



Standard Test Method for Inorganic Chlorides and Sulfates in Insulating Oils¹

This standard is issued under the fixed designation D 878; 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 approval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been adopted for use by government agencies to replace Method 5703 of Federal Test Method Standard No. 791b.

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

1. Scope

1.1 This test method describes the qualitative determination of inorganic chlorides and sulfates in electrical insulating oils.

NOTE 1—It should be pointed out that if the strong acids, hydrochloric and sulfuric, are present, they will give positive results for chlorides and sulfates, respectively.

1.2 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D 1193 Specification for Reagent Water

3. Summary of Test Method

3.1 Water is used to extract inorganic chlorides and sulfates from a test specimen of insulating oil. A portion of the water layer is treated with nitric acid and silver nitrate to reveal a white precipitate if chloride is present. A second portion is treated with hydrochloric acid and barium chloride. A white precipitate indicates the presence of sulfate.

4. Significance and Use

4.1 The presence of inorganic chlorides and sulfates in oil in contact with metal surfaces in electrical equipment can result in corrosion of transformer components. The deterioration of metal surfaces is dependent upon the quantity of the corrosive agent and the operating environment. Although not quantitative, this test method is a means for recognizing the potential for such a hazard.

5. Apparatus

5.1 *Separatory Funnel*, 250-mL and 500-mL capacity.

5.2 *Beakers*, 250-mL capacity.

5.3 *Test Tubes*, 25-mL capacity.

6. Reagents

6.1 *Purity of Reagents*—Use reagent grade chemicals in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.³ Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

6.2 *Purity of Water*—Unless otherwise indicated, reference to water shall be understood to mean reagent water conforming to Specification **D 1193**, Type I or Type II.

6.3 *Barium Chloride Solution (100 g/L)*—Dissolve 100 g of barium chloride ($\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$) in water and dilute to 1 L.

6.4 *n-Heptane*.

6.5 *Hydrochloric Acid (relative density 1.19)*—Concentrated hydrochloric acid (HCl).

6.6 *Nitric Acid (relative density 1.42)*—Concentrated nitric acid (HNO_3).

6.7 *Silver Nitrate Solution (100 g/L)*—Dissolve 100 g of silver nitrate (AgNO_3) in water and dilute to 1 L.

7. Procedure

7.1 In a 250-mL separatory funnel, shake thoroughly 100 mL (100 cm^3) of the oil test specimen with 75 mL of water at 95°C . Allow to separate, then draw off the water layer into a 250-mL beaker.

7.1.1 In case the separated water is not clear, filter it through a 10-cm diameter qualitative filter paper into a 250-mL beaker. The filtrate is then used for tests. As a check on the filter paper,

¹ This test method is under the jurisdiction of ASTM Committee D27 on Electrical Insulating Liquids and Gases and is the direct responsibility of Subcommittee D27.06 on Chemical Test.

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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 *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.