



Standard Test Method for Copper Strip Corrosion by Industrial Aromatic Hydrocarbons¹

This standard is issued under the fixed designation D849; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This test method covers the corrosiveness of industrial aromatic hydrocarbons to a copper strip.

NOTE 1—For a similar copper strip test applicable to other petroleum products, see Test Method D130 and Test Method D1838.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see Section 8.

2. Referenced Documents

2.1 ASTM Standards:²

B152/B152M Specification for Copper Sheet, Strip, Plate, and Rolled Bar

D130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test

D1838 Test Method for Copper Strip Corrosion by Liquefied Petroleum (LP) Gases

D4790 Terminology of Aromatic Hydrocarbons and Related Chemicals

D6809 Guide for Quality Control and Quality Assurance Procedures for Aromatic Hydrocarbons and Related Materials

2.2 Other Documents:³

OSHA Regulations, 29 CFR paragraphs 1910.1000 and 1910.1200

2.3 ASTM Adjuncts:

ASTM Copper Strip Corrosion Standards (13 photo lithographed aluminum strips; includes Test Method D130)⁴

3. Terminology

3.1 See Terminology D4790 for definition of terms used in this test method.

4. Summary of Test Method

4.1 A polished copper strip is immersed in 200 mL of specimen in a flask with a condenser and placed in boiling water for 30 min. At the end of this period, the copper strip is removed and compared with the ASTM Copper Strip Corrosion Standards.

5. Significance and Use

5.1 This test method is suitable for setting specifications, for use as an internal quality control tool, and for use in development or research work on industrial aromatic hydrocarbons and related materials. It also gives an indication of the presence of certain corrosive substances which may corrode equipment, such as acidic compounds or sulfur compounds.

6. Apparatus

6.1 *Flask*, of sufficient size to allow for refluxing 200 mL specimen, of chemically resistant glass with flat bottom and vial mouth.

6.2 *Glass Condenser*, length may vary, with the inside diameter of the condenser tube not less than 10 mm. A cork is used to connect the flask with the condenser. A condenser and flask with ground-glass joints may also be used.

¹ This test method is under the jurisdiction of ASTM Committee D16 on Aromatic Hydrocarbons and Related Chemicals and is the direct responsibility of Subcommittee D16.01 on Benzene, Toluene, Xylenes, Cyclohexane and Their Derivatives.

Current edition approved Oct. 1, 2015. Published January 2016. Originally approved in 1945. Last previous edition approved in 2011 as D849 – 11. DOI: 10.1520/D0849-15.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, http://www.access.gpo.gov.

⁴ Available from ASTM International Headquarters. Request Adjunct No. ADJD0130. Names of suppliers in the United Kingdom can be obtained from the Energy Institute, 61 New Cavendish St., London, W1G 7AR, U.K. Two master standards are held by the EI for reference.

*A Summary of Changes section appears at the end of this standard

6.3 *Strip Polishing Vise, (optional)*, to hold the copper strip firmly without marring the edges. For convenient vises see Test Method **D130**.

6.4 *Water Bath*, of convenient design, able to maintain boiling water such that the contents of the flask are submerged during the test.

7. Reagents and Materials

7.1 *Wash Solvent*—Any volatile, sulfur-free hydrocarbon solvent may be used provided that it shows no tarnish at all when tested at 100°C for 1 h. *Iso octane* (**Warning**—See 8.2) is a suitable solvent.

7.2 *Surface Preparation/Polishing Materials*, 00 grade or finer steel wool or silicon carbide grit paper or cloth of varying degrees of fineness including 65- μm (240-grit) grade; also a supply of 105- μm (150-mesh) size silicon carbide grain or powder and absorbent cotton (cotton wool). A commercial grade is suitable, but pharmaceutical grade is most commonly available and is acceptable.

