INTERNATIONAL STANDARD

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Dried milk and dried milk products — Determination of bulk density

Lait sec et produits laitiers en poudre — Détermination de la masse volumique

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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 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8967|IDF 134 was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 5, *Milk and milk products*, and the International Dairy Federation (IDF). It is being published jointly by ISO and IDF.

This edition of ISO 8967|IDF 134 cancels and replaces ISO 8967:1992, of which it constitutes a minor revision.

Foreword

IDF (the International Dairy Federation) is a worldwide federation of the dairy sector with a National Committee in every member country. Every National Committee has the right to be represented on the IDF Standing Committees carrying out the technical work. IDF collaborates with ISO in the development of standard methods of analysis and sampling for milk and milk products.

Draft International Standards adopted by the Action Teams and Standing Committees are circulated to the IDF National Committees for voting. Publication as an International Standard requires approval by at least 50 % of the National Committees casting a vote.

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ISO 8967 | IDF 134 was prepared by the International Dairy Federation (IDF) and Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 5, *Milk and milk products*. It is being published jointly by IDF and ISO.

All work was carried out by the Joint ISO/IDF/AOAC Group of Experts on *Physical properties of dried milk products* (E701), under the aegis of its chairman, Mr J. de Vilder (BE).

This edition of ISO 8967 | IDF 134 cancels and replaces IDF 134A:1995.

Introduction

Different steps during production can influence the volume taken up by a certain mass of milk powder. The most important parameters affecting the volume of milk powder and hence its bulk density (see the definitions in Clause 2) are the dry matter content, the viscosity and the temperature of the concentrate. Also, homogenization of the concentrate and the spray-drying conditions, such as the inlet and outlet temperatures of the air and the peripheral velocity of the atomizer wheel or the pressure during nozzle atomization, are important steps. Special spray-drying conditions, such as recirculation of the fines to the wet zone in the spray drier (straight-through atomization), two-stage drying or rewetting for the production of instant milk powder, also have an influence on the volume.

In an interlaboratory study involving seven laboratories and nine samples, two methods for the determination of bulk density were tested. In one method the cylinder was dropped manually and in the other a mechanical apparatus was used for the tapping. The aim of this work was not only to establish the repeatability and reproducibility of the methods but also to determine the number of tappings needed to achieve reasonably constant volume. From this work it was clear that the mechanical operation gives far better results than the manual operation. For the mechanical test, the same apparatus as that specified in ISO 787-11 was used.

Dried milk and dried milk products — Determination of bulk density

1 Scope

This International Standard specifies a method for the determination of the bulk density of dried whole milk, dried partly skimmed milk and dried skimmed milk as defined in FAO/WHO Standard A-5 [1)], whether non-instant or instant.

The method is also applicable to dried whey, dried buttermilk and dried milk-based infant food, as well as to any of the dried products indicated above in which milk fat has been replaced by another fat, or which has been roller-dried instead of spray-dried.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
poured bulk density
quotient of the mass and volume of a powder after transferring it to a specific cylinder

NOTE For dried milk and dried milk products, it is expressed in grams per millilitre.

2.2
loose bulk density
quotient of the mass and volume of a powder after 100 tappings under the conditions specified in this International Standard

NOTE For dried milk and dried milk products, it is expressed in grams per millilitre.

2.3
bulk density
quotient of the mass and volume of a powder after 625 tappings under the conditions specified in this International Standard

NOTE 1 For dried milk and dried milk products, it is expressed in grams per millilitre.

NOTE 2 In the Système international d'unités the concepts of density as defined above are expressed in kilograms per cubic metre. In commercial practice, however, these densities of dried milk and dried milk products are traditionally expressed in grams per millilitre.

1) FAO/WHO Standard A-5 for whole milk powder, partly skimmed milk powder and skimmed milk powder, elaborated under the *Code of principles concerning milk and milk products*, 8th edition (1984), Rome: Food and Agriculture Organization, and the World Health Organization.

3 Principle

A test portion of the dried product in a measuring cylinder is tapped. After a specified number of taps, the volume of the product is recorded and its bulk density is calculated.

4 Apparatus

Usual laboratory equipment and, in particular, the following.

4.1 Balance, accurate to the nearest 0,1 g.

4.2 Measuring cylinder, of 250 ml capacity, graduated from 0 ml to 250 ml, of scale length 245 mm ± 4 mm, of mass 190 g ± 15 g, and capable of being fixed onto the apparatus (4.3).

4.3 Bulk density apparatus (see Figure 1), having the components specified in 4.3.1 to 4.3.3.

4.3.1 Screwing device, to fasten the measuring cylinder onto the apparatus, of 450 g ± 10 g mass.

4.3.2 Tapping device, capable of lifting up the screwing device (4.3.1).

4.3.3 Interval-counting device, capable of recording from 0 to 625 taps, fitted with an automatic stop, capable of being regulated to stop after a previously defined number of taps.

4.4 Laboratory spatula.

4.5 Beaker, of 250 ml capacity.

4.6 Powder funnel, with short tube, in glass or antistatic material, having the following dimensions:

— total height, 100 mm;

— length of tube, 30 mm;

— diameter of tube, 20 mm;

— upper diameter of funnel, 100 mm.

4.7 Laboratory brush.

5 Sampling

A representative sample should have been sent to the laboratory. It should not have 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 707 | IDF 50.

