



Standard Test Method for Thermal Conductivity, Thermal Diffusivity and Volumetric Heat Capacity of Engine Coolants and Related Fluids by Transient Hot Wire Liquid Thermal Conductivity Method¹

This standard is issued under the fixed designation D7896; 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 transient hot wire liquid thermal conductivity method and associated equipment (the System) for the determination of thermal conductivity, thermal diffusivity and volumetric heat capacity of aqueous engine coolants, non-aqueous engine coolants, and related fluids. The System is intended for use in a laboratory.

1.2 The System directly measures thermal conductivity and thermal diffusivity without the requirement to input any additional properties. Volumetric heat capacity is calculated by dividing the thermal conductivity by the thermal diffusivity of the sample measured.

1.3 This test method can be applied to any aqueous or non-aqueous engine coolants or related fluid with thermal conductivity in the range of 0.1 to 1.0 W/m·K.

1.4 This test method excludes fluids that react with platinum.

1.5 The range of temperatures applicable to this test method is -20 to 100°C .

1.6 This test method requires a sample of approximately 40 mL.

1.7 The System may be used without external pressurization for any fluid having a vapor pressure of 33.8 kPa (4.9 psia) or less at the test temperature.

1.8 For a fluid having a vapor pressure greater than 33.8 kPa (4.9 psia) at the test temperature, external pressurization is required (see [Annex A2](#)).

1.9 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.9.1 *Exception*—Inch-pound units are provided in [1.7](#), [1.8](#), [4.1](#), [7.8](#), and [A2.1](#) for information.

1.10 *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:*²

[D1176 Practice for Sampling and Preparing Aqueous Solutions of Engine Coolants or Antirusts for Testing Purposes](#)
[E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method](#)

3. Terminology

3.1 *Definitions of Thermal Related Units:*

3.1.1 *density* (ρ), n —the mass per unit volume of a substance under specific conditions of pressure and temperature. Unit: kg/m^3 .

3.1.2 *specific heat capacity* (C_p), n —the amount of heat required to raise the temperature of a unit mass of material by 1°C . See [Annex A1](#). Unit: $\text{J}/(\text{kg}\cdot\text{K})$.

3.1.3 *thermal conductivity* (λ), n —rate of heat flow under steady conditions through unit area, per unit temperature gradient in the direction perpendicular to the area. Unit: $\text{W}/\text{m}\cdot\text{K}$.

3.1.4 *thermal diffusivity* (α), n —a measure of the ability of a substance to transmit a difference in temperature. Unit: m^2/s .

3.1.5 *volumetric heat capacity* (VHC), n —the amount of heat required to raise the temperature of a unit volume of material by 1°C . Volumetric heat capacity is the thermal conductivity of a material divided by its thermal diffusivity. Unit: $\text{J}/\text{m}^3\cdot\text{K}$.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *transient hot wire method*, n —a method for measurement of thermal properties wherein a thin wire is immersed in

¹ This test method is under the jurisdiction of ASTM Committee [D15](#) on Engine Coolants and Related Fluids, and is the direct responsibility of Subcommittee [D15.22](#) on Non-Aqueous Coolants.

Current edition approved Feb. 1, 2014. Published June 2014. DOI: 10.1520/D7896-14.

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.