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Standard Specification for Hydrometer-Thermometer Field Tester for Engine Coolants¹

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1. Scope

1.1 This specification covers the minimum requirements of a hydrometer-thermometer type of field tester for engine coolants. This tester is intended for determining quickly the freezing protection provided by mixtures of water and ethylene glycol coolants in automotive cooling systems. This type of tester may be designed to test any one or more of the commonly used coolant products. Field testers are not as precise as Test Method D 1177.

1.2 A standard method is provided for obtaining hydrometer reading-freezing point data, at various solution temperatures, for preparing freezing temperature charts in the original calibration of testers, and is of primary use to coolant producers and tester manufacturers.

1.3 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.4 Values stated in inch-pound units are to be regarded as the standard. The metric equivalents in celcius may be approximate.

2. Referenced Documents

2.1 ASTM Standards:

D 1176 Test Method for Sampling and Preparing Aqueous Solutions of Engine Coolants or Antirusts for Testing Purposes²

D 1177 Test Method for Freezing Point of Aqueous Engine Coolant Solution²

E 1 Specification for ASTM Thermometers³

E 100 Specification for ASTM Hydrometers³

2.2 NIST:

Circular 555

3. Apparatus

3.1 The tester consists of a hydrometer float, float jar, suction bulb, thermometer, freezing temperature chart or charts, and a tester base having an intake tube, with the component parts assembled to provide a practical working instrument.

3.2 The float shall be of the airtight glass-tube type having

a cylindrical bulb. The ballast shall be securely fixed in position in the lower portion of the bulb. The stem shall contain a scale in a permanently fixed position.

3.3 The float shall be made of a suitable type of clear transparent glass and shall be capable of withstanding normal handling and temperature changes encountered in ordinary service usage through the range from -30 to 200°F (approximately -34 to 93°C). The glass shall have a cubical coefficient of expansion of approximately $0.0000128/1^{\circ}\text{F}$ at 60°F ($0.00002304/1^{\circ}\text{C}$ at 15.56°C).⁴

3.4 When the float is immersed in a solution to the lowest graduation line on the scale and is floating freely, the top of the float shall be not more than $1/8$ in. (3.2 mm)⁴ from the true vertical position.

3.5 The scale in the float shall include the relative density range of solution concentrations of the coolant or coolants for which the tester is designed. The scale for glycol coolant shall be a minimum of $1\frac{1}{2}$ in. (38.1 mm) in length and shall contain not less than 12 relative density divisions for indicating freezing protections down to at least -55°F (nominal -48°C).⁴

NOTE 1—Since testers are calibrated to hydrometer reading data instead of true specific gravity data, references to relative density in this method are to such hydrometer reading data.

3.6 The scale length shall be measured from the middle of the bottom space to the middle of the top space. A line will be shown at the bottom of each space. Each space on the glycol scale shall be designated by a letter or number. The freezing temperature chart values shall be based on the relative density reading at the line below the letter or number.

NOTE 2—When testers are used in the field, the reading should be the first letter that can be clearly discerned above the liquid level. The letter in question may be partially obscured by the liquid on the stem (liquid meniscus), but enough of the letter must be visible to permit it to be identified. The line below the letter will then be approximately level with the surface of the liquid.

3.7 The float shall be accurate to within ± 0.003 relative density, calibrated at 60°F (15.56°C),⁴ and read at the bottom of the liquid meniscus.

3.8 A label, identifying the float with the particular tester model for which it is designed, shall be contained within the float as reference for obtaining replacements.

NOTE 3—The replacement float shall give a freezing protection indication, within the tolerance of the overall accuracy requirement

¹ This specification is under the jurisdiction of ASTM Committee D-15 on Engine Coolants and is the direct responsibility of Subcommittee D15.03 on Physical Properties.

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² Annual Book of ASTM Standards, Vol 15.05.

³ Annual Book of ASTM Standards, Vol 14.03.

⁴ Temperature conversions are mathematical only and do not represent higher or lower degree of accuracy than the corresponding customary value.