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(Revision of ANSI/AWWA B603-16)

AWWA Standard

Permanganates

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American Water Works Association

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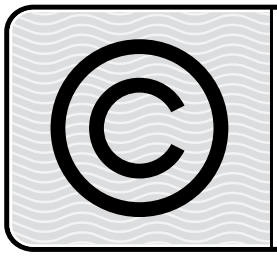
AWWA Standard

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The AWWA Standards Committee on Taste and Odor Control Chemicals, which reviewed and approved this standard, had the following personnel at the time of approval:

Nathan K. Dunahee, *Chair*

General Interest Members

N.K. Dunahee, Burns & McDonnell, Kansas City, Mo.
N. Edman (*liaison, nonvoting*), Standards Group Liaison, AWWA, Denver, Colo.
T.E.T. Gillogly, Carollo Engineers, Inc., Walnut Creek, Calif.
M.V. Liga, LAN Inc., Houston, Tex.
M.S. Reed (*liaison, nonvoting*), Standards Council Liaison, City of Fort Worth, Water Department, Fort Worth, Tex.

Producer Members

J.E. Boll, Carus Corporation, Peru, Ill.

User Members

B.E. Perron, Salem-Beverly Water Supply Board, Beverly, Mass.
M. Ramon, City of Houston, Houston, Tex.
G. Terrell, Birmingham, Ala.

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA B603.

I. Introduction.

I.A. *Background.* Potassium permanganate and sodium permanganate are strong oxidizing agents. They oxidize organic matter responsible for many types of tastes, odors, and colors. Potassium permanganate and sodium permanganate oxidize dissolved iron, manganese, and arsenic to produce oxides, which can then be settled or filtered out. They also oxidize hydrogen sulfide, thereby eliminating the rotten-egg odor. Potassium permanganate is listed by the US Environmental Protection Agency (USEPA) as a substitute preoxidant for chlorine to control total trihalomethanes (TTHMs).

Potassium permanganate ($KMnO_4$) is a manufactured product. Potassium permanganate crystals are rhombic or needlelike in shape and are purple or bronze in color. They are manufactured in several different grades. Any grade of potassium permanganate that meets quality and feed requirements may be used in water treatment. The two most widely used grades are technical grade, designed for solution feed, and free-flowing grade, suitable for either solid or solution feed. The free-flowing grade contains an additive to minimize caking and lumping caused by moisture and compaction. It may be gray because of the additive.

Liquid sodium permanganate ($NaMnO_4$) solution is an alternative to dry potassium permanganate crystals. This product was developed in response to requests by users for a liquid permanganate solution. Because of the limited solubility of potassium permanganate (6 percent at room temperature), the cation was exchanged to increase the solubility. Sodium permanganate is commercially available in concentrations up to 40 percent by weight and is manufactured according to the same manufacturing practices described above that are used in the manufacture of potassium permanganate.

I.B. *History.* AWWA B603 was initially approved as a standard by the AWWA Board of Directors on Jan. 28, 1968. Revisions were approved on May 8, 1977; June 5, 1983; June 19, 1988; June 6, 1993; June 21, 1998; June 15, 2003; Jan. 17, 2010; and Jan. 16, 2016. This edition was approved on March 13, 2023.

I.C. *Acceptance.* In May 1985, 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

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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 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.

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 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.

ANSI/AWWA B603 addresses additives requirements in Sec. 4.3.2 of the standard. The transfer of contaminants from chemicals to processed water or to the residual solids is becoming a problem of great 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/CAN 60, Drinking Water Treatment Chemicals—Health Effects. However, users of the standard may opt to make this certification a requirement for the product.

* Persons outside the United States should contact the appropriate authority having jurisdiction.
† NSF, 789 North Dixboro Road, Ann Arbor, MI 48105.
‡ American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.
§ Standards Council of Canada, 55 Metcalfe Street, Suite 600, Ottawa, ON K1P 6L5 Canada.

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Users of this standard should also 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 and Handling Precautions.* Permanganates are strong oxidizing agents and should be treated as such. The products themselves are noncombustible but will accelerate the burning of combustible materials. They react with many materials, and care should be exercised in their handling, storage, and use. Therefore, contact with all combustible materials or chemicals must be avoided. These include but are not limited to wood, cloth, organic materials, and charcoal. Avoid contact with acids, peroxides, sulfites, oxalates, and other oxidizable inorganic chemicals. Permanganates should be segregated from ammonium compounds, metallic powders, phosphorus, hydrogen peroxide, carbon, metal hydrides, hydrazine, hydroxylamines, antifreeze, hydraulic oils, and formaldehyde.

