



**American Water Works
Association**

The Authoritative Resource on Safe Water®

ANSI/AWWA B505-12
(Revision of ANSI/AWWA B505-05)

AWWA Standard

Disodium Phosphate, Anhydrous



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AWWA Standard

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA B505.

I. Introduction.

I.A. *Background.* Disodium phosphate, anhydrous, is a manufactured product obtained by combining a comparatively pure chemical, soda ash (Na_2CO_3) or caustic soda (NaOH), with phosphoric acid (H_3PO_4). The resulting product is dried, sized, and packaged.

Disodium phosphate, anhydrous, is a white, crystalline solid, commercially available in granular and powder forms. A solution of 1 lb/gal (0.12 kg/L) has a specific gravity of approximately 1.1 at 25°C (77°F).

For information on safety, refer to material safety data sheets (MSDS) available from the supplier or manufacturer.

I.B. *History.* In 1985, the AWWA Standards Committee on Scale and Corrosion-Control Chemicals recognized the need for a standard for disodium phosphate, anhydrous, used as a corrosion-control product in the treatment of potable water. The AWWA Standards Council authorized development of the standard on Nov. 18, 1985, and the first edition was approved on Jan. 25, 1988. The second edition of the standard was approved on Jan. 22, 1995. The third edition of the standard was approved on Jan. 21, 2001. The fourth edition of ANSI/AWWA B505 was approved by the AWWA Board of Directors on June 12, 2005. This edition was approved on Jan. 22, 2012.

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 Water Research Foundation[†] (formerly AwwaRF), and the Conference of State Health and Environmental Managers (COSHEM). The American Water Works Association 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

* American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.

† Water Research Foundation, 6666 West Quincy Avenue, Denver, CO 80235

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

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 B505 addresses additives requirements in Sec. 4.3.3 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 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. *Storage and Handling Precautions.* Disodium phosphate, anhydrous, is relatively hygroscopic and will absorb water. It must be stored under dry conditions. Exposure to humidity produces a caked condition. This results in poor flow and caking that interferes with the rate of dilution and effectiveness of the product. Refer to the MSDS available from the manufacturer or supplier for additional information.

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

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 B505, Standard for Disodium Phosphate, Anhydrous, of latest revision.
2. Whether compliance with NSF/ANSI 60, Drinking Water Treatment Chemicals—Health Effects, is required.
3. Details of other federal, state, or provincial, and local requirements (Section 4).
4. Physical form(s) and quantity (Sec. 4.1.1).
5. Specific maximum impurity content limits, if required (Sec. 4.3).
6. 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.
7. Form of shipment—bulk or package, type, and size of container (Sec. 6.2).
8. Whether alternative security measures have been adopted to replace or augment the security measures set out in Sec. 6.2.3 and 6.2.4.
9. Size and type of container to be used (Sec. 6.2).
10. Affidavit of compliance or certified analysis, or both, if required (Sec. 6.3).

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 changes made to the standard in this revision include the following:

1. Inclusion of a requirement for compliance with the Safe Drinking Water Act and other federal regulations (Section 4).
2. Inclusion of a requirement for tamper-evident packaging (Sec. 6.2.3 and 6.2.4).

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 e-mail at standards@awwa.org.

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**American Water Works
Association**

AWWA Standard

Disodium Phosphate, Anhydrous

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes disodium phosphate, anhydrous, for use in the treatment of potable water, wastewater, and reclaimed water. The product described is an orthophosphate used, as formulated and in blends, to inhibit corrosion of potable water conveyance systems. The product described by this standard is also known as sodium phosphate, dibasic, anhydrous.

Sec. 1.2 Purpose

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

Sec. 1.3 Application

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

SECTION 2: REFERENCES

This standard references the following documents. In their latest editions, they form a part of this standard to the extent specified within the standard. In any case of conflict, the requirements of this standard shall prevail.

NSF*/ANSI[†] 60—Drinking Water System Chemicals—Health Effects.

