Designation: D 2756 – 02

An American National Standard

Standard Test Method for Weight Loss of Electrical Insulating Varnishes[1]

This standard is issued under the fixed designation D 2756; 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.

1. Scope

1.1 This test method covers the measurement of the loss in weight of cured electrical insulating varnishes on exposure to elevated temperature in air.

1.2 The values stated in SI units are the 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 precaution statements, see Section 7.

NOTE 1—IEC 60216 Part 2 is technically equivalent to this standard.

2. Referenced Documents

2.1 *ASTM Standards:*

D 115 Test Methods for Testing Solvent Containing Varnishes Used for Electrical Insulation[2]

D 1711 Terminology Relating to Electrical Insulation[2]

D 1932 Test Method for Thermal Endurance of Flexible Electrical Insulating Varnishes[2]

D 2518 Specification for Woven Glass Fabrics for Electrical Insulation[3]

D 5423 Specification for Forced-Convection Laboratory Ovens for Evaluation of Electrical Insulation[3]

2.2 *IEC Standards:*

IEC 60216 Guide for the determination of thermal endurance properties of electrical insulating materials—Part 2: Choice of test criteria[4]

3. Terminology

3.1 *Definitions:* For definitions of terms used in this test method, refer to Terminology D 1711.

4. Summary of Test Method

4.1 Specimens are prepared by coating glass cloth with varnish to be tested. The specimens are aged at elevated temperatures and the loss in weight is determined after a specific time.

5. Significance and Use

5.1 Weight loss is useful for indicating:

5.1.1 A form of degradation at elevated temperatures in air, and

5.1.2 Evolution of volatiles which may affect other components.

6. Apparatus

6.1 *Air-Circulating Oven*, capable of meeting the requirements of Specification D 5423, Type II.

6.2 *Glass Cloth*, heat-cleaned, Style No. 116, as described in Specification D 2518.

6.3 *Balance*, capable of weighing to nearest 0.001 g.

6.4 *Desiccator Jar*, with a suitable desiccant.

7. Safety Precautions

7.1 Varnish should not be used at temperatures above the flash point when inadequate ventilation and the possibility of flames or sparks exist. Varnish should be stored in sealed containers. The precautions shall also apply to the handling of the called for reagents and solvents.

8. Sampling

8.1 Sample the varnish in accordance with Test Methods D 115.

9. Test Specimens

9.1 Prepare the test specimens as described in Test Method D 1932. Make one panel for each test temperature. Use an average of ten readings to determine the thickness of the panels.

9.2 Cure the varnish in accordance with manufacturer's requirements.

9.3 Cut two specimens, 100 by 125 mm (4 by 5 in.) from each panel to be used for the tests.

---

[1] This test method is under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.01 on Electrical Insulating Varnishes, Powders and Encapsulating Compounds.

Current edition approved Sept. 10, 2002. Published October 2002. Originally issued as D 2756 – 68. Last previous edition D 2756 – 85 (1998).

[2] *Annual Book of ASTM Standards*, Vol 10.01.

[3] *Annual Book of ASTM Standards*, Vol 10.02.

[4] Available from IEC Central Office 3, rue de Varembi P.O. Box 131 CH - 1211 Geneva 20 Switzerland

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States.

9.4 Cut an uncoated piece of cloth, 100 by 125 mm (4 by 5 in.)

10. Procedure

10.1 Dry two cured specimens for each test temperature and one uncoated specimen for 2 h at 110°C (230°F). Place them in a desiccator and allow them to cool to room temperature. Weigh each specimen to the nearest 0.001 g. The weight of the coated specimen will be the initial weight.

10.2 Subtract the weight of the uncoated specimen from the weight of each coated specimen. This is the initial weight of the varnish solids on which the percent weight loss is based.

10.3 Select at least four temperatures between 150°C (300°F) and 250°C (480°F) for weight loss aging. Suggested temperatures are: 150°C (300°F), 200°C (390°F), 220°C (430°F), and 250°C (480°F).

10.4 Hang the cured specimens in the aging ovens, taking the necessary precautions to assure good air flow parallel to the surface of the specimens. Precautions should also be taken to prevent the specimens from whipping around in the ovens. (See Note 2).

10.5 After 96 h (Note 3) remove the specimens from the oven and place them in a desiccator. After cooling to room temperature, weigh the specimens. Subtract the weight of the glass and the aluminum foil tab, if used. This is the final weight.

NOTE 2—It has been found that the use of battery clips over aluminum foil identification tabs works very well to hold the specimens and prevent whipping around in the ovens. The use of the foil tabs also prevents the battery clips from picking up any varnish, which could introduce an error in the measurement.

TABLE 1 Round-Robin Test Results

Hours at 200°C	Avg. Weight Loss, %	Interlaboratory Standard Deviation
24	21.0	1.23
48	26.0	1.64
96	31.2	2.04

NOTE 3—When more information is required, it may be desirable to use a number of selected time periods (for example: 4, 24, 48, 96 h, and in some cases, even longer periods of time). A curve of weight loss versus the logarithm of time may then be plotted which shows the instantaneous rate of the loss. A comparison of the initial rate and subsequent or final rate may provide valuable information as to the degradative mechanisms involved.

10.6 Calculate the percent weight loss as follows:

$$\text{Weight loss, \%} = [(W_1 - W_2)/W_1] \times 100 \quad (1)$$

where:
W_1 = initial weight of varnish solids, and
W_2 = final weight.

11. Report

11.1 Report the following information:

11.1.1 Identity of varnish,

11.1.2 Cure cycle on specimen, and

11.1.3 Percent weight loss after 96 h at the selected temperatures.

12. Precision and Bias

12.1 The data in Table 1 are the combined results of the six laboratories which participated in the round-robin test for this test method.[5]

12.2 This test method has no bias because the weight loss of varnishes is defined solely in terms of this method.

13. Keywords

13.1 varnish; weight loss

[5] Supporting data are available from ASTM Headquarters. Request RR: D9-1015.

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).