This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: D130 – 26

Federation of Societies for Paint Technology Standard No. Dt-28-65
British Standard 4351

Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test[1]

This standard is issued under the fixed designation D130; 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 determination of the corrosiveness to copper of aviation gasoline, aviation turbine fuel, automotive gasoline, cleaners (Stoddard) solvent, kerosine, diesel fuel, distillate fuel oil, lubricating oil, and natural gasoline or other hydrocarbons having a vapor pressure no greater than 124 kPa (18 psi) at 37.8 °C. (**Warning—**Some products, particularly natural gasoline, may have a much higher vapor pressure than would normally be characteristic of automotive or aviation gasolines. For this reason, exercise extreme caution to ensure that the pressure vessel used in this test method and containing natural gasoline or other products of high vapor pressure is not placed in the 100 °C (212 °F) bath. Samples having vapor pressures in excess of 124 kPa (18 psi) may develop sufficient pressures at 100 °C to rupture the pressure vessel. For any sample having a vapor pressure above 124 kPa (18 psi), use Test Method D1838.)

1.2 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* For specific warning statements, see 1.1, 7.1, and Annex A2.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D396 Specification for Fuel Oils
D975 Specification for Diesel Fuel
D1655 Specification for Aviation Turbine Fuels
D1838 Test Method for Copper Strip Corrosion by Liquefied Petroleum (LP) Gases
D4057 Practice for Manual Sampling of Petroleum and Petroleum Products
D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants
D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products
D6300 Practice for Determination of Precision and Bias Data for Use in Test Methods for Petroleum Products, Liquid Fuels, and Lubricants
E1 Specification for ASTM Liquid-in-Glass Thermometers

2.2 *ASTM Adjuncts:*

ASTM Copper Strip Corrosion Standard[3]

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this test method, refer to Terminology D4175.

3.2 *Acronyms:*

3.2.1 *CAMI*—Coated Abrasives Manufacturers Institute

3.2.2 *FEPA*—Federation of European Producers Association

4. Summary of Test Method

4.1 A polished copper strip is immersed in a specific volume of the sample being tested and heated under conditions of

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.05 on Properties of Fuels, Petroleum Coke and Carbon Material.

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

[3] Available from ASTM International Headquarters. Order Adjunct No. ADJD0130. Names of suppliers in the United Kingdom can be obtained from Energy Institute, 61 New Cavendish St., London, WIG 7AR, U.K. Two master standards are held by the IP for reference.

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

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temperature and time that are specific to the class of material being tested. At the end of the heating period, the copper strip is removed, washed and the color and tarnish level assessed against the ASTM Copper Strip Corrosion Standard.

5. Significance and Use

5.1 Crude petroleum contains sulfur compounds, most of which are removed during refining. However, of the sulfur compounds remaining in the petroleum product, some can have a corroding action on various metals and this corrosivity is not necessarily related directly to the total sulfur content. The effect can vary according to the chemical types of sulfur compounds present. The copper strip corrosion test is designed to assess the relative degree of corrosivity of a petroleum product.

6. Apparatus

6.1 *Copper Strip Corrosion Pressure Vessel,* constructed from stainless steel according to the dimensions as given in Fig. 1. The vessel shall be capable of withstanding a test pressure of 700 kPa gauge (100 psi). Alternative designs for the vessel's cap and synthetic rubber gasket may be used provided that the internal dimensions of the vessel are the same as those shown in Fig. 1. The internal dimensions of the pressure vessel are such that a nominal 25 mm by 150 mm test tube can be placed inside the pressure vessel.

6.2 *Test Tubes,* of borosilicate glass of nominal 25 mm by 150 mm dimensions. The internal dimensions shall be checked as acceptable by use of a copper strip (see 7.3). When 30 mL of liquid is added to the test tube with the copper strip in it, a minimum of 5 mm of liquid shall be above the top surface of the strip.

