



Designation: D 3321 – 94 (Reapproved 2002)

Standard Test Method for Use of the Refractometer for Field Test Determination of the Freezing Point of Aqueous Engine Coolants¹

This standard is issued under the fixed designation D 3321; 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 use of a portable refractometer for determining the approximate freezing protection provided by ethylene and propylene glycol-based coolant solutions as used in engine cooling systems and special applications.

NOTE 1—Some instruments have a supplementary freezing protection scale for methoxypropanol coolants. Others carry a supplemental scale calibrated in density or specific gravity readings of sulfuric acid solutions so that the refractometer can be used to determine the charged condition of lead acid storage batteries.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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.*

2. Referenced Documents

- 2.1 *ASTM Standards:*
D 1177 Test Method for Freezing Point of Aqueous Engine Coolants²

3. Summary of Test Method

3.1 These coolant testers³ are critical-angle refractometers designed for rapid, approximate measurement of ethylene and propylene glycol coolant freezing point protection. Only a few drops of test solution are required. Some testers automatically correct for ambient air temperature and the temperature of the solution being tested. The instrument is rugged, simple to read, and easy to clean and maintain.

3.2 The coolant freezing point readings are taken at points where the dividing line between light and dark crosses the

scales. Some refractometers have a coolant scale for indicating the freezing point of aqueous ethylene glycol coolants only, while other refractometers also have a scale for indicating the freezing point of aqueous propylene glycol coolants. The range of the scales varies from one device to another.

3.3 Freezing point measurements are concentration-related values and are in turn directly related to refractive index. It has been empirically determined that freezing point measurements are accurate within 1°C (2°F).

4. Significance and Use

4.1 This practice is commonly used by vehicle service personnel to determine the freezing point, in degrees Celsius or Fahrenheit, of aqueous solutions of commercial ethylene and propylene glycol-based coolant. A durable hand-held refractometer is available that reads the freezing point, directly, in degrees Celsius or Fahrenheit, when a few drops of engine coolant are properly placed on the temperature-compensated prism surface of the refractometer. This refractometer is for glycol and water solutions, and is not suitable for other coolant solutions.

4.2 The hand-held refractometer should be calibrated before use (see Section 7).

4.3 Care must be taken to use the correct glycol freezing point scale for the glycol type being measured. Use of the wrong glycol scale can result in freezing point errors of 18 and more degrees Fahrenheit.

4.4 Ethylene glycol/propylene glycol mixtures will result in inaccurate freezing point measurements using either freezing point scale.

5. Interferences

5.1 Interference can occur if the mixture is contaminated or if the prism surface is not clean. The presence of other glycols such as diethylene glycol in small amounts will not cause interference.

6. Apparatus

6.1 The hand-held critical angle refractometer is a rugged die-cast portable instrument that is covered with a high-impact plastic to minimize damage to the eyepiece lens if dropped. A polished glass prism is opposite the viewing end. A hinged plastic cover is moved over the prism (sampling end) to allow

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² *Annual Book of ASTM Standards*, Vol 15.05.

³ Coolant testers are available from Leica Inc., P.O. Box 123, Buffalo, NY 14240 and Misco Products, 3401 Virginia Rd., Cleveland, OH 44122.