INTERNATIONAL STANDARD

ISO 6883

Third edition
2000-07-01

Animal and vegetable fats and oils — Determination of conventional mass per volume ("litre weight in air")

Corps gras d'origines animale et végétale — Détermination de la masse volumique conventionnelle dans l'air («poids du litre dans l'air»)

Reference number
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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 6883 was prepared by Technical Committee ISO/TC 34, *Agricultural food products*, Subcommittee SC 11, *Animal and vegetable fats and oils*.

This third edition cancels and replaces the second edition (ISO 6883:1995), of which it constitutes a minor revision.

Annex A of this International Standard is for information only.

Animal and vegetable fats and oils — Determination of conventional mass per volume (“litre weight in air”)

1 Scope

This International Standard specifies a method for the determination of conventional mass per volume ("litre weight in air") of animal and vegetable fats and oils (hereinafter referred to as fats) in order to convert volume to mass or mass to volume.

The procedure is applicable only to fats in a liquid state.

The temperature of determination applied for any fat should be such that the fat does not deposit crystals at that temperature.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 661:1989, *Animal and vegetable fats and oils — Preparation of test sample.*

ISO 3507:1976, *Pyknometers.*

3 Term and definition

For the purposes of this International Standard, the following term and definition applies.

3.1
conventional mass per volume
litre weight in air
quotient of the mass in air of fat to its volume at a given temperature

NOTE It is expressed in kilograms per litre (numerically equal to grams per millilitre).

4 Principle

Measurement of the mass, at a specified temperature, of a volume of liquid fat in a calibrated pyknometer.

5 Apparatus

Usual laboratory apparatus and, in particular, the following.

5.1 Water bath, capable of being maintained within 0,1 °C of the temperatures chosen for the calibration and determination.

It should be fitted with a calibrated thermometer, graduated in divisions of 0,1 °C covering the relevant temperature range.

5.2 Pyknometer (Jaulmes), of capacity 50 ml, with side-arm.

It should be fitted by means of conical joints with a calibrated thermometer graduated in divisions of 0,1 °C and with a cap perforated at the top for the side-arm (see Figure 1).

The pyknometer should preferably be made of borosilicate glass, but if this is not available then one made of soda glass may be used.

NOTE The cap is only essential if the determination is carried out at a temperature below ambient.

Alternatively, the Type 3 (Gay-Lussac) pyknometer (see Figure 2) specified in ISO 3507 may be used; however, the use of a pyknometer with thermometer is preferred.

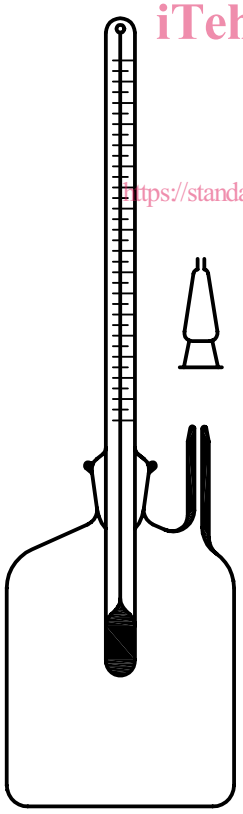

Figure 1 — Jaulmes pyknometer

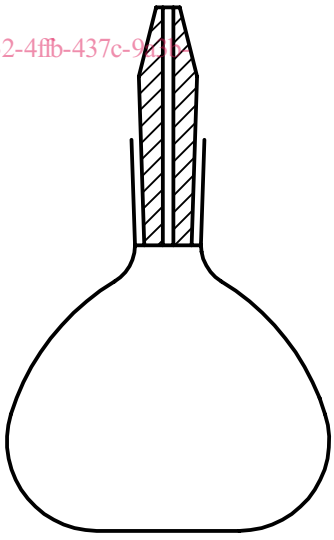

Figure 2 — Gay-Lussac pyknometer

6 Sampling

It is important that the laboratory receive a sample which is truly representative and has not been damaged or changed during transport or storage.

Sampling is not part of the method specified in this International Standard. A recommended sampling method is given in ISO 5555.

7 Preparation of test sample

Prepare the test sample in accordance with ISO 661, but do not filter or dry it.

Take care not to include air bubbles in the fat.

8 Procedure

8.1 Calibration of pyknometer

8.1.1 Calibrate the pyknometer (5.2) at least once a year, and at least in duplicate, by the procedure described in 8.1.2. Calibrate a pyknometer made of soda glass at least once every 3 months, at least in duplicate.

NOTE The calibration procedure described is used to determine the volume of the pyknometer when filled with water at the temperature θ_c.

8.1.2 Calibrate the pyknometer at the following temperatures:

a) at 40 °C if the mean coefficient of cubic expansion (γ) of the pyknometer glass is known;

b) at 20 °C and 60 °C if γ is not known.

8.1.3 Clean and thoroughly dry the pyknometer. Weigh, to the nearest 0,1 mg, the empty pyknometer with the thermometer and cap or with the stopper (m_1).

Bring recently distilled water or water of equivalent purity, free from air, to a temperature approximately 5 °C below the temperature of the water bath. Remove the thermometer and cap (or the stopper) and fill the pyknometer with the prepared water. Replace the thermometer or stopper. Take care not to include air bubbles during these operations. Place the filled pyknometer in the water bath, so that it is immersed up to the middle of its conical socket, until the contents have reached a stable temperature (which takes about 1 h). Allow the water to overflow from the side arm or stopper outlet. Record the temperature, θ_c, of the pyknometer contents to the nearest 0,1 °C. Carefully remove any water that has overflowed from the top and side of the side-arm or stopper. Place the cap on the side-arm. Remove the pyknometer from the water bath, wiping it thoroughly with fluff-free material until dry. Allow its temperature to reach ambient.