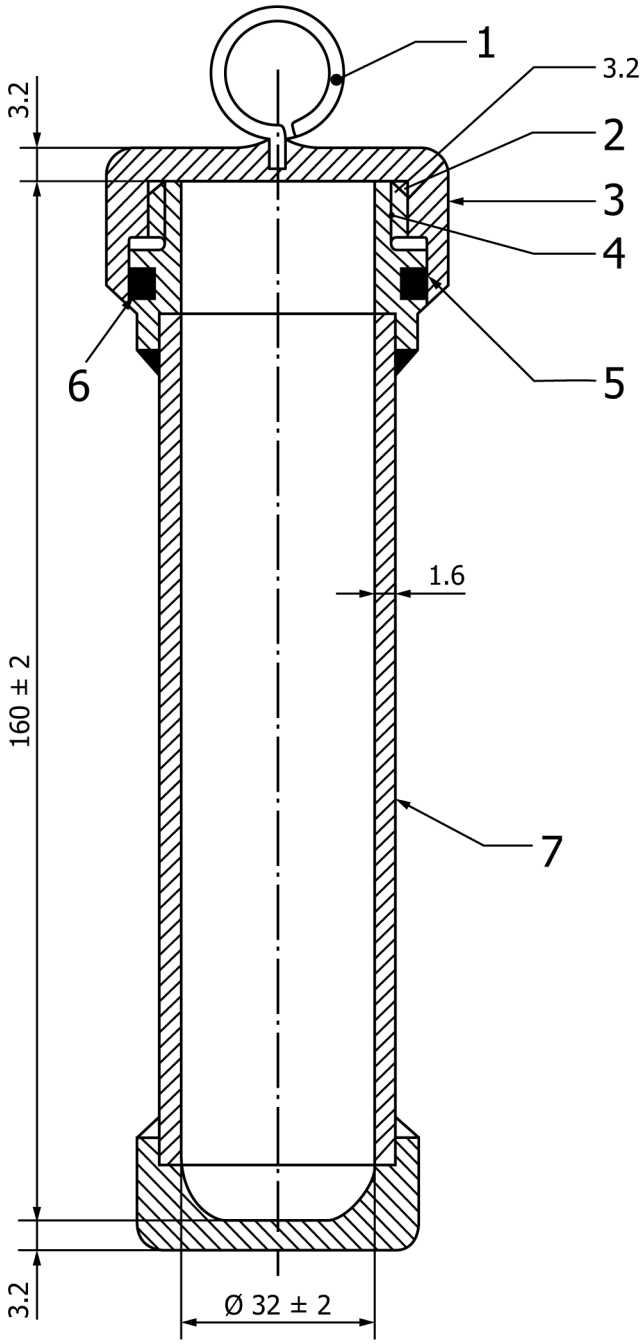
6.3 *Test Baths:*

6.3.1 *General*—All test baths shall be able to maintain the test temperature to within ±1 °C (2 °F) of the required test temperature.

6.3.2 *Liquid Bath Used for Submerging Pressure Vessel(s)*—The bath shall be deep enough to submerge one or more pressure vessels (see 6.1) completely during the test. As the bath medium, use water or any liquid that can be satisfactorily controlled to the sample test temperature. The bath shall be fitted with suitable supports to hold each pressure vessel in a vertical position when submerged.

6.3.3 *Bath(s) Used for Test Tubes*—Liquid baths shall be fitted with suitable supports to hold each test tube (see 6.2) in a vertical position to a depth of about 100 mm (4 in.) as measured from the bottom of the test tube to the bath surface. As a liquid bath medium, water and oil have been found satisfactory and controllable at the specified test temperature. Solid block baths shall meet the same temperature control and immersion conditions and shall be checked for temperature measurement (heat transfer) for each product class by running tests on tubes filled with 30 mL of product plus a metal strip of the nominal dimensions given, plus a temperature sensor.

6.4 *Temperature Sensing Device (TSD),* capable of monitoring the desired test temperature in the bath to within an accuracy of ±1 °C or better. The ASTM 12C (12F) (see Specification E1) or IP 64C (64F) total immersion thermometers have been found suitable to use in the test method so



Key:
1 Lifting eye
2 Wide groove for pressure relief
3 Knurled cap
4 Twelve threads per inch NF thread or equivalent
5 Camber inside cap to protect "O" ring when closing pressure vessel
6 Synthetic rubber "O" ring without free sulfur
7 Seamless tube
Material: stainless steel
Welded construction
Maximum test gauge pressure: 700 kPa

NOTE 1—Dimensions in millimetres.

NOTE 2—All dimensions without tolerance limits are nominal values.

FIG. 1 Pressure Vessel for Copper Strip Corrosion Test

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more than 10 mm (0.4 in.) of the mercury should extend above the surface of the bath at the test temperature.

6.5 *Polishing Vise,* for holding the copper strip firmly without marring the edges while polishing. Any convenient type of holder (see Appendix X1) may be used provided that the strip is held tightly and that the surface of the strip being polished is supported above the surface of the holder.

