ANSI/AWWA B602-08
(Revision of ANSI/AWWA B602-02)

American Water Works Association

The Authoritative Resource on Safe Water®

AWWA Standard

Copper Sulfate

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6666 West Quincy Avenue
Denver, CO 80235-3098
T 800.926.7337
www.awwa.org

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AWWA Standard

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Committee Personnel

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:

Djanette Khiari, *Chair*

Phillip A. Vella, *Secretary*

General Interest Members

C.A. Blanck, Richmond, Ind.	(AWWA)
C.R. Dugan,* Standards Council Liaison, Bath, Mich.	(AWWA)
D. Khiari, AWWA Research Foundation, Denver, Colo.	(AWWA)
J.S. Kippin, Town of Ipswich Water, Ipswich, Mass.	(NEWWA)
N.E. Otto, Denver, Colo.	(BUREC)
S.J. Posavec,* Standards Group Liaison, AWWA, Denver, Colo.	(AWWA)
M. Siddiqui, University of Utah, Salt Lake City, Utah	(AWWA)
B.H. Wilder, Daytona Beach, Fla.	(AWWA)

Producer Members

I.P. Fairchild, Chemical Specialty Group Inc., Cartersville, Ga.	(AWWA)
C.B. Lind, Mauser Corporation, Bridgewater, N.J.	(AWWA)
P.A. Vella, Carus Chemical, La Salle, Ill.	(AWWA)
T.R. Walton, Stuart, Fla.	(AWWA)

User Members

J.T. Harvey, Central Arkansas Water, Little Rock, Ark.	(AWWA)
J.J. Parker, Springfield, Mo.	(AWWA)

* Liaison, nonvoting

Contents

All AWWA standards follow the general format indicated subsequently. Some variations from this format may be found in a particular standard.

Foreword

This foreword is for information only and is not a part of ANSI/AWWA B602.

I. Introduction.

I.A. *Background.* Copper sulfate primarily is used as an algicide in potable water. It is available both as a commercial product and as a by-product of the printed-circuit-board industry.

The commercial product is produced by reacting a solution of sulfuric acid with copper metal, cupric oxide, or basic cupric copper salts. Copper sulfate crystals form in the concentrated solution and grow in size in a characteristic crystalline shape. A broad range of crystal sizes is produced by controlling the length of crystallization time or by fracturing the larger crystals and screening to the desired sizes.

The by-product copper sulfate is generally produced in printed-circuit-board shops, where proprietary etchant solutions are used to dissolve copper from printed-circuit boards. If a sulfuric acid–based etchant solution is used, it becomes saturated with copper ions and sulfate ions. Small crystals of copper sulfate form and are mechanically removed.

The presence of various impurities and their amounts in the copper sulfate depend on the impurities present in the starting materials or the solution in which the crystals grow.

The selection of crystal size for use in algae control depends on a number of factors, including algae type and growth habits as well as application method and equipment to be used. The application rate will depend on algae type and species as well as water characteristics, including pH, alkalinity and hardness, presence of suspended solids, density of algae growth, and water temperature. For potable water, the US Environmental Protection Agency (USEPA) has set a tolerance for the maximum residue of copper at 1 ppm, or equal to 4 ppm as copper sulfate pentahydrate ($CuSO_4 \cdot 5H_2O$) (40 CFR* 185.1200), which also is the secondary standard under the US National Drinking Water Regulations. USEPA, Office of Drinking Water, has set the Action Level at 1.3 mg/L copper (Cu) as the Primary Drinking Water Standard. Under most use conditions, the effective dose is considerably less than the established residue tolerance.

I.B. *History.* This standard was first approved as tentative on Sept. 15, 1957. It was developed by the AWWA Water Purification Division and also was submitted

* Code of Federal Regulations, US Government Printing Office, Superintendent of Documents, Washington, DC 20402.

for review to producers and consumers whose comments were then considered by a referee. It was approved as a standard without revision on Jan. 26, 1959, and published as AWWA B602-59.

This standard was revised by the AWWA Standards Committee on Taste and Odor Control Chemicals. The dates of approval and numerical designation of past editions of ANSI/AWWA B602 are listed below.

