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# International Standard



# 712

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## Cereals and cereal products — Determination of moisture content (Routine reference method)

*Céréales et produits céréaliers — Détermination de la teneur en eau (Méthode de référence pratique)*

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**Descriptors :** agricultural products, cereal products, grains (food), water, determination of content, dehydration analysis.

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 712 was prepared by Technical Committee ISO/TC 34, *Agricultural food products*.

This second edition cancels and replaces the first edition (ISO 712-1979), of which it constitutes a minor revision.

NOTE — This International Standard is based on Standard No. 110/1 of the International Association for Cereal Science and Technology (ICC).

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

# Cereals and cereal products — Determination of moisture content (Routine reference method)

## 1 Scope and field of application

This International Standard specifies a routine reference method for the determination of the moisture content of cereals and cereal products.<sup>1)</sup>

The method is not applicable to maize, for which a method is specified in ISO 6540, *Maize — Determination of moisture content (on milled grains and on whole grains)*.

## 2 References

ISO 711, *Cereals and cereal products — Determination of moisture content (Basic reference method)*.

ISO 950, *Cereals — Sampling (as grain)*.

## 3 Definition

**moisture content:** The loss in mass, expressed as a percentage, undergone by the product under the conditions specified in this International Standard.

## 4 Principle

If necessary, grinding of a sample, after pre-conditioning, if required. Drying of a test portion at a temperature between 130 and 133 °C, under conditions which enable a result to be obtained which is in agreement with that obtained by the basic reference method (see ISO 711).

## 5 Apparatus

### 5.1 Analytical balance.

### 5.2 Grinding mill, having the following characteristics:

- made of material which does not absorb moisture;
- easy to clean and having as little dead space as possible;

c) enabling grinding to be carried out rapidly and uniformly, without appreciable development of heat and, as far as possible, without contact with the outside air;

d) adjustable so as to obtain particles of the dimensions indicated in 7.1.1.

**5.3 Metal dish,** non-corrodible under the test conditions, or, failing this, a glass dish, with a sufficiently tight-fitting lid, and having an effective surface area enabling the test portion to be distributed so as to give a mass per unit area of not more than 0,3 g/cm<sup>2</sup>.

**5.4 Constant-temperature oven,** electrically heated, capable of being controlled in such a way that, during normal working, the temperature of the air and of the shelves carrying the test portions is within the range 130 to 133 °C in the neighbourhood of the test portions.

The oven shall have a heat capacity such that, when initially adjusted to a temperature of 131 °C, it can regain this temperature in less than 45 min (preferably in less than 30 min) after insertion of the maximum number of test portions that can be dried simultaneously.

The effectiveness of the ventilation shall be determined using durum wheat semolina, of maximum particle size 1 mm, as the test material. The ventilation shall be such that after insertion of the maximum number of test portions that the oven will accommodate, and drying at a temperature of 130 to 133 °C, the results, after heating the same test portions for 2 h and then for a further 1 h, do not differ by more than 0,15 g of moisture per 100 g of sample.

**5.5 Desiccator,** containing an effective desiccant.

## 6 Sampling

See ISO 950.

1) This method has been applied successfully to the following products: wheat, rice (paddy, husked and milled rice), barley, millet, rye and oats, in the form of grains, milled grains, semolina or flour.

## 7 Procedure

### 7.1 Preparation of the test sample

#### 7.1.1 Products not requiring to be ground

Products having particles of sizes less than or equal to 1,7 mm, less than 10 % (*m/m*) being over 1 mm and more than 50 % (*m/m*) being less than 0,5 mm, do not need to be ground before the determination.

Mix the laboratory sample thoroughly before taking the test portion (7.2.1).

#### 7.1.2 Products requiring to be ground

If the sample does not have the particle size characteristics mentioned in 7.1.1, it shall be ground either without pre-conditioning (7.1.2.1) or with pre-conditioning (7.1.2.2).

##### 7.1.2.1 Grinding without pre-conditioning

For products which are not likely to undergo variations in moisture content in the course of grinding [in general, products with a moisture content between 7 and 17 % (*m/m*)<sup>1)</sup> (see 9.1)], carry out grinding without pre-conditioning.

Adjust the grinding mill (5.2) to obtain particles of the dimensions indicated in 7.1.1, grind a small quantity of the laboratory sample and discard it.

Then quickly grind a quantity of the laboratory sample slightly greater than that required for the test portion (about 5 g), and immediately proceed in accordance with 7.2.2.

