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Standard Guide for Evaluation of Convective Heat Transfer Coefficient of Liquids¹

This standard is issued under the fixed designation D7863; 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 guide covers general information, without specific limits, for selecting methods for evaluating the heating and cooling performance of liquids used to transfer heat where forced convection is the primary mode for heat transfer. Further, methods of comparison are presented to effectively and easily distinguish performance characteristics of the heat transfer fluids.

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

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.*

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

- D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- D1298 Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
- D2270 Practice for Calculating Viscosity Index from Kinematic Viscosity at 40 °C and 100 °C
- D2717 Test Method for Thermal Conductivity of Liquids
- D2766 Test Method for Specific Heat of Liquids and Solids
- D2879 Test Method for Vapor Pressure-Temperature Relationship and Initial Decomposition Temperature of Liquids by Isoteniscope
- D2887 Test Method for Boiling Range Distribution of Petroleum Fractions by Gas Chromatography
- D4052 Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter
- D4530 Test Method for Determination of Carbon Residue (Micro Method)
- D6743 Test Method for Thermal Stability of Organic Heat Transfer Fluids
- D7042 Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)
- E659 Test Method for Autoignition Temperature of Chemicals

¹ This guide is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.L0.06 on Non-Lubricating Process Fluids.

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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.

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *heat transfer fluid, n*—a fluid which remains essentially a liquid while transferring heat to or from an apparatus or process, although this guide does not preclude the evaluation of a heat transfer fluid that may be used in its vapor state.

3.1.1.1 *Discussion*—Heat transfer fluids may be hydrocarbon or petroleum based such as polyglycols, esters, hydrogenated terphenyls, alkylated aromatics, diphenyl-oxide/biphenyl blends, and mixtures of di- and triaryl-ethers. Small percentages of functional components such as antioxidants, anti-wear and anti-corrosion agents, TBN, acid scavengers, or dispersants, or a combination thereof, can be present.

3.1.2 *heat transfer coefficient, n*—a term, h , used to relate the amount of heat transfer per unit area at a given temperature difference between two media and for purposes of this guide, the temperature difference is between a flow media and its surrounding conduit.

3.1.2.1 *Discussion*—The heat transfer coefficient for conditions applicable to fluids flowing in circular conduits under turbulent flow is referred to as the convective heat transfer coefficient.

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