Designation	*Date of Approval*
B602-57T	Sept. 15, 1957
B602-59	Jan. 26, 1959
B602-80	Jan. 28, 1980
B602-86	Jan. 27, 1986
B602-91	Jan. 27, 1991
B602-97	Feb. 2, 1997
B602-02	Jan. 20, 2002

This edition was approved by the AWWA Board of Directors on Jan. 27, 2008.

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) 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 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

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

† NSF International, 789 N. Dixboro Road, Ann Arbor, MI 48113.

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

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 B602 addresses additives requirements in Sec. 4.4 of the standard. The transfer of contaminants from chemicals to processed water or the residual solids is becoming a problem of great concern. The language in Sec. 4.4.3 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 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.* Copper sulfate pentahydrate crystals are highly soluble in water but do not react with water. Store this pesticide product in a dry place in its original container until ready for use. Store this product separately to prevent cross-contamination with other chemicals.

Proper attention to safety requirements should be followed. Protective clothing should be worn while handling copper sulfate pentahydrate, especially goggles to protect against dust or splashes into the eyes.

II.B. *Disposal.* As an algicide, copper sulfate pentahydrate is covered under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) as a pesticide. It must be packaged and labeled as a pesticide for algae control. Packaging material that is empty must be disposed of in compliance with FIFRA and local regulations. Any spilled solid material or waste liquid material must be disposed of in compliance with FIFRA and local regulations. Questions on proper disposal can be answered by your state pesticide control office or your regional USEPA hazardous waste representative.

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 items should be covered by the purchaser:

1. Standard used—that is, ANSI/AWWA B602, Copper Sulfate, of latest revision.
2. Crystal size designation.
3. Whether compliance with NSF/ANSI 60, Drinking Water Treatment Chemicals—Health Effects, is required.
4. Details of other federal, state or provincial, and local requirements (Sec. 4.1).
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. 5.1, 5.2, 5.3, 5.5, and 5.6 demonstrate that the product meets specifications. Failure to meet specifications or the absence of, or irregularities in, seals may be sufficient cause to reject the shipment.
6. If required, a statement of maximum impurity content limits and analytical methods to be used to determine compliance with limits (Sec. 5.4 and Sec. 5.5).
7. Requirement that the chemical registration and labeling be in accord with USEPA procedures for an algicide (Sec. 6.1.1).
8. Net weight to be supplied (Sec. 6.2.2).
9. 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.
10. If required, affidavit of compliance or certified analysis (Sec. 6.3).

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

V. 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 (Sec. 4.1).
2. Inclusion of a requirement for tamper-evident packaging (Sec. 6.2.3 and 6.2.4).

VI. Comments. If you have any comments or questions about this standard, please call the AWWA Volunteer and Technical Support Group, at 303.794.7711, FAX at 303.795.7603, write to the group 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

Copper Sulfate

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes copper sulfate for use in the treatment of municipal and industrial water supplies.

Sec. 1.2 Purpose

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

Sec. 1.3 Application

This standard can be referenced in specifications for purchasing and receiving copper sulfate and can be used as a guide for testing the physical and chemical properties of copper sulfate samples. The stipulations of this standard apply when this document has been referenced and then only to copper sulfate used in water supply service applications.

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.

NSF*/ANSI† 60 Drinking Water Treatment Chemicals—Health Effects.

SECTION 3: DEFINITIONS

In this standard, the following definitions shall apply:

1. *Characteristics:* In the range of temperatures ordinarily encountered, the solubility of $CuSO_4 \cdot 5H_2O$ varies as shown in Table 1. It has a specific gravity of 2.28, and the weight of the commercial product, depending on the size grading and packing, may vary from 75 to 93 lb/ft^3 (1,200 to 1,490 kg/m^3).

2. *Copper sulfate:* The copper sulfate product described in this standard is a commercial grade of copper sulfate pentahydrate containing at least 99 percent $CuSO_4 \cdot 5H_2O$. It must be packaged and labeled as a pesticide for algae control in compliance with the Federal Insecticide, Fungicide, and Rodenticide Act as administered by the US Environmental Protection Agency (USEPA).

