
**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

ISO 7971-1:2003

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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 7971-1 was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 4, *Cereals and pulses*.

This first edition of ISO 7971-1 cancels and replaces ISO 7970:1986, which has been editorially revised. The title has been changed to make it Part 1.

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: Routine method

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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.

NOTE Several routine methods are used in different countries. A routine method for the determination of bulk density, called “mass per hectolitre” utilizing a 1 litre measuring container is given in ISO 7971-2 ^[1].

2 Terms and definitions

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

2.1

mass per hectolitre

ratio of the mass of a cereal to the volume it occupies after being poured into a container under well-defined conditions

NOTE It is expressed in kilograms per hectolitre at a stated moisture content.

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 Recommendations R 15 ^[2], and shall be similar to that shown in Figure 1.

NOTE For information, the requirements for the apparatus specified in this International Standard comply with those prescribed in the relevant Council Directive of the European Communities ^[3].

4.2 Description and operation

4.2.1 Pre-filling measure

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

Dimensions in millimetres

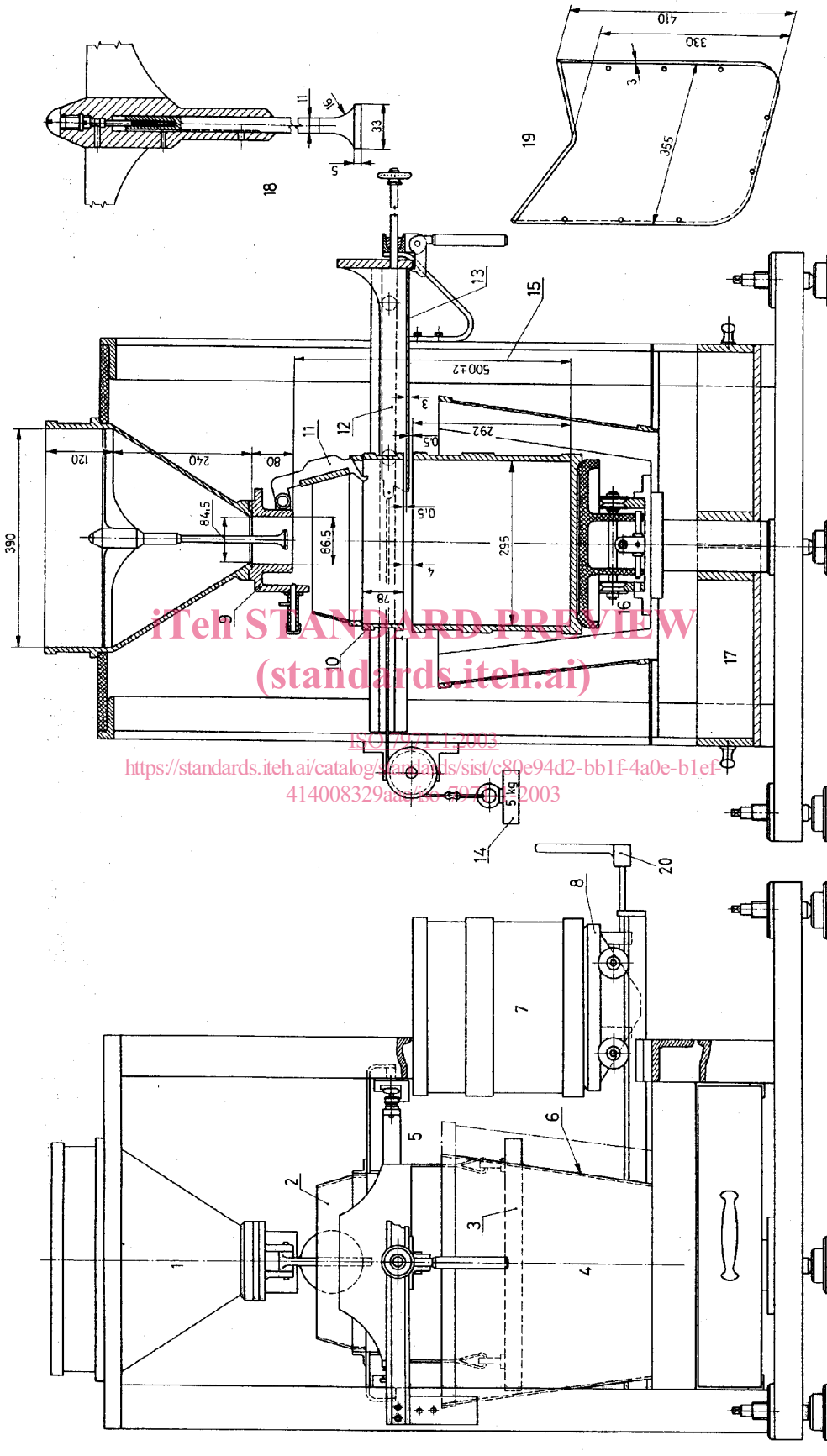


Figure 1 — Apparatus for determining bulk density of cereals

Key

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

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

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

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 measure a quantity of grain greater than the capacity 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 capacity 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 capacity.

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 plumb-line 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

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The grain contained in the measuring container is weighed using an equal-beam balance which has been weighted to compensate for the mass of the empty container. Therefore, one single weighing gives the mass of the grain.

4.3 Dimensions

4.3.1 Pre-filling measure

This shall have the following dimensions:

- volume to top: $24 \text{ l} \pm 0,1 \text{ l}$;
- internal diameter: $300 \text{ mm} \pm 10 \text{ mm}$;
- 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: $390 \text{ mm} \pm 1 \text{ mm}$,
 - height: $120 \text{ mm} \pm 2 \text{ mm}$;

- b) truncated-cone body
- upper internal diameter: 390 mm ± 1 mm,
 - lower internal diameter: 84,5 mm ± 0,2 mm,
 - height: 240 mm ± 1 mm;
- c) emptying tube
- top internal diameter: 84,5 mm ± 0,2 mm,
 - bottom internal diameter: 86,5 mm ± 0,2 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 ± 0,2 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 mm¹⁾.

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.

1) For instruments which are not compared with the international standard apparatus (see definition in OIML Recommendations R 15), this distance is fixed definitively during construction as ± 0,5 mm. For instruments which have been compared with the international standard apparatus, this distance is fixed during the comparison.