
Appendixes		
A	Materials Compatibility	15
B	Fluorosilicic Acid—Contaminants	16
Tables		
1	Maximum Allowed Concentrations of Impurities in Fluorosilicic Acid	4
2	Impurity Analytic Methods	9
B.1	Fluorosilicic Acid—Contaminants	16

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 B703.*

I. Introduction.

I.A. *Background.* Community water fluoridation is an effective, safe, and relatively inexpensive way to prevent tooth decay. Since the first fluoridation installation during 1945, studies have shown that this method of fluoride delivery benefits Americans of all ages and every socioeconomic status. Dental decay can be reduced by 20 to 40 percent among children who have consumed fluoridated water since birth. Fluorosilicic acid (H_2SiF_6) is one of several fluoride compounds presently being added to drinking water to reduce the incidence of dental cavities.

Fluorosilicic acid is an aqueous solution of H_2SiF_6—water white to amber in color. It is a corrosive acid that is irritating to the skin and has a pungent odor. It is not known to exist in any anhydrous form. The boiling point increases with increasing acid content. At a typical commercial strength of 25 percent acid content, the boiling point is 105.8°C (222.5°F), and the freezing point is approximately –15.5°C (4°F). A 25 percent solution has a pH of 1.2 and weighs 10.1 lb/gal (1.20 kg/L). The molecular weight of H_2SiF_6 is 144.08.

Most fluorosilicic acid is produced as a co-product in the manufacture of wet-process phosphoric acid and other phosphate fertilizers. The raw material, phosphate rock, contains fluoride and silica and is treated with sulfuric acid, which evolves the gases silicon tetrafluoride (SiF_4) and hydrogen fluoride (HF). These gases are passed through scrubbers and react with water to form fluorosilicic acid. Fluorosilicic acid can also be produced by fluorspar (CaF_2) reacting with sulfuric acid, which evolves just hydrogen fluoride. The hydrogen fluoride is then reacted with quartz (silicon dioxide) and water to form fluorosilicic acid. This acid is the principal raw material in the production of all silicofluoride salts. It is also used in the ceramic, brewing, paint, and metallurgical industries.

Fluorosilicic acid is added to water using various liquid-feeding devices and metering pumps. It is normally fed directly into the water to produce the optimal fluoride concentration. Dilution of the acid before feeding is not recommended. If the acid is too concentrated for the solution feeder to control, solutions of other compounds are generally indicated: for example, solutions of sodium fluoride or sodium fluorosilicate.

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

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

If the acid must be diluted, dilutions in the range of 10 to 1 and 20 to 1 (parts water to parts acid) should be avoided because they often result in the formation of an insoluble silica precipitate that can clog feeders, orifices, and other equipment. The use of softened or distilled water has no effect on the formation of this precipitate. However, the precipitate can be avoided by using dilutions outside the critical range (dilutions in the range of 200:1 to 100:1 are known to work well) or by using acid that has been fortified with hydrogen fluoride (HF). Refer to AWWA Manual M4, *Water Fluoridation Principles and Practices,*[†] for additional technical information concerning the application and use of fluorosilicic acid.

I.B. *History.* This standard was first published in the November 1954 issue of *Journal AWWA* as tentative, having been approved on July 30, 1954, by the AWWA Board of Directors. Subsequent revisions to ANSI/AWWA B703 were approved on May 15, 1960; June 18, 1971; Jan. 30, 1984; Jan. 29, 1989; Jan. 30, 1994; Jan. 23, 2000; Feb. 12, 2006; and June 12, 2011. The last edition was prepared by the AWWA Standards Committee on Fluorides and approved on Apr. 19, 2019. This edition was approved on Oct. 14, 2024.

I.C. *Acceptance.* Products that are covered by this standard should have certification in accordance with NSF[‡]/ANSI/CAN[§] 60, Drinking Water Treatment Chemicals—Health Effects and documentation on conformational testing to ANSI/AWWA B703 criteria.

Conformational testing to ANSI/AWWA B703 should be provided by the supplier to the consumer with each lot delivered. It is recommended that the consumer also conduct independent validation testing to confirm the conformational testing by the producer.

Certification of product quality in accordance with NSF/ANSI/CAN 60 should be indicated for each lot delivered and provided to the consumer by the supplier in accordance with NSF/ANSI/CAN 60 requirements.

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 Water Research Foundation (formerly AwwaRF) and the Conference of State Health and Environmental Managers (COSHEM). AWWA and the Association of

[†] AWWA, 6666 West Quincy Avenue, Denver, CO 80235.
[‡] NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105.
[§] Standards Council of Canada, 55 Metcalfe Street, Suite 600, Ottawa, ON K1P 6L5 Canada.

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

State Drinking Water Administrators (ASDWA) joined later. In April 1990, USEPA formally withdrew its list of acceptable drinking water additives, and regulatory oversight of direct and indirect drinking water additives passed to the process developed by the consortium under the leadership of NSF.

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 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 372, Drinking Water System Components—Lead Content; and NSF/ANSI/CAN 600, Health Effects Evaluation and Criteria for Chemicals in Drinking Water. NSF, in cooperation with ASDWA, does a biennial survey of the US states and Canadian provinces/territories to determine which states and provinces/territories require, by legislation, regulations or policies that products and drinking water additives be evaluated by NSF/ANSI/CAN 60 and 61. Survey results from 2009 show adoption of NSF/ANSI/CAN 60 by 47 states and nine provinces/territories and adoption of NSF/ANSI/CAN 61 by 46 states and 11 provinces/territories.

Various certification organizations may be involved in certifying products in accordance with NSF/ANSI/CAN 60. 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.