3. *Day:* A day is defined as a 24-hr period.

4. *Forms*: This product may be obtained in the form of transparent, deep blue triclinic-system crystals; as blue crystalline granules; or as light blue powder. Common names include blue vitriol and bluestone. In dry air, copper sulfate pentahydrate effloresces and may lose weight because of loss in water in crystallization. During this process, a whitish blue, powdery crust forms on the crystal surface, which may dust off, increasing the fine particle content of the product.

5. *Manufacturer:* The party that manufactures, fabricates, or produces materials or products.

6. *Purchaser:* The person, company, or organization that purchases any materials or work to be performed.

7. *Supplier:* The party that supplies material or services. A supplier may or may not be the manufacturer.

* NSF International, 789 North Dixboro Road, Ann Arbor, MI 48113.

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

Table 1. Solubility of $CuSO_4 \cdot 5H_2O$

Temperature °F (°C)	$CuSO_4 \cdot 5H_2O$ per 100 lb of solution *lb*	$CuSO_4 \cdot 5H_2O$ per 100 kg of solution *kg*	$CuSO_4 \cdot 5H_2O$ per 100 gal of water *lb*	$CuSO_4 \cdot 5H_2O$ per 100 L of water *kg*
32 (0)	19.5	19.5	186.0	22.3
104 (40)	35.2	35.2	371.1	44.5

8. *Tamper-evident packaging:* Packaging having one or more indicators or barriers to entry which, 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 to the purchaser. Properly constructed, labeled, and closed multiwall bags and fiber drums constitute two forms of tamper-evident packaging.

SECTION 4: REQUIREMENTS

Sec. 4.1 Materials

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

Sec. 4.2 Physical Requirements

4.2.1 *Size.* Copper sulfate is produced or screened into numerous size fractions depending on the individual producer's market needs. For the convenience of the purchaser, AWWA describes five standard sizes, although other sizes may be specified or used in accordance with arrangements between the supplier and purchaser. All sizes shall be free flowing, shall be free from extraneous materials, and shall meet the other requirements as stated in this standard. The five standard sizes are designated as size A, B, C, D, and E, respectively.

4.2.1.1 Size A. One hundred percent of this material shall pass a No. 8 US Standard Sieve, and not less than 95 percent shall be retained on a No. 100 US Standard Sieve.

4.2.1.2 Size B. Not more than 2 percent of this material shall be retained on a No. 3 US Standard Sieve; not less than 90 percent shall be retained on a No. 10 US Standard Sieve; and not more than 2 percent shall pass a No. 100 US Standard Sieve.

4.2.1.3 Size C. Not more than 2 percent of this material shall be retained on a ½-in. (12.7-mm) screen; not less than 50 percent shall be retained on a No. 3½ US Standard Sieve; not less than 90 percent shall be retained on a No. 8 US Standard Sieve; and not more than 2 percent shall pass a No. 100 US Standard Sieve.

4.2.1.4 Size D. Not more than 2 percent of this material shall be retained on a 1½-in. (38.1-mm) screen; not less than 50 percent shall be retained on a ⅜-in. (9.5-mm) screen; not less than 90 percent shall be retained on a No. 3 US Standard Sieve; and not more than 5 percent shall pass a No. 100 US Standard Sieve.

4.2.1.5 Size E. Not more than 2 percent of this material shall be retained on a 1½-in. (38.1-mm) screen; not less than 90 percent shall be retained on a ⅜-in. (9.5-mm) screen; and not more than 5 percent shall pass a No. 100 US Standard Sieve.

4.2.1.6 Other sizes. Many purchasers obtain copper sulfate by specifying commercial sizes with designations such as large, medium, small, rice or granular, snow crystals, or powdered. There is no agreement between manufacturers as to the exact screen sizes of the various grades that use commercial designations. If a purchase is made using these designations and the size is to be checked by sieve analysis, an agreement should be made between the supplier and the purchaser concerning the sieve analysis.