7.3 *Copper Strips*—Use strips that are 12.5 ± 2 mm ($1/2$ -in.) wide, 1.5 to 3.2 mm ($1/16$ to $1/8$ -in.) thick, and cut 75 ± 5 mm (3-in.) long from smooth-surfaced, hard, cold-finished copper of 99.9+ % purity. Electrical bus-bar stock is generally suitable (hard-temper, cold-finished type-electrolytic tough pitch (ETP) copper conforming to UNS C11000 in Specification **B152/B152M**. Drill a $3.2 \text{ mm} \pm 0.5 \text{ mm}$ hole approximately 3.2 mm from one end in the center of the strip. The strips may be used repeatedly but should be discarded when surfaces become deformed on handling.

7.4 *Copper Wire*, soft, about 150 mm in length.

7.5 *ASTM Copper Strip Corrosion Standards*, consisting of reproductions in color of typical test strips representing increasing degrees of tarnish and corrosion. The reproductions are encased in plastic in the form of a plaque. Instructions for care and use are given on the reverse side of each plaque and in Test Method **D130**.

7.6 *Ashless Filter Paper or Disposable Gloves*, for use in protecting the copper strip from coming in contact with the individual during final polishing.

8. Hazards

8.1 Consult current OSHA regulations, supplier's Safety Data Sheets, and local regulations for all materials used in this test method.

8.2 *Isooctane* is Extremely Flammable. Harmful if inhaled. Vapors may cause flash fire. Keep away from heat, sparks, and open flame. Keep container closed. Use with adequate ventilation. Avoid buildup of vapors and eliminate all sources of ignition, especially non-explosion-proof electrical apparatus and heaters. Avoid prolonged breathing of vapor or spray mist. Avoid prolonged or repeated skin contact.

9. Preparation of Strips

9.1 *Surface Preparation*—Remove all surface blemishes from all six sides of the strip obtained from a previous analysis (see **Note 2**). One way to accomplish this is to use 00 grade or

finer steel wool or silicon carbide grit paper or cloth of such degrees of fineness as are needed to accomplish the desired results efficiently. Finish with 65- μm (240-grit) silicon-carbide paper or cloth, removing all marks that may have been made by other grades of paper used previously. Ensure the prepared copper strip is protected from oxidation prior to final preparation, such as by immersing the strip in wash solvent from which it can be withdrawn immediately for final preparation (polishing) or in which it can be stored for future use.

NOTE 2—Only final polishing (see 9.2) is necessary for commercially purchased pre-polished strips.

NOTE 3—As a practical manual polishing procedure, place a sheet of the paper on a flat surface, moisten it with wash solvent, and rub the strip against the paper with a circular motion, protecting the strip from contact with the fingers by using an ashless filter paper, other suitable material, or wearing disposable gloves. Alternatively, the strip may be prepared by use of motor-driven machines using appropriate grades of dry paper or cloth.

9.2 *Final Polishing*—For strips prepared in 9.1 or new strips being used for the first time, remove a strip from its protected location, such as by removing it from the wash solvent. To prevent possible surface contamination during final preparation, do not allow fingers to come in direct contact with the copper strips, such as by wearing disposable gloves or holding the strips in the fingers protected with ashless filter paper. Polish first the ends and then the sides with the 105- μm (150-mesh) silicon-carbide grains picked up from a suitable container with a pad of absorbent cotton or cloth moistened with a drop of wash solvent. Wipe vigorously with fresh pads of absorbent cotton or cloth and subsequently handle only with stainless-steel forceps, tongs, or other suitable devices to avoid touching with the fingers. Polish the main surfaces with silicon carbide grains on absorbent cotton or cloth. Rub in the direction of the long axis of the strip, carrying the stroke beyond the end of the strip before reversing the direction. Clean all metal dust from the strip by rubbing vigorously with clean pads of absorbent cotton or cloth until the material remains unsoiled. When the strip is clean, immediately immerse the strip in the specimen flask.

NOTE 4—It is important to polish the whole surface of the strip uniformly to obtain a uniformly stained strip. If the edges show wear (surface elliptical) they will likely show more corrosion than the center. The use of a vise will facilitate uniform polishing.

