INTERNATIONAL STANDARD

ISO 7971-1

Second edition
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Cereals — Determination of bulk density, called mass per hectolitre —

Part 1: Reference method

Céréales — Détermination de la masse volumique, dite masse à l'hectolitre —

Partie 1: Méthode de référence

Reference number
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Foreword

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ISO 7971 (all parts) was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 338, *Cereal and cereal products*, in collaboration with Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 4, *Cereals and pulses*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 7971-1:2003), which has been revised to take account of ISO 7971-2:2009.

ISO 7971 consists of the following parts, under the general title *Cereals — Determination of bulk density, called mass per hectolitre*:

— *Part 1: Reference method*

— *Part 2: Method of traceability for measuring instruments through reference to the international standard instrument*

— *Part 3: Routine method*

Cereals — Determination of bulk density, called mass per hectolitre —

Part 1: Reference method

1 Scope

This part of ISO 7971 specifies the reference method for the determination of bulk density, called “mass per hectolitre”, of cereals as grain.

NOTE Several routine methods are used in different countries. A routine method for the determination of bulk density, called “mass per hectolitre”, is given in ISO 7971-3.

2 Terms and definitions

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

2.1
bulk density
“mass per hectolitre”
⟨cereals⟩ ratio of the mass of a cereal to the volume it occupies after being poured into a container under well-defined conditions

NOTE 1 Bulk density is expressed in kilograms per hectolitre of grain as received.

NOTE 2 The bulk density, as defined in this part of ISO 7971, is different from “packing density” or “intrinsic density” of cereals.

3 Principle

A sample is poured in a controlled manner from a hopper into a 20 l container, which is then weighed.

4 Requirements for apparatus

4.1 General

The apparatus used shall comply with the following requirements, which correspond to those in OIML R 15 [2], and shall be similar to that shown in Figure 1.

