INTERNATIONAL STANDARD

ISO 7700-1

Second edition
2008-11-15

Food products — Checking the performance of moisture meters in use —

Part 1: Moisture meters for cereals

Produits alimentaires — Vérification des humidimètres en service —

Partie 1: Humidimètres pour céréales

Reference number
ISO 7700-1:2008(E)

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Published in Switzerland

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 7700-1 was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 4, *Cereals and pulses*.

This second edition cancels and replaces the first edition (ISO 7700-1:1984), which has been technically revised.

ISO 7700 consists of the following parts, under the general title *Food products — Checking the performance of moisture meters in use*:

— *Part 1: Moisture meters for cereals*

— *Part 2: Moisture meters for oilseeds*

Introduction

The calibration of moisture meters may, for stable samples and under ideal measuring conditions, prove entirely satisfactory. On the other hand, the results obtained with the same moisture meter can be affected by many variables including: cereal variety, cultivation, ripeness, humidity, temperature, harvesting, transport and level of impurities, particularly for cereals received with high moisture contents.

Food products — Checking the performance of moisture meters in use —

Part 1: Moisture meters for cereals

1 Scope

This part of ISO 7700 specifies a method of checking the performance of moisture meters in service for measuring the moisture content of cereal grains.

This part of ISO 7700 is not applicable for pattern approval, nor for the initial calibration of moisture meters.

The results of the checking described in this part of ISO 7700 are used to decide whether to perform a revision or a repair of the moisture meter.

NOTE For built and pattern approval specifications, see OIML Recommendation 59[1].

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 712, *Cereals and cereal products — Determination of moisture content — Routine reference method*

ISO 5223, *Test sieves for cereals*

ISO 6540, *Maize — Determination of moisture content (on milled grains and on whole grains)*

3 Terms and definitions

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

3.1
moisture content
moisture mass fraction
loss in mass undergone by the product under the experimental conditions specified in either ISO 712 or ISO 6540

NOTE Moisture content is expressed as a percentage mass fraction [the format "% (m/m)" is deprecated].

4 Principle

The results supplied by the moisture meter are compared with those obtained by a reference method for the analysis of the same sample of grains.

At least two different species are used with, for each one, at least two samples having moisture contents as different as possible, but within the measurement range of the moisture meter.

A schematic representation of the procedure is given in Figure A.1.

If local regulations specify that additional samples are required, proceed in accordance with them.

5 Apparatus

5.1 Bottles, with airtight seals, of capacity approximately 2 l, 1 l, 0,5 l and 0,1 l, previously cleaned, rinsed and dried.

5.2 Apparatus required for the determination of moisture content, by the routine reference method in accordance with ISO 712 or ISO 6540.

5.3 Sieves, complying with the requirements of ISO 5223, and in particular sieves with long, rounded apertures of width 1,50 mm, 1,90 mm, 2,00 mm and 2,20 mm and with round holes of diameter 4,50 mm, or a **mechanical separator**, fitted with nettings as specified by the purchaser.

5.4 Thermometer.

5.5 Sample divider.

6 Preparation of samples

6.1 Selection and cleaning of samples

Select varieties of cereals from those which are most prevalent in the region where the moisture meter is used.

In the case of maize or rice, choose the type of grain rather than the variety (i.e. choose dent, flint or dent-flint grain for maize; short, medium or long grain for rice).

Clean the samples by manual sieving or with the help of the mechanical separator using appropriate sieves (5.3). Remove those elements having a smaller size than whole grains of cereals, including broken and shrivelled grains. Larger impurities can be removed by hand or using a mechanical separator (5.3).

As an indication, use the following sieves:

— sieve with long rounded apertures of width 1,50 mm for rice;

— sieve with long rounded apertures of width 1,90 mm for rye and durum wheat and “bold” rice;

— sieve with long rounded apertures of width 2,00 mm for wheat;

— sieve with long rounded apertures of width 2,20 mm for barley;

— sieve with round holes of diameter 4,50 mm for maize.

