



# National Institute of Standards & Technology

## Report of Investigation

### Flash Point Reference Materials

8517 n-Decane  
8518 n-Undecane  
8519 n-Tetradecane  
8520 n-Hexadecane

Prepared by Committee S-15 of the American Society for Testing and Materials (ASTM)  
Distributed by the National Institute of Standards and Technology (NIST)

These Reference Materials (RMs) are intended for use in verifying the performance of various flash point testing instruments. A unit of each of these RMs consists of four sealed ampoules, each containing 20 mL of the flash point fluid.

The reference flash points of RMs 8517, 8518, 8519, and 8520 for specific flash point methods were determined through a cooperative interlaboratory program between NIST and ASTM Committee S-15 (Coordinating Committee on Flash Point). The participating laboratories used ASTM Standard Test Methods D 56, D 92, D 93, D 3278, and D 3828 [1-5]. The reference values obtained, expressed in °C, are listed in Table 1.

Table 1. Reference Flash Point

	Test Method	Reference Value °C	Expanded Uncertainty °C	No. of Independent Observations
8517 n-Decane	D 56	50.9	± 0.8	17
	D 93	52.8	± 1.0	21
	D 3278/D 3828	49.7	± 1.2	6
8518 n-Undecane	D 56	67.1	± 0.7	17
	D 92	73.2	± 2.5	14
	D 93	68.7	± 1.4	21
	D 3278/D 3828	65.9	± 1.6	6
8519 n-Tetradecane	D 92	115.5	± 2.6	13
	D 93	109.3	± 2.7	17
8520 n-Hexadecane	D 92	138.8	± 2.4	13
	D 93	133.9	± 2.8	16

**Uncertainty:** The uncertainty of each value in this Report is the numerical value of an expanded uncertainty  $U = k u_c$ , with  $U$  determined from a combined standard uncertainty  $u_c$  and a coverage factor  $k$  equal to a  $t$ -factor from the  $t$  distribution with degrees of freedom equal to the number of independent observations minus 1. The expanded uncertainty defines a range of values for the certified value within which the true value is believed to lie, at a level of confidence of 95 % [6].

Gaithersburg, MD 20899  
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Supporting data and statistical analyses are provided in the ASTM Research Report RR: S15-1010, which is available from ASTM International 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959, PH: (610) 832-9585, FAX: (610) 832-9555.

Statistical analysis was performed by S.B. Schiller of the NIST Statistical Engineering Division.

The technical and support aspects involved in the issuance of these RMs were coordinated through the Standard Reference Materials Program by J.C. Colbert.

#### NOTICE AND WARNING TO USERS

**Handling and Storage:** Protect ampoules from physical damage. Please read the MSDS for these materials before use. Store in a cool, dry, and well-ventilated area away from heat, sparks, or open flame.

**Use:** Sample aliquots for analysis should be withdrawn at 20 °C to 25 °C immediately after opening the ampoules and should be processed without delay for the certified values to be valid within the stated uncertainty.

**Expiration of Report:** This report of investigation expires September, 2000. Should any of the reference values change before the expiration of the report, purchasers will be notified by NIST. Return of the attached registration card will facilitate notification.

#### ASTM Standard Test Methods

- D 56 "Standard Test Method for Flash Point by Tag Closed Tester" covers the determination of flash point by Tag closed tester, of liquids with a kinematic viscosity of less than  $5.5 \times 10^{-6} \text{ m}^2/\text{s}$  (5.5 cSt) at 40 °C or less than  $9.5 \times 10^{-6} \text{ m}^2/\text{s}$  (9.5 cSt) at 25 °C, and a flash point below 93 °C. Both manual and automated instrument models were used in the cooperative program.
- D 92 "Standard Test Method for Flash and Fire Points by Cleveland Open Cup" covers the determination of flash and fire points by Cleveland open cup of all petroleum products except fuel oils and those having open cup flash point below 79 °C. Both manual and automated instruments were used in the cooperative program.
- D 93 "Standard Test Method of Flash Point by Pensky-Martens Closed Tester" covers the determination of the flash points by Pensky-Martens closed-cup tester of fuel oils, lube oils, suspension of solids, liquids that tend to form a surface film under the test conditions, and other liquids of similar viscosities. Both manual and automated instruments were used in the cooperative program.
- D 3278 "Standard Test Method for Flash Point of Liquids by Small Scale Closed Cup Apparatus" covers procedures for determining whether a material does or does not flash at a specified temperature or for determining the lowest finite temperature at which a material does flash when using a small scale tester.
- D 3828 "Standard Test Method for Flash Point by Small Scale Closed Tester" covers procedures for determining the flash point by a small scale closed tester.

#### REFERENCES

- [1] ASTM D 56-93, Annual Book of ASTM Standards, Vol. 05.01, (1993).
- [2] ASTM D 92-90, Annual Book of ASTM Standards, Vol. 05.01, (1993).
- [3] ASTM D 93-90<sup>e1</sup>, Annual Book of ASTM Standards, Vol. 05.01, (1993).
- [4] ASTM D 3278-89, Annual Book of ASTM Standards, Vol. 06.01, (1993).
- [5] ASTM D 3828-93, Annual Book of ASTM Standards, Vol. 05.02, (1995).
- [6] "Guide to the Expression of Uncertainty in Measurement," ISBN 92-67-10188-9, 1st Ed. ISO, Switzerland, (1993): see also Taylor, B.N. and Kuyatt, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results", NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C., (1994).