Dimensions in millimetres

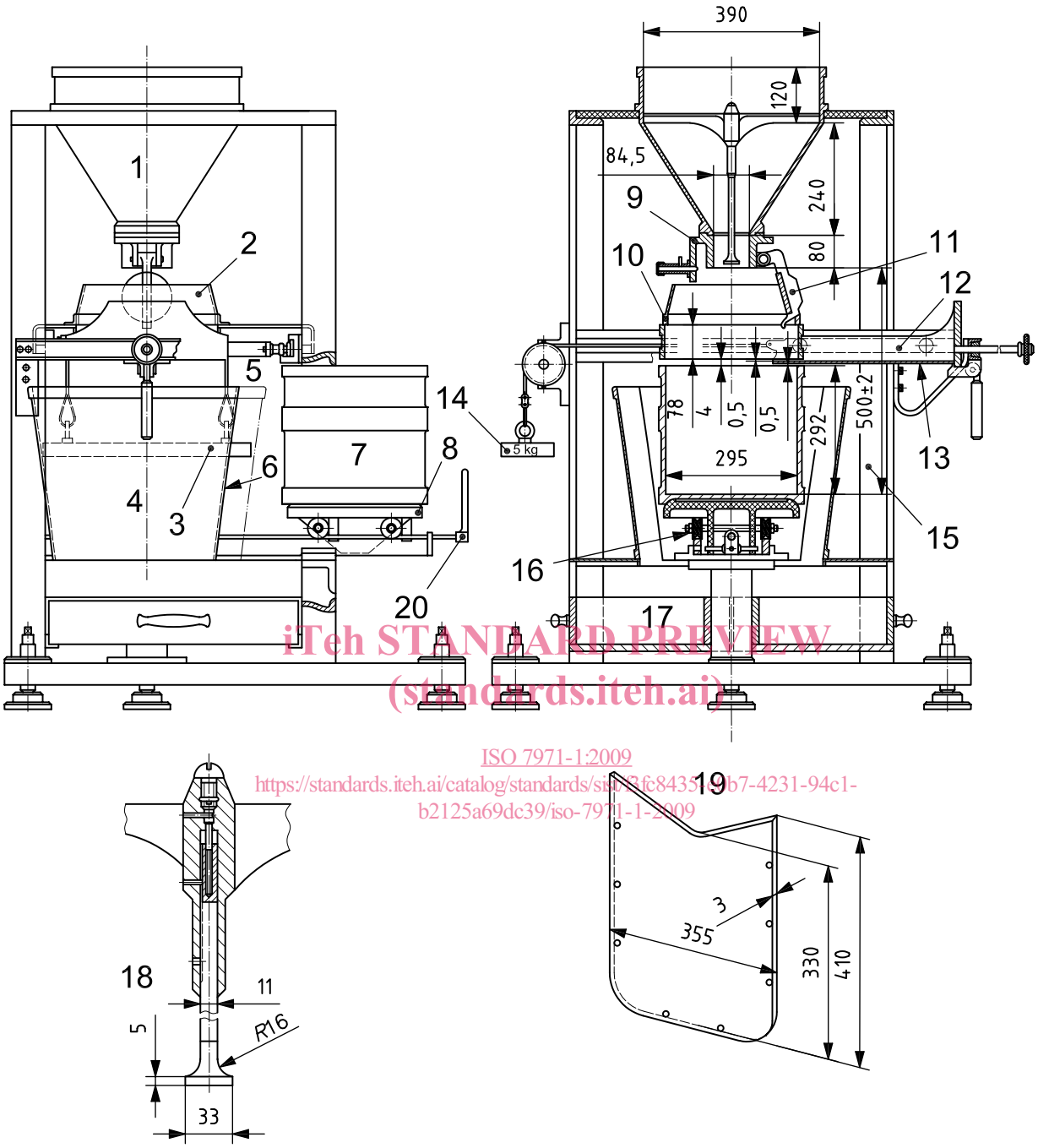

Figure 1 — Apparatus for determining bulk density of cereals (*continued*)

Key

1	filling hopper	11	shutter
2	truncated cone for guiding the flow of grain	12	frame of straightedge
3	straightedge counterweight	13	straightedge
4	guiding skirt for surplus grain	14	straightedge counterweight
5	guide by rail and rollers of the frame of the straightedge	15	height of flow
6	removable part of skirt allowing the measuring container to be removed	16	wedged base support of measuring container in filling position
7	measuring container, volume 20 l	17	collecting box for surplus grain
8	base support of measuring container	18	distributor
9	tapered emptying tube	19	straightedge
10	guiding collar for grain flow	20	handle of wedge for base support

NOTE This figure is for information only except for the dimensions shown, which are obligatory.

Figure 1 — Apparatus for determining bulk density of cereals

4.2 Description and operation

4.2.1 Pre-filling container. The pre-filling measure has a nominal volume of 24 l. Its internal form is a right circular cylinder with height approximately equal to its diameter.

4.2.2 Filling hopper. The hopper has the shape of a truncated vertical circular cone surmounted by a cylindrical rim. Its lower part terminates in an axial tube with a slightly tapering bore, the wider end of which is at the bottom. A shutter, hinge-mounted on the tube and able to close the tube completely, controls the emptying process.

The hopper receives from the pre-filling container a quantity of grain greater than the content of the measuring container.

4.2.3 Distributor. The distributor is an inverted circular mushroom-shaped element connected to the bottom end of a vertical rod positioned in the axis of the hopper.

The rod lowers the distributor inside the tapered tube to an adjustable level from top to bottom to allow adjustment of the apparatus: lowering the distributor increases the rate of flow of the grain, which collects in greater quantity owing to compaction in the measuring container, thus giving higher results; conversely, the results are lower when the distributor is raised.

4.2.4 Measuring container. The measuring container has a nominal volume of 20 l. Its internal form is a right circular cylinder with height approximately equal to its diameter. Its upper edge is ground flat.

4.2.5 Base support for the measuring container. A base on rails supports the container and allows it to travel underneath the hopper, in the axis of which it can be locked, or taken out of the chassis for easy removal.

