

American Water Works Association
ANSI/AWWA B600-96
(Revision of ANSI/AWWA B600-90)



AWWA STANDARD
FOR
POWDERED ACTIVATED CARBON



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AMERICAN WATER WORKS ASSOCIATION

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Foreword

This foreword is for information only and is not a part of AWWA B600.

I. Introduction

I.A. *Background.* Activated carbon is a form of carbon that is activated by a carefully controlled oxidation process to develop a porous carbon structure with surface areas greater than 500 m²/g. This surface area gives the activated carbon the adsorptive capacity to adsorb dissolved organic chemicals, many of which are taste- and odor-causing substances in water. Treatment with powdered activated carbon is usually accomplished by mixing the activated carbon with water to form a slurry, and then applying the slurry to the water to be treated at a suitable point in the plant flow. The activated carbon, along with adsorbed impurities, is removed by settling or filtration.

I.B. *History.* The first edition of ANSI/AWWA B600, Standard for Powdered Activated Carbon, was approved as tentative by the AWWA Board of Directors on July 11, 1949, and later as a standard on May 15, 1953. Subsequent revisions were approved Jan. 23, 1966, Jan. 28, 1978, and June 1990. This edition was approved by the AWWA Board of Directors on Feb. 4, 1996.

ANSI/AWWA B600 provides information on preparing purchase specifications for the purchase of powdered activated carbon to be used as an adsorption media for the treatment of municipal and industrial water supplies. Granular activated carbon is covered in ANSI/AWWA B604, Standard for Granular Activated Carbon.

This standard does not cover the design of activated carbon handling facilities or adsorption processes. Design information may be found in *Journal AWWA* and in other publications, some of which are listed in the bibliography (Appendix A) to this standard.

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 all direct and indirect drinking water additives. Other members of the original consortium included the American Water Works Association Research Foundation (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. An advisory program formerly administered by USEPA, Office of Drinking Water, discontinued on Apr. 7, 1990.
2. Specific policies of the state or local agency.

*Persons in Canada, Mexico, and non-North American countries should contact the appropriate authority having jurisdiction.

3. Two standards developed under the direction of NSF, ANSI/NSF[†] 60, Drinking Water Treatment Chemicals—Health Effects, and ANSI/NSF 61, Drinking Water System Components—Health Effects.

4. 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 ANSI/NSF 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.

Appendix A, “Toxicology Review and Evaluation Procedures,” to ANSI/NSF 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 Appendix A procedures may not always be identical, depending on the certifier.

ANSI/AWWA B600-96 does not address additives requirements. Thus, 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 all 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. *Handling and Storage.* The following safety precautions should be exercised to minimize or eliminate hazards when handling and storing powdered activated carbon. Activated carbon will readily adsorb oxygen from the air, creating an acute oxygen depletion hazard in confined areas. Appropriate safety measures for oxygen-deficient atmospheres should be strictly adhered to when entering enclosed or partially enclosed areas containing activated carbon.

II.B. *Fire Hazard.* Powdered activated carbon is a combustible material. The ignition point of activated carbon varies from 600°F to 800°F (315°C to 426°C). After ignition, activated carbon will not burn with a flame, but will glow or smolder and continue to do so until all of the activated carbon material is oxidized.

The activated carbon should be stored in a building or compartment that is as fire resistant as possible. Bags of powdered activated carbon should be stacked in rows with aisles between them so that each bag may be easily removed in case of fire. Nothing else should be stored in the same building or compartment with activated carbon. Strict precautions must be taken to avoid powdered activated carbon contacting strong oxidizing agents, such as chlorine, hypochlorites, potassium permanganate, ozone, and peroxide. Mixing activated carbon with hydrocarbons (such as oils, gasoline, diesel fuel, grease, paint thinners, and so forth) may cause spontaneous combustion.

*American National Standards Institute, 11 W. 42nd St., New York, NY 10036.

[†]NSF International, 3475 Plymouth Rd., Ann Arbor, MI 48106.

[‡]Both publications available from National Academy of Sciences, 2102 Constitution Ave. N.W., Washington, DC 20418.

Therefore, activated carbon must be kept separate from hydrocarbon storage or spills.

In case of an activated carbon fire, the safest procedure, if possible, is to place the smoldering material in a metal container and remove it from the building. An activated carbon fire may also be smothered by means of a very fine spray or mist of water from a hose or by a foam-type chemical extinguisher. A direct stream of water should not be used, as it will cause the smoldering particles to fly into the air and spread the fire.

II.C. Activated Carbon Dust. Respiratory protection should be worn when bags of activated carbon or dry bulk material are unloaded or otherwise handled. Excessive dusting and inhalation of activated carbon dust should be avoided.

Activated carbon is an electrical conductor and should not be allowed to accumulate as dust near or on open electrical circuits. Electrical outlets, lights, and motors in dry-activated-carbon feed and storage rooms should be watertight to preclude the entrance of activated carbon dust.

II.D. Adsorptive Capacity. The optimum method of determining the effectiveness of an activated carbon is to measure its performance to remove specific impurities (such as organic compounds or taste- and odor-causing compounds, including geosmin or 2-methylisoborneol) present in the water to be treated. There are typically many different impurities at varying concentrations that need to be adsorbed in a particular water treatment system. The substance causing the problem may be defined in very general terms or not at all. Consequently, a practical first step is to determine the effectiveness of an activated carbon by evaluating its performance in adsorbing the actual impurities present in the water to be treated.