Sec. 4.3 Chemical Requirements

4.3.1 *General.* The term *copper sulfate* as used in this standard means the blue triclinic cupric sulfate pentahydrate crystal form with the following molecular formula: $CuSO_4 \cdot 5H_2O$. The pure compound, 100 percent $CuSO_4 \cdot 5H_2O$, has the following composition: anhydrous salt ($CuSO_4$), 63.92 percent; water of crystallization, 36.08 percent; copper (Cu), 25.45 percent; and sulfate (SO_4), 38.47 percent. The grade specified herein shall not contain less than 25.0 percent of metallic-copper equivalent. These values are based on the following weights: Cu = 63.546; S = 32.066; O = 16.000; and H = 1.008.

4.3.2 *Insoluble matter.* The water-insoluble matter shall not exceed 0.5 percent.

Sec. 4.4 Impurities*

4.4.1 *General.* The copper sulfate supplied in accordance with this standard shall contain no substances in quantities capable of producing deleterious or

* See Sec. I.C of the foreword.

injurious effects on the health of those consuming water that has been properly treated with copper sulfate.

4.4.2 *Impurity requirements.* Impurity limits may be required by the purchaser to ensure that the material supplied is suitable for water treatment purposes. (See also Sec. III of the foreword.)

4.4.3 *Product certifications.* Copper sulfate 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 and Inspection

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

5.1.1.1 Sampling packages. If the material is packaged, 10 percent of the packages shall be sampled, but no fewer than 5 packages and no more than 15 packages shall be sampled from any one shipment. No sample shall be taken from a broken package. In sampling, a uniform amount of material shall be carefully taken from every package sampled in order to avoid taking a disproportionate amount of material from the top or bottom of the package.

5.1.1.2 Sampling bulk shipments. If the copper sulfate is moved by conveyor or elevator, a mechanical sampling arrangement may be used. In this case, the material shall be moved at a reasonably uniform rate by the conveyor or elevator, and the gross or unsplit sample shall be selected by cutting across the full stream of material at regular intervals rather than by selecting at odd times a portion of the material being handled.

5.1.2 *Sample size.* For the purpose of sampling, shipments of material may be divided into lots, no single lot of material to exceed 100 tons (90,700 kg). Thus, no more than 100 tons (90,700 kg) of material shall be represented by a single sample.

5.1.2.1 Gross sample. The gross or unsplit sample shall not be less than

0.25 percent of the lot represented and in no case less than 25 lb (11.4 kg). The size of particles in the sample shall be, as nearly as possible, the same as in the entire shipment.

5.1.2.2 Size reduction. If the gross sample is in excess of 50 lb (22.7 kg), it may be reduced to this amount without crushing for sizes A, B, and C. For sizes D and E, a minimum of 77 lb (35 kg) is required to provide adequate material for all tests. The reduction in amount may be accomplished by the standard coning-and-quartering procedure or preferably through standard riffling equipment.

5.1.2.3 Sample division. After reduction of the gross sample, it may be divided into two portions: one for sieve and screen analyses and the other for chemical analysis.

5.1.2.4 Sieve and screen analysis. The sample required for sieve and screen analyses shall be 10 times the amount stipulated for a single test under Sec. 5.3. This sample shall be divided according to Sec. 5.1.2.6.

5.1.2.5 Chemical analysis. The sample required for chemical analysis shall not be less than 10 lb (4.54 kg). If it exceeds 50 lb (22.7 kg), it shall be reduced to that weight by the standard coning-and-quartering procedure or by the use of riffling equipment. It shall then be crushed to pass through a 1/4-in. (6.35-mm) coarse-series sieve before any further reduction in amount. Following the latter procedure, the sample may be reduced to not less than 10 lb (4.54 kg) by riffling or the coning-and-quartering procedure. The final 10 lb (4.54 kg) of sample shall be crushed to pass through a No. 10 US Standard Sieve and divided according to Sec. 5.1.2.6.