Standard Methods for the Examination of Water and Wastewater. APHA,[‡] AWWA, and WEF.[§]

SECTION 3: DEFINITIONS

The following definitions shall apply in this standard:

1. *Day:* A day is defined as a 24-hr period.
2. *Disodium phosphate, anhydrous:* A white, crystalline solid that is soluble sodium phosphate containing Na₂O and P₂O₅ in a molar ratio of 2.0 Na₂O to 1.0 P₂O₅. Its formula is Na₂HPO₄.
3. *Manufacturer:* The party that manufactures, fabricates, or produces materials or products.
4. *Potable water:* Water that is safe and satisfactory for drinking and cooking.
5. *Purchaser:* The person, company, or organization that purchases any materials or work to be performed.
6. *Reclaimed water:* Wastewater that becomes suitable for beneficial use as a result of treatment.
7. *Supplier:* The party that supplies material or services. A supplier may or may not be the manufacturer.
8. *Tamper-evident packaging:* Packaging having one or more indicators or barriers to entry that, if breached or missing, can reasonably be expected to provide visible evidence to the purchaser that tampering has occurred. The tamper-evident features of the packaging shall be designed to and shall remain intact when handled in a reasonable manner during manufacture, storage, shipment, and delivery

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

† American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.

‡ American Public Health Association, 800 I Street NW, Washington, DC 20001.

§ Water Environment Federation, 601 Wythe Street, Alexandria, VA 22314.

to the purchaser. Properly constructed, labeled, and closed multiwall paper bags and fiber drums constitute two forms of tamper-evident packaging.

9. *Wastewater:* A combination of the liquid and water-carried waste from residences, commercial buildings, industrial plants, and institutions, together with any groundwater, surface water, and stormwater that may be present.

SECTION 4: REQUIREMENTS

Materials shall comply with the requirements of the Safe Drinking Water Act and other federal regulations for potable water, wastewater, and reclaimed water systems as applicable.

Sec. 4.1 Physical Requirements

The material shall be clean and uniform in composition. It shall be in a free-flowing condition when packages or containers are opened on receipt of shipment. The material shall conform to the sizing and bulk density of the grade specified by the purchaser.

4.1.1 *Sizing and bulk density.* This standard does not include provisions for particle size or bulk density. Disodium phosphate, anhydrous, is dissolved in water and fed as a solution. Once in solution, disodium phosphate, anhydrous, cannot be identified in terms of bulk density or particle size. Purchasers should base supplementary specifications for size and bulk density on the requirements of the available dry-feed equipment and the site at which the chemical will be used.

4.1.2 *Solubility.* The solubility of this material is 11 g/100 g of saturated solution at 25°C (77°F).

Sec. 4.2 Chemical Requirements

4.2.1 *P₂O₅.* Disodium phosphate, anhydrous, shall contain not less than 48.0 percent phosphorous pentoxide (P₂O₅), 21.0 percent phosphorus (P), or 64.3 percent phosphate (PO₄) on an as-is basis.

4.2.2 *pH.* The pH of a 1 percent by weight solution of disodium phosphate, anhydrous, shall be in the range of 8.8 to 9.5.

4.2.3 *Other.* Disodium phosphate, anhydrous, can be expressed on an as-is basis as either phosphorous pentoxide (P₂O₅), phosphate (PO₄), or phosphorus (P). The following conversions are provided to facilitate comparisons if needed.

4.2.3.1 Calculation as P. Percent P_2O_5 content can be expressed as percent P content by multiplying P_2O_5 by 0.437.

$$P = 0.437 (\text{percent } P_2O_5) \quad (\text{Eq 1})$$

4.2.3.2 Calculation as PO_4 . Percent P_2O_5 content can be expressed as percent PO_4 content by multiplying P_2O_5 by 1.34.

$$PO_4 = 1.34 (\text{percent } P_2O_5) \quad (\text{Eq 2})$$

4.2.3.3 Calculation of P as PO_4 . Percent P content can be expressed as percent PO_4 content by multiplying P by 3.06.

$$PO_4 = 3.06 (\text{percent P}) \quad (\text{Eq 3})$$

Sec. 4.3 Impurities*

4.3.1 *General.* The material supplied in accordance with this standard shall contain no soluble inorganic or organic substances in quantities capable of producing deleterious or injurious effects on the health of those consuming water that has been properly treated with the material.

