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ANSI/AWWA B406-14
(Revision of ANSI/AWWA B406-06)

American Water Works Association

*Dedicated to the World's Most Important Resource™*

AWWA Standard

# Ferric Sulfate

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Approved by American National Standards Institute June 2, 2014.

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# Committee Personnel

The AWWA Subcommittee on Ferric Sulfate–Ferrous Sulfate, 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 B406.*

## I. Introduction.

I.A. *Background.* Ferric sulfate is used as an inorganic coagulant for removal of suspended and colloidal particles from water by coagulation and flocculation. It is prepared by oxidizing ferrous sulfate or by dissolving ferric oxide in sulfuric acid. Ferric sulfate is available in dry form as a powdery-granular product, grayish-white to reddish-gray in color, or as a stable solution that is relatively clear and reddish-brown in color. The term *ferric sulfate* as used in this standard refers to the manufactured ferric sulfate product, a partially hydrated dry ferric sulfate having the basic formula $Fe_2(SO_4)_3 \cdot xH_2O$ in which $x$ averages approximately 9. This ferric sulfate dissolves rapidly in water, as contrasted with anhydrous ferric sulfate, which dissolves very slowly in water. Similarly, in this standard the term *liquid ferric sulfate* refers to a solution of ferric sulfate containing between 10 percent and 14 percent ferric iron by weight. This percentage may be varied by agreement between the supplier and purchaser.

I.B. *History.* This standard was first approved as tentative on Jan. 23, 1961, by the AWWA Board of Directors, and was approved as a standard on Feb. 11, 1964. Subsequent revisions to ANSI/AWWA B406 were approved by the AWWA Board of Directors in 1987, 1992, 1997, and 2006. This edition of B406 was approved by the AWWA Board of Directors on June 8, 2014.

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, now Water Research Foundation) 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

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† Persons outside the United States should contact the appropriate authority having jurisdiction.

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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 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.

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

Annex A, "Toxicology Review and Evaluation Procedures," to NSF/ANSI 60, 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.

ANSI/AWWA B406 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. 4.3.2 is a recommendation only for direct additives used in the treatment of potable water to be certified by an accredited certification organization in accordance with NSF/ANSI 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. *Manufacture and Use of Ferric Sulfate.* Due to the corrosivity of chlorides on some metals, this edition of ANSI/AWWA B406 includes a limitation on chloride impurity of 10 ppm $Cl^-$ per 1 percent of contained ferric iron. This limitation is based on a static-test corrosion test using liquid ferric sulfate, which contained 10 percent ferric iron in a solution containing up to 1,000 ppm $Cl^-$ held at 100°F (38°C), in which no corrosion of 304 or 316 stainless steel resulted during 21 days of contact. Mild

* NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105.

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steel as a control, however, was consumed in several days, regardless of the presence or absence of chlorides. Because a hot ferric sulfate solution containing chlorides may increase corrosivity or extraction of metal impurities when loaded, stored, or used at product temperatures exceeding 100°F (38°C), the purchaser may wish to discuss with the supplier the level of chlorides, temperatures, and potential corrosivity, particularly with temperatures exceeding 100°F (38°C).

II.B. *Storage and Handling Considerations.* Dry ferric sulfate is mildly hygroscopic and should, therefore, be stored in a dry place. When feeding ferric sulfate, the correct water ratio (quantity of water to weight of material in the dissolving tank) should be maintained. The feeding equipment manufacturer's directions for feeding should be followed.

Liquid ferric sulfate should be stored in corrosion-resistant tanks and metered into the water as required with appropriate metering equipment. While liquid ferric sulfate remains a stable liquid for at least 72 hr at 32°F (0°C) without freezing or crystallizing, with only a slight increase in viscosity, it is recommended that tanks be insulated or heated if prolonged periods of temperature below 32°F (0°C) are normally expected.

Human exposure to either dry or liquid ferric sulfate should be minimized by adequate ventilation, protective clothing, good hygiene, and careful "housekeeping" practices. Personnel handling dry ferric sulfate should wear goggles, a dust mask, gloves, and other protective clothing. Those handling liquid ferric sulfate should wear goggles, gloves, and an acid-resistant apron. Splashing or misting of the liquid should be avoided. A respirator with an activated carbon filter suitable for a weak sulfuric acid mist should be worn when handling liquid ferric sulfate.

II.C. *Basis for Payment.* The basis for payment shall be the net weight of ferric sulfate supplied, excluding the weight of the shipping container.

II.D. *Free Acid.* Liquid ferric sulfate can be manufactured with free sulfuric acid levels from 0 percent to over 3.5 percent. The purchaser and supplier may agree on a free acid level in excess of or lower than the standard maximum depending on the application.

**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 B406, Ferric Sulfate, of latest revision.

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2. Type of ferric sulfate to be supplied.

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

4. If requesting impurity information, the purchaser must state maximum impurity content limits and the analytical methods to be used to determine compliance with the limits (Sec. 4.3).

5. Quantity of ferric sulfate required and method of packaging and shipping (Section 5 and Section 6).

6. If an analysis by a referee laboratory is required (Sec. 5.10.1), the assignment of testing costs should be addressed.

7. Whether weight certificates are required (Sec. 6.2.5).

8. An affidavit of compliance, certified analysis, or both, if required (Sec. 6.3).

9. Details of other federal, state or provincial, and local requirements (Section 4).

10. 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. 5.5, Sec. 5.6, Sec. 5.8, and Sec. 5.9, 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.

11. Whether alternative security measures have been adopted to replace or augment the security measures set out in Sec. 6.2.6 and 6.2.7.

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

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

1. Inclusion of a requirement for compliance with the Safe Drinking Water Act and other federal regulations.

2. Inclusion of a requirement for tamper-evident packaging (Sec. 6.2.6 and 6.2.7).

**V. Comments.** If you have any comments or questions about this standard, please call AWWA Engineering and Technical Services at 303.794.7711, FAX at 303.795.7603, write to the department at 6666 West Quincy Avenue, Denver, CO 80235-3098, or email at standards@awwa.org.

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# Ferric Sulfate

## SECTION 1: GENERAL

### Sec. 1.1 Scope

This standard describes dry-form ferric sulfate and liquid ferric sulfate for use in the treatment of potable water, wastewater, or reclaimed water.

### Sec. 1.2 Purpose

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

### Sec. 1.3 Application

This standard can be referenced in documents for purchasing and receiving ferric sulfate and can be used as a guide for testing the physical and chemical properties of ferric sulfate. The stipulations of this standard apply when this document has been referenced and then only to ferric sulfate used in the treatment of potable water, wastewater, or reclaimed water.

## SECTION 2: REFERENCES

This standard references the following document. In its latest edition, it forms a part of this standard to the extent specified within the standard. In any case of conflict, the requirements of this standard shall prevail.