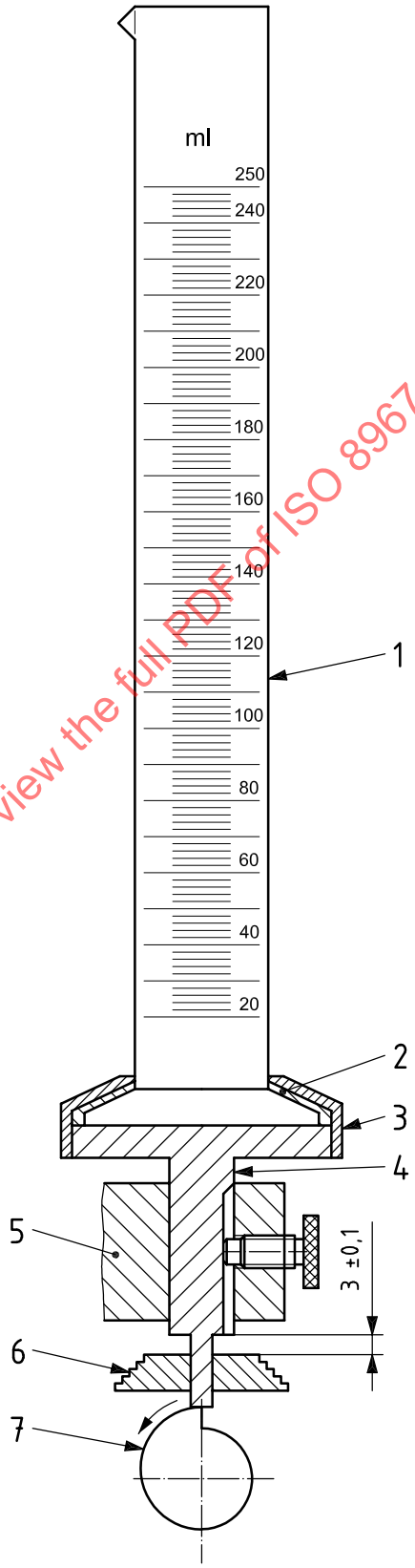
Place the laboratory sample in a clean, dry, airtight container. The intact unopened retail container may be used.

6 Preparation of test sample

Keep the laboratory sample at ambient temperature (20 °C to 25 °C). Thoroughly mix the sample (avoid the breakage of particles) by repeatedly rotating and inverting the container. The container should be not more than two-thirds full. If the container is too full to allow thorough mixing, transfer all the laboratory sample to a clean, dry, airtight container of adequate capacity and mix as described above.

In the case of instant dried milk, the mixing shall be very gentle to avoid reducing the particle size of the sample.

Dimensions in millimetres



Key

1 measuring cylinder
2 rubber sleeve
3 holder for measuring cylinder
4 shaft
5 sleeve
6 anvil
7 cam

Figure 1 — Bulk density apparatus

7 Procedure

7.1 Test portion

Weigh into a beaker (4.5) 100 g ± 0,1 g of powder. If 100 g of powder does not fit into the measuring cylinder (4.2), reduce the mass to 50 g ± 0,1 g.

7.2 Determination

7.2.1 Place the funnel (4.6) on the measuring cylinder (4.2) and transfer the powder to the cylinder using the spatula (4.4). If necessary, use the brush (4.7) to transfer all traces of powder to the measuring cylinder.

In order to make the reading easier, level off the surface with the spatula (4.4) and record the volume in millilitres (V_0).

7.2.2 Fix the measuring cylinder (4.2) in the bulk density apparatus (4.3) and tap 100 times. Level off the surface with the spatula and record the volume in millilitres (V_{100}).

7.2.3 Regulate the number of taps to 625 (including the 100 taps of 7.2.2). After tapping, level off the surface with the spatula and record the volume in millilitres (V_{625}).

8 Expression of results

Calculate the result, expressed in grams per millilitre, according to the appropriate formula given below.

Poured bulk density

$$\rho_0 = m/V_0 \quad (1)$$

Loose bulk density

$$\rho_{100} = m/V_{100} \quad (2)$$

Bulk density

$$\rho_{625} = m/V_{625} \quad (3)$$

where

ρ_0, ρ_{100} and ρ_{625} are the densities, in grams per millilitre, after transfer, after 100 tappings and after 625 tappings, respectively;

m is the mass of the test portion, in grams;

V_0, V_{100} and V_{625} are the volumes, in millilitres, after transfer, after 100 tappings and after 625 tappings, respectively.

Express the results to the third decimal place.

9 Precision

9.1 Interlaboratory test

The values for repeatability and reproductibility were derived from the results of an interlaboratory test carried out in accordance with ISO 5725:1986.

9.2 Repeatability

The absolute difference between two single test results, obtained using the same method on identical test material in the same laboratory by the same operator using the same equipment within a short interval of time, will in not more than 5 % of cases be greater than $0{,}025\ \bar{\rho}$ g/ml, where $\bar{\rho}$ is the arithmetic mean of the two results.

Take $\bar{\rho}$ as the result if the repeatability is satisfactory. Reject both results if the difference exceeds $0{,}025\ \bar{\rho}$ g/ml and carry out two new single determinations.

9.3 Reproducibility

The absolute difference between two single test results, obtained using the same method on identical test material in different laboratories with different operators using different equipment, will in not more than 5 % of cases be greater than $0{,}04\ \bar{\rho}$ g/ml where $\bar{\rho}$ is the arithmetic mean of the two results.

10 Test report

The test report shall specify

a) all information necessary for the complete identification of the sample;

b) the sampling method used, if known;

c) the test method used, with reference to this International Standard, i.e. ISO 8967 | IDF 134;

d) all operating details not specified in this International Standard, or regarded as optional, together with details of any incidents which may have influenced the test result(s);

e) the test result(s) obtained or, if the repeatability has been checked, the final quoted result obtained.