4.3.2 *Water-insoluble matter.* Water-insoluble matter in the material shall not exceed 0.2 percent by weight.

4.3.3 *Product certification.* Disodium phosphate, anhydrous, is a direct additive used in the treatment of potable water. This material should be certified as suitable for contact with or treatment of drinking water by an accredited certification organization in accordance with NSF/ANSI 60. Evaluation shall be accomplished in accordance with requirements that are no less restrictive than those listed in NSF/ANSI 60. Certification shall be accomplished by a certification organization accredited by the American National Standards Institute.

SECTION 5: VERIFICATION

Sec. 5.1 Sampling

Disodium phosphate, anhydrous, is hygroscopic, and the entire process of sampling, mixing, dividing, and packing should be performed with as few delays as possible.

5.1.1 *Sampling point.* Samples shall be taken at the point of destination.

* See Sec. I.C. of the foreword.

5.1.2 *Sampling device.* Disodium phosphate, anhydrous, shall be sampled using a sampling tube that is at least $\frac{3}{4}$ in. (19 mm)* in diameter.

5.1.3 *Amount of shipment to be sampled.* Five percent of the packages or containers shall be sampled, but a minimum of 5 packages and a maximum of 15 packages in any one shipment shall be sampled. No sample shall be taken from a broken package.

5.1.4 *Sample size and handling.* The gross sample, weighing at least 10 lb (4.54 kg), shall be mixed thoroughly and rapidly and shall be divided to provide three 1-lb (0.454-kg) samples. The samples shall be sealed in airtight glass containers. A label identifying the sample shall be affixed to each sample container. The label shall be signed and dated by the sampler. A chain-of-custody form shall accompany all samples and shall be properly completed by the individuals collecting samples.

5.1.5 *Test samples.* Test samples shall be obtained from sealed material samples delivered to the laboratory. Material samples shall be unsealed only when it is necessary to remove quantities of the material for testing. Removal shall be accomplished quickly, and the material sample shall then be resealed for future use.

5.1.6 *Retention.* Samples shall be retained for at least 28 days after date of receipt before disposal.

Sec. 5.2 Test Procedures

5.2.1 *Laboratory examination.* Samples to be analyzed for phosphorus content have a maximum holding time of 28 days. Therefore, the samples should be examined in the laboratory as soon as possible after the shipment is received.

5.2.2 *Test procedure for solubility.* Weigh 10 g of sample and add slowly, while stirring, to 100 mL of distilled water at 10°–38°C (50°–100°F). Stir moderately for 30 min, after which time all material should, by visual determination, be dissolved. Filter through tared, dried glass-fiber filter of the type used in total suspended solids. Wash the beaker with distilled water. Using the same distilled water, wash the residue with six 25-mL portions of distilled water. Dry the filter and residue at 105°C (221°F) for 1 hr and weigh. Report the increase in weight as a percentage of the original sample weight as insoluble matter.

5.2.3 *Test procedure for P_2O_5 content.* Phosphorous pentoxide (P_2O_5) content shall be determined by the titration method described in the following

* Metric conversions given in this standard are direct conversions of US customary units and are not those specified in International Organization for Standardization (ISO) standards.

paragraphs. As an alternative, the procedures presented in Sec. 5.2.4 may be used. If discrepancies between the methods develop, the titration method in Sec. 5.2.3 shall govern.

5.2.3.1 Reagents.

1. Sodium hydroxide solution, 1*N*.
2. Sodium hydroxide solution, 6*N*.
3. Hydrochloric acid, concentrated (1.19 specific gravity).

5.2.3.2 Procedure.

1. Accurately weigh a 4.000-g (± 0.0001 -g) sample and quantitatively transfer to a 400-mL beaker. Add 200 mL of distilled water and 15 mL of concentrated HCl.

2. Cover with a watch glass and boil gently for at least 30 min. Cool to room temperature. Wash down beaker walls and watch glass cover with a minimal amount of distilled water.

3. Bring pH to a value of approximately 3.0 with 6*N* NaOH. Boil and cool. Bring volume to 200 mL with distilled water. Calibrate the pH meter with 7 and 10, or 4 and 7 pH buffers. Adjust the sample to exactly pH 3.9 and titrate with 1*N* NaOH to pH 8.8. Record the titration (T_1) in milliliters from pH 3.9 to pH 8.8.

