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### **Cereals – Determination of bulk density, called mass per hectolitre – Part 3: Routine method (ISO 7971-3:2009)**

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NORME EUROPÉENNE  
EUROPÄISCHE NORM

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**Cereals - Determination of bulk density, called mass per hectolitre - Part 3: Routine method (ISO 7971-3:2009)**

Céréales - Détermination de la masse volumique, dite masse à l'hectolitre - Partie 3: Méthode pratique (ISO 7971-3:2009)

Getreide - Bestimmung der Schüttdichte, sogenannte Masse je Hektoliter - Teil 3: Routineverfahren (ISO 7971-3:2009)

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## Foreword

This document (EN ISO 7971-3:2009) has been prepared by Technical Committee CEN/TC 338 "Cereal and cereal products", the secretariat of which is held by AFNOR, in collaboration with Technical Committee ISO/TC 34 "Food products".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2010, and conflicting national standards shall be withdrawn at the latest by February 2010.

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

## Part 3: Routine method

### 1 Scope

This part of ISO 7971 specifies a routine method for the determination of bulk density, called “mass per hectolitre” of cereals as grain using manual or automatic, mechanical, electric or electronic mass per hectolitre measuring instruments.

NOTE Further details of the measuring instruments are specified in ISO 7971-2:2009, 6.4.

### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7971-2, *Cereals — Determination of bulk density, called mass per hectolitre — Part 2: Method of traceability for measuring instruments through reference to the international standard instrument*

### 3 Terms and definitions

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

#### 3.1

##### 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 grains 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.

[ISO 7971-1:2009]

### 4 Principle

The mass per hectolitre of a cereal is obtained from the mass of a volume of cereal determined under controlled sample filling and flow conditions.

The mass per hectolitre can be affected by:

- a) space between the grains, which depends on the grain size and shape;
- b) density of the grains.

## 5 Apparatus

**5.1 General requirement for bulk density apparatus.** Any apparatus (5.2 and 5.3) shall be verified according to ISO 7971-2 and shall fulfil the performance demands specified therein.

**5.2 Hand-operated measuring instrument.** Apparatus consisting of a filling hopper, a measuring container and the accessories necessary for their use.

The manner in which the grain is poured into the measuring container and the way in which it packs into the container can cause the measurements taken by the various instruments to vary and lead to measurement errors.

To minimize such variations, special attention should be given to ensuring that the design of the instruments and their size, material and shape are appropriate.

NOTE Annexes A and B of this part of ISO 7971 contain examples of technical specifications of two hand-operated instruments with a capacity of 1 l.

**5.3 Automatic measuring instrument.** This category includes various types of devices, some of which can be used on their own or combined with an infrared analyser.

The measurement is based on the application of equations to allow the correcting of the bias and/or the drifts monitored. It does not include manual weighing. The numeric value of the hectolitre mass is directly displayed.

**5.4 Analytical balance,** capable of being read to the nearest 0,1 g or 0,01 g depending on the volume of the container (see 6.2).

## 6 Procedure

### 6.1 General

The measurements shall be taken using grain from which large impurities (straw, stones, husks, etc.) have been discarded, taking environmental conditions into consideration to ensure that there is no difference in temperature between the grain and the room in which the test is performed.

Determine the bulk density in duplicate. For all the devices and for every sample, it is advisable to perform the two measurements on two different grain test portions.

NOTE Repeating the measurement on the same grain test portion changes the friction coefficient which therefore makes it easier for the grains to slide; they are then more tightly packed, which increases the value of the bulk density.

### 6.2 Hand-operated instruments

Check that the various components of the instrument are clean and that they are working properly.

Make sure that equipment is placed on a firm, flat base, after using a spirit level to check that the base is horizontal.

Take great care to avoid any impact during filling. If the apparatus is jolted, cancel the test and start again.

Each type of apparatus is different; use each according to the manufacturer's instructions.

When using the analytical balance (5.4), weigh to the nearest 1 g for a 1 l container or the nearest 0,1 g for apparatus with a container of smaller volume.

### 6.3 Automatic instruments

As the operations to be performed prior to the actual measurement differ according to the type of equipment used, reference to the manufacturer's instructions is recommended.

Ensure that the instrument is placed on a horizontal surface in a room protected from extreme temperatures, humidity, dust and vibrations.

Take particular care to:

- a) select the correct cereal to be measured to ensure that the right calibration is used;
- b) use the volume of cereals recommended for the device in question;
- c) empty the collector drawer between samples.

### 6.4 Expression of results

Take the arithmetic mean of the two determinations as the result if the repeatability conditions are met.

Express the result to the nearest 0,1 kg/hl.

## 7 Precision

### 7.1 Interlaboratory test

Details of an interlaboratory test on the precision of the method are summarized in Annex C. The values derived from this interlaboratory test cannot be applied to other bulk density ranges and matrices than those given.

### 7.2 Repeatability

The absolute difference between two independent 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, shall not in more than 5 % of cases be greater than the repeatability limit

$$r = 0,4$$

for products whose mass per hectolitre is between 67,5 kg/hl and 84,5 kg/hl (see Tables C.1, C.2, and Figure C.1).

### 7.3 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, shall not in more than 5 % of cases be greater than the reproducibility limit

$$R = 1,2$$

for products whose mass per hectolitre is between 67,5 kg/hl and 84,5 kg/hl (see Tables C.1, C.2, and Figure C.1).