5.1.2.6 Sample preparation. The prepared sample shall be uniformly divided to provide at least five 1-lb (0.45-kg) samples for chemical analysis. The uncrushed sample shall be uniformly divided to provide five samples of approximately equal weight. The samples shall be sets of crushed and uncrushed material. The samples shall be sealed in airtight, moistureproof glass containers. Each sample container shall be labeled to identify it properly and handled carefully to prevent any change in the chemical or physical characteristics of the sample.

Sec. 5.2 Laboratory Examination—General

5.2.1 *Completion of testing.* The purchaser's laboratory examination of one of the five samples collected in accordance with Sec. 5.1 shall be completed within five days after receipt of the shipment.

5.2.2 *Test procedures.* Methods of testing copper sulfate shall conform to the procedures presented in this standard. Alternate procedures may be used

only on the written acceptance of the purchaser. In any case of conflict, the methods of this standard shall prevail.

Sec. 5.3 Size Determination

5.3.1 *Test procedure.* The material used for sizing tests shall be dry. Air drying, rather than heat drying, shall be employed because heat will drive off the water of crystallization. All sizing tests shall be conducted in a dry atmosphere. US Standard sieves shall be used and shall not be nested. The material shall be put through one sieve at a time. The test portion shall be placed in the properly selected sieve and shaken in a motor-driven or hand-operated sieve shaker for 5 min. The portion retained on the sieve shall be weighed to the nearest 0.1 g.

5.3.2 *Sample amount.* The sample amount required in these tests depends on the size grade involved. The following schedule of minimum sample amounts per individual test is suggested:

Size grade	Minimum test portion *g*
A	100
B	200
C	1,500
D	3,000
E	3,000

Sec. 5.4 Determination of Water-Insoluble Matter

5.4.1 *Test procedure.* Dissolve 50 g of the sample in about 300 mL H_2O using a 400-mL beaker. Add two drops of H_2SO_4, heat on a steam plate, and filter hot solution through a tared platinum Gooch crucible. Wash thoroughly with hot water, dry at 100°C, cool in a desiccator, and weigh. Calculate percent insoluble matter as follows:

$$\% \text{ insoluble matter} = \frac{100\,(A - B)}{C}$$

Where:

A = weight of crucible plus insoluble matter, in grams
B = weight of crucible, in grams
C = weight of sample, in grams

Sec. 5.5 Determination of Copper Content

5.5.1 *General.* The copper content shall be determined electrolytically except under conditions noted in Sec. 5.5.5.

5.5.2 *Test sample.* The sample that has been reduced to pass through a No. 10 US Standard Sieve shall be used directly for the determination of copper. The entire 1-lb (0.45-kg) sample shall be thoroughly mixed and approximately 100 g of the material selected from the gross sample placed in a properly stoppered glass container. Any test portions selected from the 100-g portion are to be weighed therefrom immediately.

5.5.3 *Procedure.* The test procedure is as follows:

1. Weigh out test portions of approximately 5 g of copper sulfate as rapidly as possible and transfer to tall-form 400-mL beakers, washing off the glass balance pan with a stream of water from a wash bottle. Dissolve the test portions in 350 mL distilled water and then add 10 mL concentrated HNO_3 and 10 mL concentrated H_2SO_4. Allow test portions to cool to room temperature.

2. The copper shall be deposited electrolytically on tared, perforated, platinum cylinder cathodes, with a straight platinum wire for the anode. The beakers shall be carefully covered with split watch glasses to prevent loss by spraying.

3. Apply a current density of 0.5 A/dm^2 of cathode area until deposition is complete. (Cathode area equals gross area of inside of cylinder, including perforations.) It is customary to conduct this operation overnight. When the solution is colorless, wash down the cover glasses, the electrodes, and sides of the beaker, raising the level of the liquid slightly, and continue the electrolysis for about 15 min, noting whether or not copper is deposited on the newly exposed surface of the platinum. If copper appears, raise the level of the liquid slightly and continue the electrolysis until none appears on the electrode. The completion of electrolysis may be determined by testing a few drops of the solution on a spot plate with saturated hydrogen sulfide solution. Electrolysis is complete when no copper sulfide coloration is observed.

