



Designation: D8561 – 24

Standard Test Method for Gel Time of Solventless Varnishes by Plunger Method¹

This standard is issued under the fixed designation D8561; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

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.

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

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 a specific precaution statement, see Section 8.

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

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

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 Products.

Current edition approved March 1, 2024. Published March 2024. DOI: 10.1520/D8561-24.

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 International Electrotechnical Commission (IEC), 3, rue de Varembé, 1st floor, P.O. Box 131, CH-1211, Geneva 20, Switzerland, <https://www.iec.ch>.

3.2 Definitions:

3.2.1 *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.

4. Summary of Test Method

4.1 A specific size sample of liquid solventless insulating varnish is placed in a tube. A plunger is inserted into the varnish. The tube is placed in a heated block or bath. The plunger is oscillated up and down until the tube is lifted enough to trip an optical sensor. This stops the timing mechanism.

5. Significance and Use

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

6. Apparatus

6.1 *Gel Time Apparatus Consisting of:*

6.1.1 *Plunger*—Aluminum wire (1.0 mm (0.040 in.)), with a section at one end wound into a helix of 5 turns with an inside diameter of approximately 4 mm (0.16 in.). The overall length of the wire shall be appropriate to the testing machine and allow the helix to be in approximate center of the resin in the test tube.

6.1.2 *Test Tube* (16 mm by 160 mm).

6.1.3 *Heating Block or Heating Bath* capable of controlling the temperature to ± 1.0 °C (1.8 °F) up to 200 °C (392 °F). The bath shall be filled with silicone oil and have agitation to maintain a uniform temperature.

6.1.4 *Mechanism* capable of moving the plunger up and down at distance of 10 mm (0.38 in.) at a rate of 15 s per cycle.

6.1.5 *Optical Sensor* set to detect 6 mm movement of the test tube.

6.1.6 *Foam Ring (Polyethylene)*—6 mm (0.63 in.) ID, 35 mm (1.38 in.) OD to trip optical sensor.

6.1.7 *Timer* capable of measuring in 1 s intervals.

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

7. Reagents and Materials

7.1 *Varnish* to be tested.

7.2 *Catalyst*, if required.