Designation: D5800 – 21

Standard Test Method for Evaporation Loss of Lubricating Oils by the Noack Method[1]

This standard is issued under the fixed designation D5800; 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 four procedures for determining the evaporation loss of lubricating oils (particularly engine oils). The evaporation measured is reported as percent total loss. The test method relates to one set of operating conditions but may be readily adapted to other conditions as required.

1.2 Procedure B and Procedure D that are in the main section of the test method provide equivalent results. Procedures A and C, which are in Annex A1 and Annex A2, have equivalent results. It has been determined that Procedures A and C show a slight bias when compared to Procedures B and D. Procedures B and D give slightly higher results versus Procedures A and C on formulated engine oils, while Procedures B and D give lower results versus Procedures A and C on basestocks. Thus, a correction factor is utilized to convert between the two sets of Procedures based on the fluid type.

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

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products

D6299 Practice for Applying Statistical Quality Assurance and Control Charting Techniques to Evaluate Analytical Measurement System Performance

D6300 Practice for Determination of Precision and Bias Data for Use in Test Methods for Petroleum Products, Liquid Fuels, and Lubricants

2.2 *DIN Standards:*[3]

DIN 1725 Specification for Aluminum Alloys

DIN 12785 Specifications for Glass Thermometers

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *evaporation loss, n—of a lubricating oil by the Noack method*, that mass of volatile oil vapors lost when the oil is heated in a test crucible through which a constant flow of air is drawn.

3.1.2 *volatility, n*—the tendency of a liquid to form a vapor.

4. Summary of Test Method

4.1 A measured quantity of sample is placed in an evaporation crucible or reaction flask that is then heated to 250 °C with a constant flow of air drawn through it for 60 min. The loss in mass of the oil is determined.

4.2 Interlaboratory tests have shown that Procedure A, Procedure B, Procedure C, and Procedure D yield statistically equivalent precision, with a correlation coefficient of $R^2 = 0.996$ (see research report).

5. Significance and Use

5.1 The evaporation loss is of particular importance in engine lubrication. Where high temperatures occur, portions of an oil can evaporate.

5.2 Evaporation may contribute to oil consumption in an engine and can lead to a change in the properties of an oil.

[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 D02.06 on Analysis of Liquid Fuels and Lubricants.

Current edition approved Oct. 1, 2021. Published October 2021. Originally approved in 1995. Last previous edition approved in 2020 as D5800 – 20. DOI: 10.1520/D5800-21.

[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] Available from Deutsches Institut für Normung e.V.(DIN), Am DIN-Platz, Burggrafenstrasse 6, 10787 Berlin, Germany, http://www.din.de.

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

5.3 Many engine manufacturers specify a maximum allowable evaporation loss.

5.4 Some engine manufacturers, when specifying a maximum allowable evaporation loss, quote this test method along with the specifications.

5.5 The apparatuses used in Procedure C (see Annex A2) and Procedure D, also permit collection of the volatile oil vapors for determination of their physical and chemical properties. Elemental analysis of the collected volatiles may be helpful in identifying components such as phosphorous, which has been linked to premature degradation of the emission system catalyst.

Procedure B—Non-Woods Metal Apparatus

6. Apparatus

6.1 The following procedure, Procedure B, describes an automated test method that uses the same principle, and the same crucible as Procedure A. Only the heat transfer medium to the sample and lid are different. It does not use Woods alloy, and the sample temperature is directly monitored.

6.2 *Noack Evaporative Testers*[4], (see Fig. 1 and Fig. 2 for both models), comprising the following:

6.2.1 *Heating Block Unit,* electrically heated by base and jacket heaters, having a total power consumption sufficient to ensure a specimen temperature profile similar to the one recorded in the specimen when heated with the Woods metal heater block. In the center of the heating block, there is a circular recess to insert the evaporative crucible. The jacket heater is configured to ensure a direct contact with the crucible. A mechanism is provided to open the jaws for crucible insertion. Two catches on the block prevent the crucible from rising, and the base heater is spring loaded to ensure a direct contact with the crucible.

