Designation: ~~D2890 – 92 (Reapproved 2018)~~ D2890 – 23

Standard Test Method for Calculation of Liquid Heat Capacity of Petroleum Distillate Fuels[1]

This standard is issued under the fixed designation D2890; 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~~ Scope*

1.1 This test method covers the calculation of liquid heat capacity, Btu/lb · °F (kJ/kg · K), at atmospheric pressure, of petroleum fuels for which distillation data may be obtained in accordance with Test Method D86 without reaching a decomposition point prior to obtaining 90 % by volume distilled.

1.2 This test method is not applicable at temperatures less than 0 °F (−18 °C) and greater than 60 °F (16 °C) above the volumetric average boiling point of the fuel.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *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.*

1.5 *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]

D86 Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure
D287 Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer/Method)
D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this test method, refer to Terminology D4175.

3.2 *Definitions of Terms Specific to This Standard:*

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.04.0K on Correlative Methods.

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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**

3.2.1 *mean average boiling point (MeABP), n*—defined internally for this method in Section 7, Procedure 7.3.

3.2.2 *volumetric average boiling point (VABP), n*—defined internally for this method in Section 7, Procedure 7.2.

3.2.3 *Watson characterization factor, K, n*—a systematic way of classifying a crude oil according to its paraffinic, naphthenic, intermediate or aromatic nature.

3.2.3.1 *Discussion*—

A K value of 12.5 or higher indicates a crude oil of predominantly paraffinic constituents, while 10 or lower indicates a crude of more aromatic nature.

4. Summary of Test Method

4.1 The Watson characterization factor, K, is obtained from a graphical correlation relating determined Test Method D86 distillation data and K. The liquid heat capacity is obtained, either graphically or mathematically, from correlations relating calculated heat capacity, temperature at which heat capacity is being calculated, determined API gravity, and K.

NOTE 1—Details of the method have been published.[3]

5. Significance and Use

5.1 Heat capacities obtained by this method are those at atmospheric pressure. However, because the temperature range is low, the calculated values are similar to saturated liquid heat capacities in the temperature-pressure range required for most engineering design.

6. Data Requirements

6.1 Distillation temperatures at (in °F) 10 %, 30 %, 50 %, 70 %, and 90 % by volume distilled obtained in accordance with Test Method D86.

6.2 API gravity determined in accordance with Test Method D287 or a method of equivalent accuracy.

7. Procedure

7.1 Calculate to the nearest 0.1 unit the slope of the Test Method D86 distillation curve, °F/volume %, as the difference between the 10 and 90 volume % distilled temperatures divided by 80.

7.2 Calculate to the nearest 1 °F the volumetric average boiling point (VABP) as the sum of Test Method D86 10 %, 30 %, 50 %, 70 %, and 90 % by volume distilled temperatures divided by 5.

7.3 Obtain a temperature correction to the nearest 1 °F from Fig. 1, using the slope and VABP calculated in accordance with ~~6.1~~7.1 and ~~6.2~~7.2. Calculate the mean average boiling point (MeABP) as the VABP plus the correction.

7.4 Obtain to the nearest 0.1 unit the Watson characterization factor, K, from Fig. 2 using the determined API gravity and calculated MeABP.

7.5 Obtain the calculated heat capacity at each specified temperature, either graphically from Fig. 3 or by solving the following equation:

$$C_p = [0.6811 - 0.308\,G + (0.000815 - 0.000306\,G)T] \quad (1)$$

$$(0.055\,K + 0.35)$$

[3] *Technical Data Book-Petroleum Refining*, Chapter 7, American Petroleum Institute, Division of Refining, 1220 L St. NW, Washington, DC 20005.