##### 7.1.2.2 Grinding with pre-conditioning

Products which are likely to undergo changes in moisture content in the course of grinding [in general, products with a moisture content more than 17 % (*m/m*)<sup>1)</sup> or less than 7 % (*m/m*)] shall be pre-conditioned so as to bring their moisture content to between 7 and 17 % (*m/m*)<sup>1)</sup> [if possible between 9 and 15 % (*m/m*) (see 9.1)], before grinding.

If the moisture content is more than 17 % (*m/m*)<sup>1)</sup> (the more frequent case), weigh, to the nearest 1 mg, a sufficient quantity of the laboratory sample to provide a test portion slightly greater than 5 g (see 7.2.2) and carry out a pre-drying operation according to the instructions in 7.3, except that the time of heating in the oven (5.4) shall be 7 to 10 min and the cooling of the product to laboratory temperature shall be carried out with the dish (5.3) uncovered and without a desiccator, for at least 2 h.

If the moisture content is less than 7 % (*m/m*), weigh, to the nearest 1 mg, a sufficient quantity of the laboratory sample to provide a test portion slightly greater than 5 g (see 7.2.2), place it in a suitable atmosphere (generally that of the laboratory) and leave it until a moisture content within the limits indicated above is obtained.

After conditioning, weigh the sample to the nearest 1 mg, immediately grind it, controlling the grinding so as to obtain particles of the dimensions indicated in 7.1.1, and immediately proceed in accordance with 7.2.2.

### 7.2 Test portion

**7.2.1** For products not requiring to be ground, rapidly weigh, to the nearest 1 mg, a quantity slightly greater than 5 g of the test sample (7.1.1) in the dish (5.3), previously dried and tared, together with its lid, to the nearest 1 mg.

**7.2.2** In the case of products which have had to be ground, rapidly weigh all the grindings obtained (7.1.2.1 or 7.1.2.2) to the nearest 1 mg, in the dish (5.3), previously dried and tared, together with its lid, to the nearest 1 mg.

### 7.3 Drying

Place the open dish containing the test portion (7.2), together with the lid, in the oven (5.4) and leave for 2 h (90 min for flours) from the moment when the oven temperature is again between 130 and 133 °C.

Rapidly take the dish out of the oven, cover it and place it in the desiccator (5.5); when several tests are being carried out simultaneously, never place dishes on top of one another in the desiccator.

When the dish has cooled to laboratory temperature (generally between 30 and 45 min after it has been placed in the desiccator), weigh it to the nearest 1 mg.

### 7.4 Number of determinations

Carry out two determinations on test portions taken from different test samples but from the same laboratory sample.

## 8 Expression of results

### 8.1 Method of calculation and formulae

The moisture content, expressed as a percentage by mass of the product as received, is given by the following formulae:

a) *without pre-conditioning*:

$$(m_0 - m_1) \frac{100}{m_0}$$

where

$m_0$  is the mass, in grams, of the test portion (7.2.1 or 7.2.2);

$m_1$  is the mass, in grams, of the test portion after drying (7.3).

1) 15 % (*m/m*) in the case of oats and rice (paddy, husked and milled rice).

b) *with pre-conditioning:*

$$\left[ (m_0 - m_1) \frac{m_3}{m_0} + m_2 - m_3 \right] \frac{100}{m_2}$$

$$= 100 \left( 1 - \frac{m_1 m_3}{m_0 m_2} \right)$$

where

$m_0$  is the mass, in grams, of the test portion (7.2.2);

$m_1$  is the mass, in grams, of the test portion after drying (7.3);

$m_2$  is the mass, in grams, of sample taken before pre-conditioning (7.1.2.2);

$m_3$  is the mass, in grams, of the pre-conditioned sample (7.1.2.2).

Take as the result the arithmetic mean of the two values obtained, if the requirement for repeatability (see 8.2) is satisfied. If it is not, the determinations shall be repeated.

Round the result to the nearest 0,05 unit.

## 8.2 Repeatability

The difference between the values obtained from two determinations (see 7.4) carried out simultaneously or in rapid succession by the same analyst shall not exceed 0,15 g of moisture per 100 g of sample.

## 8.3 Remark

The results compared with those obtained by the basic reference method (see ISO 711) generally differ by less than 0,15 g of moisture per 100 g of sample.

## 9 Notes on procedure

**9.1** The range of moisture contents given for conditioning products before grinding corresponds approximately to a laboratory atmosphere of temperature 20 °C and relative humidity 40 to 70 %. It should be modified for other atmospheric conditions.

**9.2** Never place moist products in an oven containing test portions at the end of drying, as this will result in partial rehydration of the latter.

## 10 Test report

The test report shall show the method used and the result obtained. It shall also mention all operating details not specified in this International Standard, or regarded as optional, as well as any incidents which may have influenced the result.

The report shall include all details required for the complete identification of the sample, and in particular the date on which the analysis was carried out.

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