



Designation: **D4669—18** **D4669 – 24**

Standard Test Method for Polyurethane Raw Materials: Determination of Specific Gravity of Polyols¹

This standard is issued under the fixed designation D4669; 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 These test methods measure the specific gravity of polyols. Test Method A measures the specific gravity of polyols using a pycnometer and Test Method B lists a reference for measuring the specific gravity of liquids using a density meter that is applicable to polyols (see **Note 1**).

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—There is no known ISO equivalent to this standard.

1.3 *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
- [D883 Terminology Relating to Plastics](#)
 - [D4052 Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter](#)
 - [E2251 Specification for Liquid-in-Glass ASTM Thermometers with Low-Hazard Precision Liquids](#)
 - [E202 Test Methods for Analysis of Ethylene Glycols and Propylene Glycols](#)

3. Terminology

3.1 *Definitions*—For definitions of terms used in these test methods see Terminology **D883**.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *specific gravity*—the ratio of the weight in air of a given volume of the material at a stated temperature to the weight in air of an equal volume of water at a stated temperature. It shall be expressed as specific gravity, 25/25°C, indicating that the sample and reference water were both measured at 25°C.

¹ These test methods are under the jurisdiction of ASTM Committee **D20** on Plastics and is the direct responsibility of Subcommittee **D20.22** on Cellular Materials - Plastics and Elastomers. It was recommended to ASTM by the Center for the Polyurethane Industry of the American Chemistry Council.

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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.

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

4. Significance and Use

4.1 These test methods are suitable for quality control, specification testing, and research. The specific gravity is necessary when converting kinematic viscosity to absolute viscosity.

TEST METHOD A—SPECIFIC GRAVITY USING A PYCNOMETER

5. Apparatus

5.1 *Pycnometer*, of 25 or 50-mL capacity, conical shape with a capillary side arm overflow tube complete with a standard-taper $\frac{5}{12}$ ground-glass joint to receive a ground-glass vented cap. A thermometer with a scale graduated from 12 to 38°C in 0.2-degree divisions joins the neck of the flask with a standard-taper $\frac{10}{18}$ ground-glass joint. The thermometer contained in the pycnometer shall be calibrated in accordance with Specification **E2251**.

5.2 *Water Bath*, capable of maintaining a temperature of $25.0 \pm 0.05^\circ\text{C}$ during the test.

5.3 *Thermometer*, an ASTM Low Softening Point Thermometer having a range from -2 to +80°C and conforming to the requirements for Thermometer S15C as prescribed in Specification **E2251**.

5.4 *Analytical Balance*, sensitive to 0.1 mg.

6. Reagents

6.1 *Chromic Acid Cleaning Solution*—Prepare a saturated solution of chromic acid (CrO_3) in concentrated sulfuric acid (H_2SO_4 , sp gr 1.84).

6.2 *Acetone*, reagent grade

7. Sampling

7.1 High molecular weight polyester and polyether polyols contain molecules covering an appreciable range of molecular weights. These have a tendency to fractionate during solidification. Unless the material is a finely ground solid it is necessary to melt (using no higher temperature than necessary) and mix the polyol well before removing a sample for analysis. Since many polyols are hygroscopic, take care to provide minimum exposure to atmospheric moisture during the sampling.

8. Procedure

8.1 Clean the pycnometer by filling it with a chromic acid cleaning solution. Allow it to stand for a few hours, empty, and rinse well with distilled water.

8.2 Fill the pycnometer with freshly boiled distilled water cooled to $23 \pm 1^\circ\text{C}$, and set the pycnometer thermometer in place carefully, avoiding trapping of air. Place the pycnometer in the water bath that has been maintained at $25.0 \pm 0.05^\circ\text{C}$ for at least 30 min and allow it to equilibrate to 25.0°C . Wipe the overflow from the side-arm capillary and cover with the vented cap, remove from the bath, wipe dry, and weigh.

8.3 Empty the pycnometer, rinse well with acetone and dry under vacuum for 15 min. Weigh the pycnometer and subtract the weight of the empty pycnometer from the weight when filled with water in order to obtain the weight, W , of the contained water at 25°C in air.

8.4 The sample for test must be completely liquid. If the sample contains solid polyol, warm the entire sample in the original container until it becomes liquid. Then cool the sample to 22.2°C to 24°C and quickly fill the pycnometer with it, allowing it minimal exposure to the atmosphere.

8.5 Insert the thermometer carefully, avoiding trapping of air. Place the pycnometer in the water bath that has been maintained