6.6 *Viewing Test Tubes,* flat glass test tubes, are convenient for protecting corroded copper strips for close inspection or storage (see Appendix X1 for the description of a flat-glass viewing tube). The viewing test tube shall be of such dimensions as to allow the introduction of a copper strip (see 7.3) and made of glass free of striae or similar defects.

6.7 *Forceps,* with either stainless steel or polytetrafluoroethylene (PTFE) tips, for use in handling the copper strips, have been found suitable to use.

6.8 *Timing Device,* electronic or manual, capable of accurately measuring the test duration within the allowable tolerance.

7. Reagents and Materials

7.1 *Wash Solvent*—Any volatile, less than 5 mg⁄kg sulfur hydrocarbon solvent may be used provided that it shows no tarnish at all when tested for 3 h at 50 °C (122 °F). 2,2,4-trimethylpentane (*iso*octane) of minimum 99.75 % purity is the referee solvent and should be used in case of dispute. (**Warning—**extremely flammable, see A2.1.)

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 grade (220 grit CAMI-grade or P220 FEPA-grade); also a supply of 105 µm (120 grit to 150 grit CAMI-grade or P120 to P150 FEPA-grade) 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 Specification*—Use strips that are 12.5 mm ± 2 mm (½ in.) wide, 1.5 mm to 3.2 mm (1⁄16 in. to ⅛ in.) thick, and cut 75 mm ± 5 mm (3 in.) long from smooth-surfaced, hard-temper, cold-finished copper of 99.9 + % purity; electrical bus bar stock is generally suitable (see Annex A1). The strips may be used repeatedly but shall be discarded when the strip's surface shows pitting or deep scratches that cannot be removed by the specified polishing procedure, or when the surface becomes deformed, or the dimensions for the copper strip fall outside the specified limits.

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

8. ASTM Copper Strip Corrosion Standards[3]

8.1 These consist of reproductions in color of typical test strips representing increasing degrees of tarnish and corrosion, the reproductions being encased for protection in plastic and made up in the form of a plaque.

8.1.1 Keep the plastic-encased ASTM Copper Strip Corrosion Standards protected from light to avoid the possibility of fading. Inspect for fading by comparing two different plaques, one of which has been carefully protected from light (for example, new plaque). Observe both sets in diffused daylight (or equivalent) first from a point directly above and then from an angle of 45°. If any evidence of fading is observed, particularly at the left-hand end of the plaque, it is suggested that the one that is the more faded with respect to the other be discarded.

8.1.1.1 Alternatively, place a suitably sized opaque strip (for example, 20 mm (¾ in.) black electrical tape) across the top of the colored portion of the plaque when initially purchased. At intervals remove the opaque strip and observe. When there is any evidence of fading of the exposed portion, the standards shall be replaced.

8.1.1.2 These plaques are full-color reproductions of typical strips. They have been printed on photo lithographed strips encased in plastic and made up in the form of a plaque for protection. Directions for their use are given on the reverse side of each plaque.

8.1.2 If the surface of the plastic cover shows excessive scratching, it is suggested that the plaque be replaced.

9. Samples

9.1 In accordance with D4057 or D4177, or both, it is particularly important that all types of fuel samples, that pass a low-tarnish strip classification, be collected in clean, dark glass bottles, plastic bottles, or other suitable containers that will not affect the corrosive properties of the fuel. Avoid the use of tin plate containers for collection of samples, since experience has shown that they may contribute to the corrosiveness of the sample.

9.2 Fill the containers as completely as possible and close them immediately after taking the sample. Adequate headspace in the container is necessary to provide room for possible thermal expansion during transport. It is recommended that volatile samples be filled between 70 % and 80 % of the container's capacity. Take care during sampling to protect the samples from exposure to direct sunlight or even diffused daylight. Carry out the test as soon as possible after receipt in the laboratory and immediately after opening the container.

9.3 If suspended water (that is, haze) is observed in the sample, dry by filtering a sufficient volume of sample through a medium rapid qualitative filter, into the prescribed clean, dry test tube. Carry out this operation in a darkened room or under a light-protected shield.

9.3.1 Contact of the copper strip with water before, during or after completion of the test run will cause staining, making it difficult to evaluate the strips.

10. Preparation of Test Strips

10.1 *Surface Preparation*—Remove all surface blemishes from all six sides of the strip obtained from a previous analysis (see Note 1). One way to accomplish this is to use 00 grade or finer steel wool or silicon carbide paper or cloth of such degrees of fineness as are needed to accomplish the desired results efficiently. Finish with 65 µm (220 grit CAMI-grade or P220 FEPA-grade) silicon carbide paper or cloth, removing all marks that may have been made by other grades of paper used

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