

Determination of the density of grease — Density cup method

This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This standard describes a method for the determination of the density in air of greases of NLGI consistencies 000, 00, 0 1, 2 and 3.

2 Normative references

The following standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

IP 475: 1988, *Petroleum products — Liquid hydrocarbons — Manual sampling*. (≡ ISO 3170)

ISO 3696, *Water for analytical use — Specification and test methods*.

Appendix G: *IP Standard Methods for the Analysis and Testing of Petroleum and Related Products and British Standard 2000 Parts*.

American Standard Classification of Lubricating Grease ASA Designation Z11.130 – 1963.

3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply:

3.1

density in air

the apparent mass in air of the grease divided by its volume at a specified temperature expressed in grams per millilitre in air.

3.2

apparent mass in air

the value obtained by weighing an object in air without making a correction for the effect of air buoyancy on the object being weighed.

4 Principle

Using a density cup fitted with a tight fitting lid the apparent mass in air of a known volume of grease is determined at a specified temperature. The volume of the cup having been calculated from the apparent mass in air of water contained in the cup at the test temperature and the density of water at the test temperature. This volume and the apparent mass in air of the grease in the cup are used to calculate the grease's density at the test temperature.

5 Chemicals and materials

5.1 Water, conforming to grade 3 of ISO 3696.

5.2 Cleaning solvent, for removal of traces of the test portion from the density cup and lid.

NOTE 1 - Low volatility (benzene free) solvents have been found to be suitable.

6 Apparatus

Usual laboratory apparatus and glassware, together with the following.

6.1 Steel spatula

6.2 Top-pan balance, capacity 200 g capable of weighing to the nearest 1 mg.

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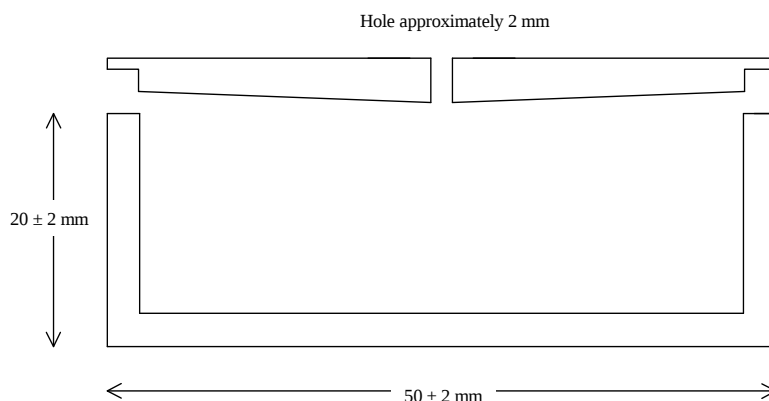


Figure 1

6.3 Density Cup and lid¹⁾, made of stainless steel or aluminium 50 mm ± 2 mm diameter and 20 mm ± 2 mm high, with a close fitting lid containing a hole approximately 2 mm diameter in the centre of the lid (see figure 1).

7 Sampling

Unless otherwise specified samples shall be taken in accordance with IP 475.

8 Calibration of the density cup

8.1 Check the density cup and lid (6.3) for dryness and cleanliness and if necessary clean with a cleaning solvent (5.2).

8.2 Bring the density cup and lid and the water (5.1) to the test temperature.

NOTE 2 - 15 °C, 20 °C or 30 °C have been found to be suitable temperatures.

8.3 Weigh the density cup and lid, and record the result to the nearest milligram.

8.4 Overfill the cup with water and place the lid in position. Remove excess water expelled from the cup from the outside of the cup and lid using a clean dry cloth.

8.5 Weigh the density cup and lid plus water and record the result to the nearest milligram.

8.6 Calculate the volume V of the density cup at the test temperature t °C as follows:

can be obtained from the Energy Institute.

$$V_t \text{ } ^\circ\text{C} = \frac{W_w - W_c}{\rho_w \text{ } t \text{ } ^\circ\text{C}} \quad (1)$$

where

W_c is the apparent mass in air of the cup and lid;

W_w is the apparent mass in air of cup, lid and water;

$\rho_w \text{ } t \text{ } ^\circ\text{C}$ is the density of water at the test temperature from the Density of Water table given in Appendix G of IP Standard Test Methods for Analysis and Testing of Petroleum Products and Related Products and British Standards 2000 Parts.

9 Procedure

9.1 Check the density cup and lid (6.3) for dryness and cleanliness and if necessary clean with a cleaning solvent (5.2).

9.2 Bring the density cup and lid and the sample to be tested to the test temperature.

NOTE 3 - 15 °C, 20 °C or 30 °C have been found to be suitable temperatures.

9.3 Weigh the density cup and lid, and record the result to the nearest milligram.

9.4 Using the spatula (6.1), overfill the density cup with the test portion, periodically agitating the cup to remove trapped air.

9.5 Using the spatula scrape off the excess grease extending above the rim by drawing the blade of the spatula across the cup.

1) Contact details of suppliers of suitable density cups

9.6 Place the lid onto the cup and gently push down, forcing excess grease out of the side of the cup and through the hole in the lid.

9.7 Ensure all excess grease has been expelled, then using a clean dry cloth wipe the outside of the cup and lid free of grease.

9.8 Weigh the density cup and lid plus grease and record the result to the nearest milligram.

10 Calculation

Calculate the density in air D of the grease at t °C as follows:

$$D_{t^{\circ}\text{C}} = \frac{W_g - W_c}{V_{t^{\circ}\text{C}}} \quad (2)$$

where

W_c is the apparent mass in air of the cup and lid;

W_g is the apparent mass in air of cup, lid and grease;

$V_{t^{\circ}\text{C}}$ is the volume of the cup at the test temperature (8.6).

11 Expression of results

Report the density of the grease at the test temperature t °C in grams per millilitre in air to three decimal places.

12 Precision

12.1 The Round Robin data collecting exercise to calculate the precision of this test method was not carried out strictly in accordance with IP 367. For this reason only a reproducibility statement can be made.

12.2 Reproducibility, R

The difference between two single and independent results, obtained by different operators in different laboratories on nominally identical test material, in the normal and correct operation of the test method, would exceed the following value in only one case in twenty.

$$R = 0,012 \text{ g/ml}$$

13 Test report

The test report shall contain at least the following information:

- a reference to this standard;
- the type and identification of the product tested;
- the result of the test (see clause 11);
- any deviation, by agreement or otherwise, from the procedure specified;
- the date of the test.

Summary of changes

The location of selected changes made to this standard since the last version, that may impact the use of the standard, are:

Section 8.6) Calibration of density cup, additional wording.

Section 9.4) 6.2 changed to 6.1