10. Procedure

10.1 Fasten the 150-mm length of soft copper wire through the hole provided near one end of the strip, taking care not to touch the strip with the fingers after polishing.

10.2 Place the strip in the flask and add 200 mL of the sample. The specimen must not contain separated water. Filter through a dry filter paper, if necessary, to remove water.

10.3 Connect the flask to the vertical reflux condenser by means of a properly bored cork or glass stopper. It is absolutely necessary that a cork or glass, not rubber, stopper be used, in order to avoid contamination of the specimen by sulfur from rubber stoppers. The copper wire may be allowed to extend into the condenser tube for convenience in removing the strip. Completely immerse the strip.

TABLE 1 Copper Strip Classifications

Classification	Designation	Description ^A
Freshly polished strip	...	^B
1	slight tarnish	a. Light orange, almost the same as freshly polished strip b. Dark orange
	...	
2	moderate tarnish	a. Claret red b. Lavender c. Multicolored with lavender blue or silver, or both, overlaid on claret red d. Silvery e. Brassy or gold
	...	
	...	
	...	
3	dark tarnish	a. Magenta overcast on brassy strip b. Multicolored with red and green snowing (peacock), but no gray
	...	
4	corrosion	a. Transparent black, dark gray or brown with peacock green barely showing b. Graphite or lusterless black c. Glossy or jet black
	...	
	...	

^A The ASTM Copper Strip Corrosion Standard is a colored reproduction of strips characteristic of these descriptions.

^B The freshly polished strip is included in the series only as an indication of the appearance of a properly polished strip before a test run. It is not possible to duplicate this appearance after a test even with a completely noncorrosive sample.

10.4 Place the flask in the gently boiling water bath, and immerse the flask to the liquid line of the specimen within the flask.

10.5 Remove the copper strip 30 min from the time the flask was immersed in the bath. Do not touch the copper strip, but remove it by the wire that has been provided. Do not allow the strip to come in contact with separated water during any part of the test, since water causes bad local staining of the copper. If it is desired to preserve the strip for future reference, dip it immediately into white shellac or lacquer.

11. Interpretation of Results

11.1 Compare the exposed strip with the ASTM Copper Strip Corrosion Standards described in 7.5 and as summarized in Table 1. Hold the test strip and the Standard in such a manner that light reflected from them at an angle of approximately 45° will be observed.

11.1.1 When a strip is in the obvious transition state between that indicated by any two adjacent standard strips, rate the sample at the more tarnished classification. Should a strip appear to have a darker orange color than Standard Strip 1b, consider the observed strip as still belonging in Classification 1; however, if any evidence of red color is observed, the observed strip belongs in Classification 2.

11.1.2 Repeat the test if blemishes due to fingerprints are observed, or due to spots from any particles or water droplets that may have touched the test strip during the digestion period.

11.1.3 Repeat the test also if the sharp edges along the flat faces of the strip appear to be in a classification higher than the greater portion of the strip; in this case, it is likely that the edges were burnished during preparation (polishing).

12. Report

12.1 Report the corrosiveness of the copper strip in accordance with one of the classifications of the ASTM Copper Strip Corrosion Standards and as summarized in Table 1. A rating of 1a or 1b is considered a “Pass;” all others shall be considered failures.

13. Precision and Bias

13.1 In the case of pass/fail data, no generally accepted method for determining precision and bias is currently available.

14. Quality Guidelines

14.1 In the case of pass/fail data, no generally accepted method for determining that this test is under statistical control is currently available.

15. Keywords

15.1 aromatic hydrocarbon; copper corrosion test; corrosiveness to copper

SUMMARY OF CHANGES

Committee D16 has identified the location of selected changes to this standard since the last issue (D849–11) that may impact the use of this standard. (Approved October 1, 2015.)

- (1) Revised footnote 4.
- (2) Revised 7.3.

- (3) Added 11.1.2 and 11.1.3.
- (4) Added keywords to Section 15.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; <http://www.copyright.com/>