The products should be stored in a cool, dry area in closed containers and should be protected from physical damage. Concrete floors are preferred. Avoid wooden decks. Protect the liquid sodium permanganate solution from freezing.

Spills of dry potassium permanganate should be swept up and transferred to clean metal drums and disposed of according to federal, state or provincial, and local regulations. Spilled dry potassium permanganate should not be returned to the original drums that contain uncontaminated product. After the permanganate has been cleaned up, the residual permanganate on the floor should be flushed with water into a sanitary sewer, complying with federal, state or provincial, and local regulations.

Spills of liquid sodium permanganate solution should be collected and disposed of properly. Contain and dilute spillage to approximately 6 percent with water and reduce the permanganate with sodium thiosulfate, sodium bisulfite, or sodium metabisulfite. Deposit sludge in an approved landfill or, where permitted, flush into a sanitary sewer with large quantities of water.

When handling either potassium permanganate or sodium permanganate, good safety procedures must be observed. These include the use of safety goggles, safety glasses with side shields, or face shields; impervious rubber or PVC gloves; and aprons. A NIOSH–MSHA-approved respirator meeting general industry standards as described in

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ANSI/ASSE* Z88.2, American National Standard Practices for Respiratory Protection, latest revision, is recommended when handling dry potassium permanganate crystals and where significant exposure to the liquid sodium permanganate solution exists.

If clothing becomes spotted when handling the liquid sodium permanganate, wash off immediately with large quantities of water.

Permanganates are corrosive to the eyes and can cause severe burns. If exposed to permanganate, immediately flush the affected eye with water for 15 min while holding the eyelid open. Consult a physician immediately.

For additional safety aspects, refer to safety data sheets (SDSs) available from the chemical supplier or manufacturer.

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 B603, Permanganates, 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 (Sec. 4).

4. Grade desired—technical, free-flowing, or other dry crystals, or liquid solution. Physical and chemical requirements are provided in the standard for both the dry technical and free-flowing grades (Sec. 4.1.1) and the liquid products (Sec. 4.1.2). Chemical requirements for dry potassium permanganate are provided for technical and free-flowing grades (Sec. 4.2). If a grade other than technical, free-flowing, or liquid product is desired, the purchaser must specify the requirements of the grade desired.

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. 5.3, Sec. 5.4, and Sec. 5.5, 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 the shipment.

* American Society of Safety Professionals (formerly American Society of Safety Engineers), 520 North Northwest Highway, Park Ridge, IL 60068.

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

7. Whether alternative security measures have been adopted to replace or augment the security measures set out in Sec. 6.2.3 and Sec. 6.2.4.

8. Affidavit of compliance or certified analysis, 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 revisions made to the standard in this edition include the following:

1. Minor boilerplate language updates in the following sections:
    - I.C. *Acceptance*
    - III.A. *Purchaser Options and Alternatives*
    - Sec. 2: References
    - Sec. 3: Definitions
    - Sec. 4: Requirements
    - Sec. 4.3.2 *Product Certifications*
    - Sec. 5.6 Notice of Nonconformance
    - Sec. 6.1 Marking
    - Sec. 6.2 Packaging and Shipping
    - Sec. 6.3 Affidavit of Compliance

V. Comments. If you have any comments or questions about this standard, please contact 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.

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ANSI/AWWA B603-23
(Revision of ANSI/AWWA B603-16)

American Water Works Association
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AWWA Standard

Permanganates

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes both dry potassium permanganate ($KMnO_4$) crystals, CAS* No. 7722-64-7, and liquid sodium permanganate ($NaMnO_4$) solutions, CAS No. 10101-50-5, for use in the treatment of potable and reuse or reclaimed water and wastewater.

Sec. 1.2 Purpose

The purpose of this standard is to provide the minimum requirements for dry potassium permanganate crystals and liquid sodium permanganate solutions, including physical, chemical, sampling, testing, packaging, and shipping requirements.

Sec. 1.3 Application

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

* Chemical Abstract Service, P.O. Box 3012, Columbus, OH 43210.

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