4. Follow the same procedure with a dried sample of high-purity potassium acid phosphate (KH_2PO_4). Record the titration (T_2) in milliliters from pH 3.9 to pH 8.8.

5.2.3.3 Calculation. The percent of P_2O_5 in the sample is equal to the percent P_2O_5 in KH_2PO_4 multiplied by the ratio T_1/T_2 . Because the percent P_2O_5 of pure KH_2PO_4 is 52.16,

$$\text{percent of } \text{P}_2\text{O}_5 \text{ in sample} = \frac{52.16 \times T_1}{T_2} \quad (\text{Eq 4})$$

5.2.4 *Alternative test procedures for P_2O_5 content.* Phosphorous pentoxide content shall be determined either by the method described in Sec. 5.2.3 or by the quinolinium phosphate method described in detail below. Purchasers may also use methods from Section 4500-P in Standard Methods for the Examination of Water and Wastewater. If discrepancies between the methods develop, the titration method in Sec. 5.2.3 shall govern.

5.2.4.1 Reagents.

1. Citric-molybdate solution. Mix 54.0 g of 100 percent molybdic anhydride (MoO_3) with 200 mL of distilled water. Add 11 g of reagent-grade NaOH and stir while heating until the MoO_3 dissolves. Dissolve 60 g of pure citric acid

in 250 mL of distilled water and add 140 mL of concentrated HCl. Pour the molybdate solution into the acid solution while stirring continuously. Cool, filter, and dilute to 1 L. The solution may be slightly green or blue, and the color will deepen when exposed to light. If necessary, add a 0.5 percent solution of potassium bromate (KBrO_3), drop by drop, until the green color becomes pale. Store in a dark place in a polyethylene bottle.

2. Quinoline solution. Place 300–400 mL of distilled water and 60 mL of concentrated HCl in a 1-L beaker and heat to $64^{\circ}\text{--}80^{\circ}\text{C}$ ($148^{\circ}\text{--}176^{\circ}\text{F}$). While stirring, slowly add 50 mL of pure synthetic quinoline that is free of reducing agents. When the quinoline has dissolved, cool, dilute to 1 L, filter, and store in a polyethylene bottle.

5.2.4.2 Procedure.

1. Accurately weigh 1.000 g (± 0.001 g) of sample and quantitatively transfer to a 250-mL beaker. Add 100 mL of distilled water and 30 mL of concentrated nitric acid and boil for 30 min. Cool and filter through glass-fiber filter of the type used in total suspended solids. Transfer the filtrate to a 500-mL volumetric flask and dilute with distilled water to 500 mL.

2. Pipette a 20-mL aliquot (containing 0.040 g of sample) into a 250-mL beaker and dilute with distilled water to about 100 mL.

3. Add 30 mL of citric-molybdate solution and boil gently for 3 min. If the solution contains precipitate at this time, discard the test and repeat the procedure; otherwise, immediately add 15 mL of quinoline solution from a burette while stirring continuously. First, add 2–3 mL, drop by drop, over a period of 40–60 sec; then, add the remainder, in a steady stream, over a period of 1 min. Keep hot, but do not boil, for 5 min, stirring occasionally, then cool to room temperature.

4. Filter through a glass-fiber filter disk on a Gooch crucible, which has been previously dried at 200°C (392°F) and weighed. Wash twice with 5–10 mL of distilled water at room temperature. Dry the crucible and contents to constant weight (about 20 min) at 200°C (392°F), cool, and weigh. Correct for reagent blank and multiply by 0.032074 to obtain the weight of P_2O_5 .

5.2.4.3 Calculation.

$$\text{percent of } \text{P}_2\text{O}_5 \text{ in sample} = \frac{\text{weight of } \text{P}_2\text{O}_5 \times 100}{\text{weight of sample in aliquot}} \quad (\text{Eq } 5)$$

5.2.5 *Test procedure for pH.* Weigh out 10 g of the sample, dissolve, and dilute to 1.0 L with distilled water. This equals a 1 percent solution. Determine the

pH using a calibrated pH meter with a glass electrode. Report as pH of a 1 percent solution.