6.2.2 *Evaporative Crucible,* with screw cover (see Fig. 3). The crucible is made of stainless steel (see Fig. 4). Above the support ring is the thread for the cover. The nickel-plated brass cover (see Fig. 5) is hermetically sealed to the crucible by an internal conical sealing surface. Three nozzles of hardened steel (see Fig. 6) permit the air stream to pass through the cover. The extraction tube (see Figs. 7 and 8), which slopes downward, leads from a threaded and sealed connection in the center of the cover.

6.2.3 *Temperature Probe*—The specimen temperature measuring device shall have an accuracy of 0.5 °C, or better, and a resolution of 0.1 °C, or better. The probe is provided with a calibration certificate of 250.0 °C with a precision of ±0.1 °C. Its diameter is 4 mm, and its position is as indicated in Fig. 4. It should be calibrated with appropriate procedure at appropriate frequency (minimum once a year).

6.3 *Balance,* capable of weighing at least 500 g to the nearest 0.01 g.

6.4 *Crucible Clamp and Spanner.*

6.5 *Reamer,* 2 mm diameter.

6.6 *Ball Bearing,* 3 mm to 5 mm diameter.

6.7 *Glassware Assembly,* strictly identical to the description in A1.1.6 – A1.1.12 and A1.1.15 of Procedure A.

[4] The sole source of supply of the apparatus known to the committee at this time for the Model A/B (NCK2/NCK2 5G) is ISL (PAC LP), B.P. 70285 14653 Carpiquet Cedex, Verson, France. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

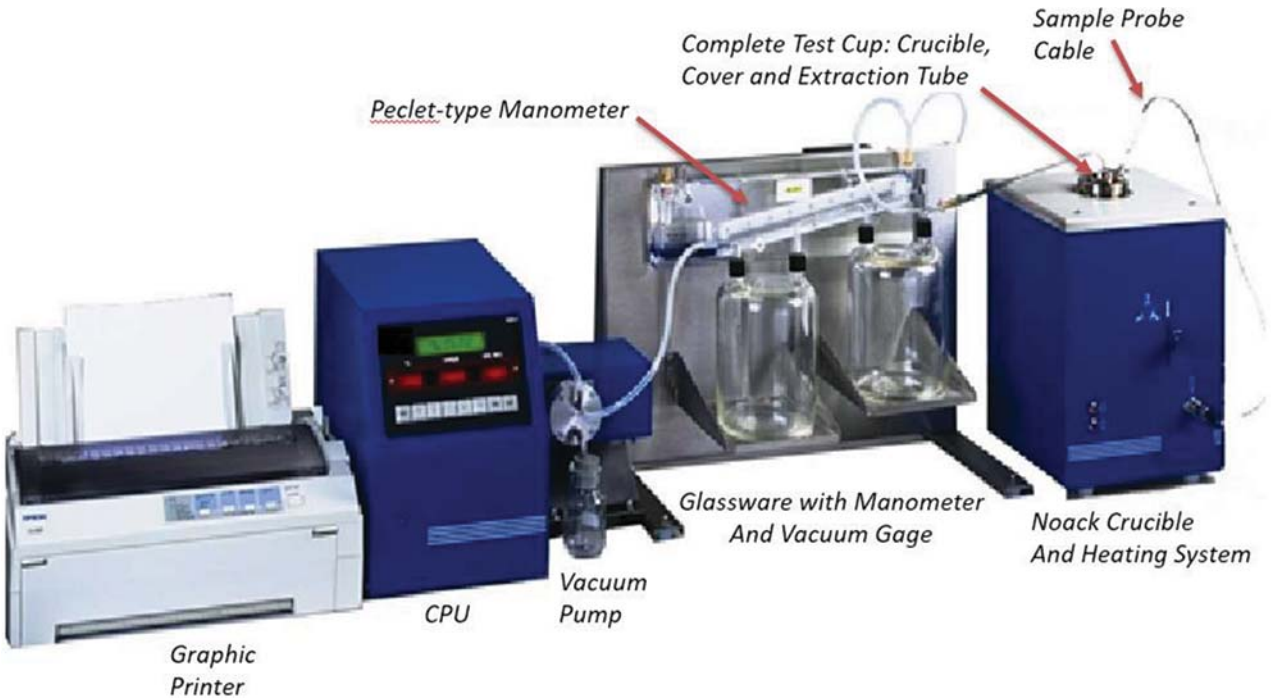

FIG. 1 Model A