Weigh the full pyknometer with the thermometer and cap, or with the stopper, to the nearest 0,1 mg (m_2).

If the value of γ for the pyknometer glass is not known, adjust the water bath to the desired second calibration temperature and repeat the calibration procedure.

8.2 Determination

8.2.1 General

For a temperature of determination below ambient temperature, use a Jaulmes pyknometer.

Clean and thoroughly dry the pyknometer. Weigh, to the nearest 0,1 mg, the empty pyknometer with the thermometer and cap or with the stopper.

Adjust the water bath (5.1) to a temperature that does not vary by more than 1 °C from the temperature required for the determination, i.e. the temperature at the time of measurement of the fat in the bulk tank.

Bring the prepared test sample (clause 7) to a temperature of 3 °C to 5 °C below the temperature of the water bath. Mix carefully.

8.2.2 Fats which are solid at ambient temperatures

Heat the test sample (clause 7) to approximately 5 °C to 10 °C above its melting point. Stir until all the crystals are seen to be dissolved completely. Follow the procedure in 8.2.1, allowing the full pyknometer to cool before weighing it.

8.2.3 Using the Jaulmes pyknometer

Weigh, to the nearest 0,1 mg, the empty pyknometer with the thermometer and cap.

Remove the cap from the side arm and replace it by a short piece of flexible plastic tubing (3 cm to 5 cm) to form a watertight joint. Fill the pyknometer with the test sample and replace the thermometer, taking care not to include air bubbles.

NOTE Some of the sample rises into the plastic tube and is then able to expand or contract, as appropriate.

Immerse the filled pyknometer, up to the middle of its conical socket, for 2 h in the water bath (5.1) maintained at the temperature chosen for the determination, to allow the contents to reach this temperature. Remove the filled plastic tube with thumb and forefinger and wipe dry the surplus sample from the outlet. Replace the cap. Record the temperature, θ_d, of the pyknometer to the nearest 0,1 °C.

Remove the pyknometer from the water bath, wiping it carefully with fluff-free material until dry. Allow its temperature to reach ambient then weigh, to the nearest 0,1 mg, the full pyknometer with the thermometer and cap (m_3).

8.2.4 Using the Gay-Lussac pyknometer

Weigh, to the nearest 0,1 mg, the empty pyknometer with the stopper.

Fill the pyknometer with the test sample (clause 7) and replace the stopper, taking care not to include air bubbles. Immerse the filled pyknometer, up to the middle of its conical socket, for 2 h in the water bath (5.1) maintained at the temperature chosen for the determination, to allow the contents to reach this temperature.

Allow the sample to overflow and wipe the surplus from the outlet. Record the temperature ,θ_d, of the water bath to the nearest 0,1 °C. Wipe dry the surplus from the outlet.

Remove the pyknometer from the water bath, wiping it carefully with fluff-free material until dry. Allow its temperature to reach ambient, then weigh, to the nearest 0,1 mg, the full pyknometer with stopper (m_3).

9 Expression of results

9.1 Calculation of the volume of the pyknometer

Calculate the volume of the pyknometer at the calibration temperature, θ_c, by the equation:

$$V_c = \frac{m_2 - m_1}{\rho_w}$$

where

V_c is the volume, in millilitres, of the pyknometer at calibration temperature θ_c;

m_2 is the mass, in grams, of the pyknometer filled with water, including thermometer and cap or stopper;

m_1 is the mass, in grams, of the empty pyknometer with thermometer and cap or with stopper;

ρ_w is the conventional mass per volume of water at calibration temperature θ_c, in grams per millilitre (deduce ρ_w from Table 1, if necessary by interpolation).

If the mean coefficient of cubic expansion (γ) of the pyknometer glass is not known, calculate γ from the calibration results at 20 °C and 60 °C by the equation:

$$\gamma = \frac{V_{c2} - V_{c1}}{V_{c1}(\theta_2 - \theta_1)}$$

where

γ is the mean coefficient of cubic expansion of the pyknometer glass, per degree Celsius;

V_{c2} is the volume, in millilitres, of the pyknometer at calibration temperature θ_2;

V_{c1} is the volume, in millilitres of the pyknometer at calibration temperature θ_1;

θ_1 is the temperature, in degrees Celsius, close to 60 °C at which the pyknometer was calibrated;

θ_2 is the temperature, in degrees Celsius, close to 20 °C at which the pyknometer was calibrated.

NOTE The mean coefficient of cubic expansion of glass depends on the composition of the glass, for example:

borosilicate glass D 50:	$\gamma \approx$ 0,000 01 per degree Celsius;
borosilicate glass G 20:	$\gamma \approx$ 0,000 015 per degree Celsius;
soda glass:	$\gamma \approx$ 0,000 025 to 0,000 030 per degree Celsius.

Calculate the volume of the pyknometer at a temperature θ_d by the equation:

$$V_d = V_c\left[1 + \gamma(\theta_d - \theta_c)\right]$$

where

V_d is the volume, in millilitres, of the pyknometer at a temperature θ_d;

V_c is the volume, in millilitres, of the pyknometer at calibration temperature θ_c;