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STANDARD

ANSI/ASHRAE Standard 86-2013 (RA 2016)
(Reaffirmation of ANSI/ASHRAE Standard 86-2013)

Methods of Testing the Floc Point of Refrigeration-Grade Oils

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NOTE

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FOREWORD

This standard describes a standard test method for measuring the floc point (waxing tendency) of refrigeration-grade oils. Petroleum-derived oils are mixtures of large numbers of chemically distinct hydrocarbon molecules. At the low temperatures encountered in the low-pressure side of refrigeration units, some of the larger molecules separate from the bulk of the oil in the form of wax-like deposits. Wax deposition of these molecules in refrigeration systems is undesirable, as they are known to clog capillary tubes and to cause expansion valves to stick. The floc point procedure requires, in addition to the oil, a fluid in which the oil is completely miscible to a temperature below that at which floc will form. Refrigerant-12 (R-12) was selected because it fits this requirement. Refrigerant-22 (R-22), for example, cannot be used because phase separation would, generally, result before the floc point was reached. The ensuing hazing, clouding, and separation into two different layers precludes obtaining a floc point. The industry has a great deal of experience in successfully extrapolating floc point data from the test tube to field application.

Development of a floc point using some other fluid besides R-12 is feasible. However, it would require a research project and extrapolation of the data from another fluid without the field correlation, which has been available for R-12 floc point data, could result in major field problems.

This 2016 reaffirmation of Standard 86-2013 was prepared under the auspices of ASHRAE. It may be used in whole or in part by an association or government agency with due credit to ASHRAE. Adherence is strictly on a voluntary basis and merely in the interest of obtaining uniform guidelines throughout the industry. This version of the reaffirmation has no changes.

1. PURPOSE

This standard provides a method for measuring the waxing tendency of refrigeration-grade oils.

2. SCOPE

The floc point measurement indicates the waxing tendency of refrigeration-grade oils at low temperatures. The floc point is defined as the highest temperature at which wax or other solid substances precipitate when a mixture 10% by volume of oil and 90% by volume of R-12 is cooled under specified conditions. The results can be used to compare the waxing tendency of several different oils.

3. DEFINITIONS

floc point: the highest temperature at which solid substances precipitate when a mixture 10% by volume of oil and 90% by volume of R-12 is cooled under specified conditions.

flocculent: containing, or occurring in the form of, loosely aggregated particles or soft flakes.

refrigeration-grade oil: a naphthenic/paraffinic type oil that is stable with system components, will form a friction-reducing film between rubbing surfaces and seal critical clearances, and has low-temperature transport properties suitable for the application for which it is used.

wax: higher molecular weight materials that are not soluble in R-12/mineral oil mixtures at a particular temperature.

4. APPARATUS

4.1 Cooling Bath. A cooling bath is required for obtaining the necessary temperature. It is prepared by using dry ice or a refrigeration system as the cooling source. The cooling bath shall be large enough for testing three sample tubes at one time. A large, wide-mouthed, clear Dewar flask is one cooling bath option. Dry ice in a liquid such as ethanol or acetone is required. The use of liquids such as ethanol is necessary because this liquid has the advantage of reduced frosting when the sample tube is raised from the bath for observation. A mechanical stirrer shall be provided for stirring the bath. Proper stirring is important to eliminate temperature differences. A small piece of aluminum foil in the liquid will indicate the degree of stirring obtained. If an electric motor is used, it is required to be of a type safe for use above the flammable cooling medium. A wire mesh basket with small openings shall be provided in the bath for the introduction of the dry ice so small pieces of dry ice cannot come into contact with the sample tube and cause local cold spots. The wire mesh basket can be raised or lowered to control the bath temperature.

4.2 Temperature-Measuring Devices. The temperature is measured with a precision electrical digital thermometer, a mercury thermometer, or an alcohol thermometer. ASTM standard thermometers 6F or 6C shall be used for this purpose. Thermometers shall be calibrated as prescribed by ASTM E1-07.[1]

4.3 Sample Tube. The sample tube consists of a thick walled borosilicate glass tube with a flared end and round bottom, as shown in Figure 1. Tube dimensions are 0.375 in. (9.5 mm) ID × 0.600 in. (15 mm) OD × 9 in. (228 mm) long. The tube shall be permanently graduated at the 0.34 oz (10.0 mL) volume (calibrated at room temperature).

4.4 Metal Connector Fittings. The metal connector fittings shall be as shown in Figure 1.

4.5 Graph Paper. In certain instances, graph paper is used with a glass plate to judge the cloudiness of the test sample. The graph shall have 20 lines per 1.0 in. (25.4 mm).

4.6 Mechanical Vacuum Pump. A mechanical vacuum pump that provides an absolute pressure of 13.3 Pa (0.1 mm Hg) shall be used.