4. When electrolysis is complete, remove the cathode quickly while washing with water from a wash bottle and then rinse the cathode in two successive baths of 95 percent alcohol. Dry in oven at 110°C for 3 min, cool, and weigh as metallic copper.

5.5.4 *Calculation:*

$$\%\ CuSO_4 \cdot 5H_2O = 100 \times 3.938 \times \frac{\text{increased weight of electrode, in grams}}{\text{sample weight, in grams}}$$

NOTE: If results obtained for copper are low, it may be desirable to save the solution (from which the copper has been removed) for the electrolytic determi-

nation of nickel, which may be an interference in the analysis. Commercial electroanalyzers can be obtained from laboratory supply houses located throughout the United States, Canada, and Mexico. When making analyses, instructions that come with the instrument should be followed closely.

5.5.5 *Alternate procedures.* By consent of all parties concerned, more rapid procedures for the electrolytic determination of copper may be employed. In general, it is assumed that the procedure would follow that specified above with the exception that higher current densities and rotating electrodes would be used.

5.5.5.1 Selection of method. The electrolytic method is less subject to error than the volumetric thiosulfate method (also called the iodide method). Some water utility laboratories may not have the equipment for the electrolytic determination. In such cases, the purchaser and supplier may enter into an agreement to use the volumetric method, provided it is mutually understood. If the volumetric method is used, the exact procedure shall be agreed on by both the purchaser and the supplier. In case of a disagreement over analysis, the referee shall use the electrolytic method.

Sec. 5.6 Other Tests

Tests for impurities or analytical procedures other than those specified in this document may be arranged between the supplier and the purchaser.

Sec. 5.7 Notice of Nonconformance

If the copper sulfate 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 10 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. 5.1.2.6 of this standard. In the event that the test results obtained by the supplier do not agree with the test results obtained by the purchaser, the remaining sealed samples 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.* Because copper sulfate is generally used by water utilities to control algae growth, it is a pesticide as defined by current federal regulations. Each package must bear a label reviewed and accepted by USEPA. This label must list, among other items, the brand name (if any), the manufacturer or supplier, the active ingredient and content, and the net weight of the contents, and it must bear a USEPA registration number as well as the USEPA establishment number indicating where the product was manufactured or last repackaged. Failure to provide this label is subject to punishment under federal law. Packages shall also bear markings required by the Department of Transportation (DOT).

6.1.2 *Optional.* The package may also bear the statement: "Guaranteed by (name of manufacturer) to meet American Water Works Association Standard B602 for Copper Sulfate."

Sec. 6.2 Packaging and Shipping

Packaging and shipping of copper sulfate shall conform to the current regulations of DOT.

6.2.1 *Packaging.* Copper sulfate shall be shipped in 50-lb or 100-lb (22.7-kg or 45.4-kg) multiwall paper bags; 100-lb to 400-lb (45.4-kg to 182-kg) fiber drums; in bulk; or in other DOT-approved containers in accordance with the purchaser's documents. Railcars or trucks must be tight and well-cleaned before loading. Every shipment shall be free from dirt, chips, and other foreign material.

6.2.2 *Net weight.* The net weight of the packages shall not deviate from the recorded weight by more than ±2.5 percent. If exception is taken to the weight of the material received, the weight shall be based on the certified weight of not less than 10 percent of the packages shipped. The packages shall be selected at random from the entire shipment.

6.2.3 *Security requirements for nonbulk shipments.* Packaged product shall be stored, shipped, and delivered in tamper-evident packaging as defined

* Governmental packaging, marking, and shipping references reflect US requirements. Users of ANSI/AWWA B602 outside the US should verify applicable local and national regulatory requirements. Because of frequent changes in these regulations, all parties should remain informed of possible revisions. Provisions of the purchaser's documents should not preclude compliance with applicable regulations.

in Section 3, No. 8, 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 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 agreed on by the manufacturer and purchaser may be used that provide reasonable assurance of protection against tampering.

Sec. 6.3 Affidavit of Compliance

The purchaser may require an affidavit from the manufacturer or supplier that the material provided complies with all applicable requirements of this standard.

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 the people and the environment.

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