Designation: D3056 – 14

Standard Test Method for Gel Time of Solventless Varnishes[1]

This standard is issued under the fixed designation D3056; 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 gel time of a solventless varnish mixed with a catalyst, if required, and exposed to elevated temperature.

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 a specific precaution statement, see Section 6.

NOTE 1—Although this standard and IEC 60455–2 differ in approach or detail, data obtained using either are technically equivalent.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1711 Terminology Relating to Electrical Insulation

2.2 *IEC Standard:*[3]

IEC 60455–2 Resin Based Reactive Compounds Used for Electrical Insulation—Part 2: Methods of Test

3. Terminology

3.1 *Definitions:*

3.1.1 *gel time, n—of solventless varnish*, the time required at a specified temperature for a solventless varnish to be transformed from a liquid state to a gel as measured with a suitable gel time apparatus.

3.1.2 See Terminology D1711 for definitions of other terms relating to electrical insulation.

4. Significance and Use

4.1 Gel time is important in determining batch uniformity and some processing characteristics. It is indicative of pot life and shelf life.

5. Apparatus

5.1 *Gel Time Apparatus.*[4]

5.2 *Power Supply,* 110 V ac variable.

5.3 *Balance,* with accuracy to the nearest 0.01 g.

5.4 *Temperature Controller,* capable of maintaining to ±1°C.

5.5 *Magnetic Stirrer,* with a magnetized stirring bar coated with a tetrafluoroethylene.

6. Safety Precautions

6.1 It is unsafe to use varnish at temperatures above the flash point without adequate ventilation, especially if the possibility exists that flames or sparks are present. Store varnish in sealed containers.

7. Procedure

7.1 Set up the gel time apparatus as described in the instruction manual supplied by the manufacturer.

7.2 Fill the bath with water or a silicone liquid to completely immerse the test specimen of solventless varnish when the test tube is placed in the bath. Water is useful up to 100°C. Silicone liquids must be used above 100°C but are suitable for use at lower temperatures.

NOTE 2—The silicone liquid will be DC-200 or equivalent.

[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.

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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] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[4] The sole source of supply of the apparatus known to the committee at this time is Sunshine Gel Time Meter, Catalog No. 22, manufactured by Sunshine Scientific Instruments, 1810 Grant Ave., Philadelphia, PA 19115. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[4] which you may attend.

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

7.3 Place the bath on the magnetic stirrer, and insert the stirring bar into the bath. Connect the heating coil to the temperature controller. Start the cold water on the bath condenser.

7.4 Adjust the bath to the desired temperature.

7.5 If the varnish requires the addition of catalyst, weigh 100 ± 1 g of solventless varnish into a 150-mL beaker and record the mass to the nearest 0.01 g.

7.6 Weigh the desired amount of catalyst to an accuracy of ±1 % into the 100 g of solventless varnish and mix thoroughly.

7.7 Weigh 9.5 to 10.5 g of catalyzed solventless varnish into a 16 by 150-mm test tube.

7.8 Insert the glass test rod from the gel time apparatus in the test tube.

7.9 Quickly place the test tube in the bath, connect the glass test rod to the meter, center and start the timer. The timer must be started within 10 s after the test tube is placed in the bath.

7.10 Allow the test specimen to remain in the bath until the meter indicates completion of test. The meter will shut off when the specimen has gelled.

8. Report

8.1 Report the following information:
8.1.1 Identification of solventless varnish,
8.1.2 Name and amount of catalyst used,
8.1.3 Gel time to the nearest 0.1 min, and
8.1.4 Temperature of the bath and the liquid used.

9. Precision and Bias

9.1 *Precision*—The data in Table 1 are the combined results of five laboratories which participated in the round robin for this test method.[5]

TABLE 1 Round-Robin Test Results

NOTE 1—Testing was done using an unsaturated polyester varnish in 200-cP silicone oil at 100°C.

Catalyst	Gel Time, Avg, Min	Interlaboratory Standard Deviation
Tertiary butyl perbenzoate, 1 %	17.5	2.8
Dicumyl peroxide, 1 %	78.4	10.0

9.2 *Bias*—This test method has no bias because the value for gel time is defined solely in terms of this test method.

10. Keywords

10.1 gel time; solventless varnish; varnish

[5] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D09-1022.

SUMMARY OF CHANGES

Committee D09 has identified the location of selected changes to this standard since the last issue (D3056 – 05 (2010)) that may impact the use of this standard. (Approved Nov. 1, 2014.)

(1) Revised subsection 1.1.