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.

ANSI/AWWA B703 addresses additives requirements in Sec. 4.3 of the standard. The transfer of contaminants from chemicals to processed water or to residual solids is becoming a problem of greater concern. The language in Sec. 4.3.3 is a recommendation only for direct additives used in the treatment of potable water to be certified by an

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

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

accredited certification organization in accordance with NSF/ANSI/CAN 60 Drinking Water Treatment Chemicals—Health Effects. However, users of the standard may opt to make this certification a requirement for the product. 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. *Storage, Handling, and Safety Precautions.* Fluorosilicic acid must be handled carefully because it is corrosive. If the acid comes in contact with skin, the affected parts should be immediately rinsed thoroughly for at least 15 min with water. Then apply 2.5 percent calcium gluconate gel liberally to areas suspected of fluorosilicic acid contact, paying particular attention to areas under the fingernails. It is recommended that a supply of the gel be kept on site wherever fluorosilicic acid is handled or stored. Prompt medical attention should follow. For information on safety, refer to the safety data sheets available from the chemical supplier or manufacturer. Protective safety gear should be worn when handling fluorosilicic acid. The following protective clothing and equipment should be the minimum available:

1. gauntlet neoprene gloves (12-in. [300-mm] minimum glove length),
2. full 8-in. (200-mm) face shield and chemical splash-proof safety goggles,
3. heavy-duty, acid-proof-type neoprene aprons, and
4. safety shower and eyewash in an easily accessible location.

Bulk storage tanks and other containers can be made of polyethylene, rubber-lined steel, fiberglass-reinforced plastic (FRP), or other appropriate materials. Storage tanks for fluorosilicic acid shall also be placed in proper secondary containment made with appropriate lined materials.

FRP for fluorosilicic acid applications should be composed of an epoxy vinyl ester resin. The acid contact surfaces of the FRP should be provided with a single or double synthetic veil/liner. After an FRP tank is constructed, it should be cured using methyl ethyl ketone peroxide (MEKP).

Materials such as glass, ceramics, steel, concrete, and wood are not suitable for fluorosilicic acid containers and other equipment because they are attacked by the hydrofluoric acid (HF) and SiF_4 formed at the surface of the fluorosilicic acid. Bulk storage tanks and other containers can be made of polyethylene, rubber-lined steel, fiberglass, or other appropriate materials. The polyethylene should be manufactured

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

from high-density, crosslinked material (crosslinking provides strength). The polyethylene should contain a minimum of 0.25 percent ultraviolet (UV) stabilizer to protect against sunlight. Steel tanks must always be lined. The linings are commonly made of natural rubber, neoprene, butyl rubber, or equivalent and should be at least 2.4-mm (3⁄32-in.) thick. Fiberglass for fluorosilicic acid applications must be composed of a vinyl ester resin and a synthetic veil/liner. Structural carbon, Hastelloy C, Durimet 20, or equivalent materials can be used for hardware. The rooms where the acid is stored and used should be thoroughly ventilated with a vent located near the ceiling because acid fumes are lighter than air. Closed tanks should be vented to the outside, and such tank venting systems should be pressure tested for leaks before being placed into service. When crosslinked polyethylene tank venting systems are pressure tested, extreme care must be exercised, as maximum allowed tank overpressures are typically ~5 psig. Additional information on materials compatibility appears in Appendix A.

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 B703, Fluorosilicic Acid, of latest revision.

2. Whether compliance with NSF/ANSI/CAN 60, Drinking Water Treatment Chemicals—Health Effects, is required.

3. Details of federal, state, provincial, territorial, and local requirements (Section 4).

4. Concentration (strength of acid desired) (Sec. 4.2). The acid shall contain between 20 and 30 percent H_2SiF_6 by weight. Where variations in acid strength are acceptable, arrangements should be made between the purchaser and the supplier as to the method of payment based on the aggregated acid content.

5. Whether the purchaser will reject product from containers or packaging with missing or damaged seals. The purchaser may reject product from bulk containers or packages with missing or damaged seals unless the purchaser's tests of representative samples, conducted in accordance with Sec. 5.2, demonstrate that the product meets the standard. Failure to meet the standard or the absence of, or irregularities in, seals may be sufficient cause to reject a shipment.

6. Form of shipment—bulk or package, package type, and package size (Sec. 6.2).

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

7. Whether alternative security measures have been adopted to replace or augment the security measures set out in Sec. 6.2.5 and Sec. 6.2.6.

8. Affidavit of compliance, certified analyses, or both, if required (Sec. 6.3).

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. Major changes made in this revision of the standard include the following:

1. Minor boilerplate updates to the following sections:
    - I.C. Acceptance
    - III. A. Purchaser Options and Alternatives
    - Section 2: References
    - Section 4: Requirements
    - Sec. 4.3.3. Product certifications

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 e-mail at standards@awwa.org.

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

American Water Works Association

ANSI/AWWA B703-24
(Revision of ANSI/AWWA B703-19)

AWWA Standard

Fluorosilicic Acid

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes fluorosilicic acid (H_2SiF_6) for use in the treatment of potable water.

Sec. 1.2 Purpose

The purpose of this standard is to provide the minimum requirements for fluorosilicic acid, including physical, chemical, sampling, packaging, shipping, and testing requirements.

Sec. 1.3 Application

This standard can be referenced in documents for purchasing and receiving fluorosilicic acid and can be used as a guide for testing the physical and chemical properties of fluorosilicic acid samples. The stipulations of this standard apply when this document has been referenced and only to fluorosilicic acid used in the treatment of potable water.

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