Various tests have been developed for use as indicators of an activated carbon's general performance. The tests use a specific adsorbate at a high concentration to reduce the amount of time it takes to complete the test. All of these tests are of limited versatility and are not necessarily indicative of an activated carbon's performance for a given application. Examples of these tests are the iodine, phenol, and tannin adsorption tests. The iodine test is an indication of the total surface area of an activated carbon. ANSI/AWWA B600-96 no longer lists the phenol and tannin adsorption tests. However, for informational and historical purposes, the evaluation procedures and qualification levels for the phenol and tannin tests have been reprinted from ANSI/AWWA B600-78 in Appendix B. The phenol test can be used as an indicator of an activated carbon's ability to remove low-molecular-weight impurities. The tannin test can be used as an indicator of an activated carbon's ability to remove high-molecular-weight impurities.

The threshold odor test may be used to determine an activated carbon's performance in removing tastes and odors from a particular water. This test is often used to determine the optimum dosage of an activated carbon needed for removal of taste- and odor-causing substances at a particular treatment facility. Because of the subjective nature of the test and the variance in water quality that usually occurs at a treatment facility, the threshold odor test may be difficult to use as a reproducible indicator of activated carbon quality and performance.

This standard uses an iodine adsorption test to determine acceptable surface area and adsorptive capacity. This is not intended to mean that the iodine adsorption test is the only performance indicator for a particular treatment application. A value is specified for a minimum iodine number in this standard. This value was determined by considering test performances for most of the manufactured activated carbons that are used successfully for water treatment. The purchaser may find it

advisable to modify the figure specified for a minimum iodine number or to include the tannin, phenol, or threshold odor tests as dictated by the relationship of these parameters to the actual treatment performance. The threshold odor test procedure is included in Sec. 5.2.7. The test procedures for tannin and phenol values may be found in Appendix B of this standard for those purchasers who want to include these requirements in their specifications.

Only two test methods are included in the text of ANSI/AWWA B600-96; however, it is not intended to limit or discourage the use or investigation of other test procedures. Appendix B, although not a part of ANSI/AWWA B600-96, has been included for those purchasers who continue to consider the phenol and tannin evaluation procedures and qualification levels. As water quality standards dictate, alternative or additional test methods, such as the Flavor Profile Analysis Test, may be added to the standard in the future. Users of this standard may suggest to the Activated Carbon Committee the adoption of other tests found to be useful.

III. Use of This Standard. AWWA has no responsibility for the suitability or compatibility of the provisions of this standard to any intended application by any user. Accordingly, each user of this standard is responsible for determining that the standard's provisions are suitable for and compatible with that user's intended application.

III.A. Purchaser Options and Alternatives. The following items should be covered in the purchaser's specifications:

1. Standard used—that is, ANSI/AWWA B600, Standard for Powdered Activated Carbon, of latest revision.
2. Quantity of powdered activated carbon to be purchased, in lb (kg).
3. Whether an affidavit of compliance is required (Sec. 6.3).
4. When requested, a representative sample of the powdered activated carbon shall be submitted to the purchaser for acceptance before shipment. The sample must be submitted in clean, vapor-proof containers, clearly marked with the address of the supplier, and identified with the lot number of the contents. A duplicate sample shall be tested by the supplier, and a certified test report shall be submitted to the purchaser with the purchaser's sample, showing compliance with the requirements of the purchaser's specifications, along with a statement certifying that the material for shipment is equal in quality to the sample submitted.
5. The purchaser may elect to accept the powdered activated carbon on the basis of (1) the supplier's certified test report and an accompanying affidavit of compliance indicating that the product proposed for use complies with this standard and with the purchaser's specifications with no exceptions; (2) the supplier's certified test report completed by a qualified third-party testing laboratory approved by the purchaser and an accompanying affidavit of compliance; (3) the purchaser's own testing of the reference sample submitted by the supplier and the required affidavit of compliance; or (4) the purchaser's own testing of the representative sample, collected according to Sec. 5.1 after receipt of shipment, showing compliance with this standard and the purchaser's specifications.
6. Particle-size distribution, if other than that specified (Sec. 4.1.3).
7. Minimum iodine number, if other than that specified (Sec. 4.1.4).
8. Additional adsorptive capacity tests (Sec. 4.1.5).
9. Provisions for reaching agreement on sampling technique (Sec. 5.1).
10. Marking (Sec. 6.1).
11. Method of packaging and shipping (Sec. 6.2).

12. If shipment is to be in bulk: type of freight car, hopper car, or truck (Sec. 6.2.4), and whether bulk shipments are to be accompanied by weight certificates of certified weighers (Sec. 6.2.5).

13. Name of the manufacturer whose product will be furnished by the supplier.

14. The purchaser may authorize shipment on the basis of the supplier's certification of quality, or may test the reference sample submitted by the supplier to confirm compliance before shipment is authorized.

15. The purchaser may elect to collect a representative sample of the material after delivery. The procedure used shall be in accordance with Sec. 5.1. One of the three sample portions taken may be tested to determine compliance with the purchaser's specifications.

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

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

1. The standard has been changed to AWWA standard style.

2. The acceptance clause (Sec. I.C) and definitions (Sec. 3) have been revised to approved wording.

V. Comments. If you have any comments or questions about this standard, please call the AWWA Standards and Materials Development Department, (303) 794-7711 ext. 6283, FAX (303) 795-1440, or write to the department at 6666 W. Quincy Ave., Denver, CO 80235.