Sec. 5.3 Notice of Nonconformance

If the material delivered to the purchaser does not meet the chemical, physical, safety, or security requirements of this standard, the purchaser shall provide a notice of nonconformance to the supplier within five days after receipt of the shipment at the point of destination. The results of the purchaser's tests shall prevail, unless the supplier notifies the purchaser within five days after receipt of the notice of nonconformance that a retest is desired. On receipt of the request for a retest, the purchaser shall forward to the supplier one of the sealed samples taken in accordance with Sec. 5.1. In the event the results obtained by the supplier do not agree with the test results obtained by the purchaser, the other sealed sample shall be forwarded, unopened, for analysis to a referee laboratory agreed on by both parties. The results of the referee analysis shall be accepted as final.

The supplier shall provide to the purchaser an adjustment that is agreed on between the supplier and the purchaser reflecting the diminished quality of the product.

SECTION 6: DELIVERY*

Sec. 6.1 Marking

6.1.1 *Required.* Each package shall be marked legibly with the net weight of its contents, the name of the manufacturer, the name of the material, the brand name and the manufacturing code, and any labels required by local, state, and federal authorities.

6.1.2 *Optional.* Packages may also bear the statement, "Guaranteed by (name of manufacturer) to meet the requirements of ANSI/AWWA B505, Disodium Phosphate, Anhydrous," provided that the requirements of this standard are met.

* Governmental packaging and marking references reflect US requirements. Users of ANSI/AWWA B505 outside the United States should verify applicable local and national regulatory requirements. Because these regulations change frequently, all parties should remain informed of possible revision. Provisions of the purchaser's specifications should not preclude compliance with applicable regulations.

Sec. 6.2 Packaging and Shipping

6.2.1 *Containers.* Disodium phosphate, anhydrous, shall be packed and shipped in 50- or 100-lb (23- or 45-kg) net weight, moisture-proof, multiwall paper or polyethylene bags; or in 100- or 300-lb (45.4- or 136.1-kg) net weight, nonreturnable fiber drums; or in other suitable containers or net weights as may be required by the purchaser.

6.2.2 *Net weight.* The net weight of packaged material shall not deviate from the weight indicated on the label by more than ± 1.0 percent. Any exception taken to the weight of the material received shall be based on a deviation from the certified unit weight of not less than 10 percent of the packages shipped and selected at random from the entire shipment. However, not less than 10 or more than 25 packages need to be weighed.

6.2.3 *Security requirements for non-bulk shipments.* Packaged product shall be stored, shipped, and delivered in tamper-evident packaging as defined in Section 3, or an alternative method or methods may be agreed on by the manufacturer and purchaser that provide a reasonable assurance of protection against tampering.

6.2.4 *Security requirements for bulk shipments.* Bulk quantities of product shall be secured by employing one of the following security measures or a combination of measures:

6.2.4.1 *Seals.* Bulk quantities of product may be sealed with a uniquely numbered tamper-evident seal(s). The seal numbers shall be recorded and disclosed on shipping documents such as the Bill of Lading. Seals shall be inspected upon receipt of product by the purchaser and evidence of tampering or removal should be reported to the carrier and supplier.

6.2.4.2 *Chain of custody.* A continuous chain of custody may be maintained between the manufacturer and the purchaser during storage and shipment if so specified by the purchaser.

6.2.4.3 *Alternative method.* An alternative method or methods may be agreed on by the manufacturer and purchaser that provide reasonable assurance of protection against tampering.

Sec. 6.3 Affidavit of Compliance or Certified Analysis

The purchaser may require either (1) an affidavit from the manufacturer or supplier that the material provided complies with applicable requirements of this standard, or (2) a certified analysis of the material at the time of delivery detailing the desired items.

AWWA is the authoritative resource for knowledge, information, and advocacy to improve the quality and supply of water in North America and beyond. AWWA is the largest organization of water professionals in the world. AWWA advances public health, safety, and welfare by uniting the efforts of the full spectrum of the entire water community. Through our collective strength, we become better stewards of water for the greatest good of people and the environment.

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