4.2.6 Protection and guiding collar for grain flow. A cylindrical collar, of the same diameter as the measuring container, is placed between the hopper and the measuring container, leaving a horizontal space between its lower edge and the upper edge of the container to allow the passage of a straightedge.

During filling, the collar, which is surmounted by a truncated cone-shaped section, protects the grain as it drops and at the end retains the surplus grain.

4.2.7 Straightedge (levelling blade). The straightedge is a flat, thin but rigid steel blade, sharpened to the form of an open V at the front. It is fixed horizontally in a frame mounted on rollers and driven in its plane by a counterweight.

The frame guides the straightedge across the grain in the gap between the collar and the upper edge of the measuring container. The movement shall be continuous and not jerky, and the straightedge shall touch neither the collar nor the container.

In its movement, the straightedge levels the grain to the level of the measuring container, thus giving a determined volume.

4.2.8 Collecting box for surplus grain. At the same time as levelling the grain, the straightedge also closes off the lower surface of the collar as it removes from the container any grain surplus to its volume.

When the straightedge is drawn back, with the container removed, this surplus grain falls into a collecting box placed beneath the base of the container and towards which the grain is guided by a skirt.

4.2.9 Overall assembly. The apparatus is assembled in a rigid chassis equipped with a verticality adjustment screw; verticality is checked by means of a plumbline or a spirit-level.

The hopper with its tube and distributor, the collar and the measuring container shall be coaxial and positioned vertically by means of the adjustment device described above, the upper edge of the measuring container thus being horizontal.

4.2.10 Weighing device. The grain contained in the measuring container is weighed using a non-automatic balance which has been weighted to compensate for the mass of the empty container. Therefore, one single weighing gives the mass of the grain.

The error of the balance shall not exceed ± 0,01 % of load between 10 kgf and 20 kgf or, when using weights, the sum of errors of weights shall not exceed ± 0,02 %.

4.3 Dimensions

4.3.1 Pre-filling container

This shall have the following dimensions:

— volume to top: 24 l ± 0,1 l;

— internal diameter: 300 mm ± 10 mm;

— internal height: approximately 340 mm, adjusted to obtain the specified volume.

4.3.2 Filling hopper

This shall have the following dimensions:

a) top rim

— internal diameter: 390 mm ± 1 mm;

— height: 120 mm ± 2 mm;

b) truncated-cone body

— upper internal diameter: 390 mm ± 1 mm;

— lower internal diameter: 84,5 mm ± 0,5 mm;

— height: 240 mm ± 1 mm;

c) emptying tube

— top internal diameter: 84,5 mm ± 0,5 mm;

— bottom internal diameter: 86,5 mm ± 0,5 mm;

— length: 80 mm ± 0,5 mm.

4.3.3 Distributor

This shall have the following dimensions:

a) diameter of the rod: 11 mm ± 0,2 mm;

b) mushroom-shaped element

— diameter: 33 mm ± 0,2 mm;

— head thickness: 5 mm ± 0,5 mm;

— connecting radius to the rod: 16 mm ± 0,5 mm;

c) distance from bottom surface of mushroom to bottom end of emptying tube: 14 mm ± 0,5 mm.

4.3.4 Measuring container

This shall have the following dimensions:

— volume up to ground top: 20 l ± 0,01 l;

— internal diameter: 295 mm ± 1 mm;

— internal height: approximately 292 mm, adjusted to obtain the specified volume.

4.3.5 Base support for measuring container

This shall have the following dimensions:

— distance between bottom of inside of container and bottom end of emptying tube: 500 mm ± 2 mm;

— distance between top of container and lower surface of straightedge: 0,5 mm ± 0,2 mm.

4.3.6 Protection and guiding collar for grain flow

This shall have the following dimensions:

— internal diameter: 295 mm ± 1 mm;

— height: 78 mm ± 2 mm;

— distance between lower edge of collar and upper surface of straightedge: 0,5 mm ± 0,2 mm.

4.3.7 Straightedge (levelling blade)

This shall have the following dimensions:

— thickness of blade: 3 mm ± 0,2 mm;

— mass of driving counterweight: 5 kg ± 0,1 kg.