6.2 Preparation of cereals for test

6.2.1 Preparation of test sample (A)

Select at least two cereal species (or two different grain types for maize or rice) and, from each, select at least two samples having moisture contents as different as possible, depending on the availability of samples, providing these are within the measurement range of the moisture meter being checked.

Each test sample (A) shall be composed of only one species (or grain type, for maize or rice).

The samples (A) shall have their natural moisture, i.e. they shall not be conditioned by wetting or drying. Using grains which have a high moisture content is consequently only possible during the harvest period.

Samples shall be clean and homogeneous. If necessary, they can be cleaned following the instructions in 6.1. Homogenize each test sample (A) by shaking and inverting the bottle.

The volume of each test sample (A) shall be two-thirds a bottle of appropriate capacity (5.1).

NOTE If the bottle is too full, the sample cannot be completely mixed and if the bottle is not full enough, there will be hygrometric exchanges between the grains and the air present in the bottle, and a modification in the moisture content of the sample can occur.

If the moisture meter is used for measuring the moisture content of only one species, only this species shall be used to check the performance of the moisture meter.

6.2.2 Preparation of first reference test portion (B)

From each test sample (A), quickly take a representative test portion (B), using the sample divider (5.5) and taking care to avoid any modification in moisture content of grain. Place test portion (B) into another bottle (5.1), the capacity of which ensures that it is filled by two-thirds, and close it.

7 Procedure

7.1 Initial reference moisture content determination

Determine the moisture content of first reference test portion (B) following the routine reference method in accordance with ISO 712 for cereals other than maize, or in accordance with ISO 6540 for maize.

7.2 Stabilization of sample temperature

It should be noted that a difference in temperature between the moisture meter and test portions (A – B) can influence the measurement result. In that case (e.g. as stated by the pattern approval), test portions and meter should be left to come to thermal equilibrium before performing the test.

Measure and record the room temperature with a thermometer (5.4). It is recommended that tests be carried out under ambient temperature conditions in the range of 15 °C to 25 °C. If such conditions are not possible, the tests shall be carried out under the ambient temperature assigned for the working conditions of the moisture meter (see technical specifications of the manufacturer).

No requirements are defined regarding the relative humidity, except if specified by the manufacturer of the moisture meter.

7.3 Checking of moisture meter

Homogenize test portion (A − B) by shaking and inverting the bottle.

On opening of the bottle, examine the sample and make sure there is no trace or odour of mustiness, fermentation or germination.

With the moisture meter, make at least three successive measurements for each test portion (A − B). After each measurement, return test portion (A − B) to the corresponding bottle and re-mix before making the next measurement.

If the technology of the moisture meter is such that the cereals are milled in the meter, the above procedure has to be adapted, particularly with respect to the volume of the test portion (A − B), to perform the three measurements.

A single test portion (A − B) can be used for measurement:

15 times,	if the reference moisture content is less than:	17 % (mass fraction)
9 times,	if the reference moisture content is between:	17 % and 25 % (mass fraction)
6 times,	if the reference moisture content is more than:	25 % (mass fraction)

NOTE 1 The number of measurements may vary depending on local regulations.

NOTE 2 The shelf-life of the samples is limited, depending on their moisture content.

NOTE 3 The same test portion (A − B) could be used for checking several moisture meters.

7.4 Final reference moisture content determination

After checking the moisture meters (7.3), from each test sample quickly take a second reference test portion (C), using the sample divider (5.5) and taking care to avoid any modification of its moisture content. Place the second reference test portion (C) into another bottle (5.1), the capacity of which ensures that it is filled by two-thirds, and close it. Again determine again the moisture content of this second reference test portion (C), following the routine reference method in accordance with ISO 712 for cereals other than maize, or in accordance with ISO 6540 for maize.

8 Expression of results

For each test sample (A), the following data are obtained:

a) Two results from the routine reference method, $w_{H_2O,B}$ (initial determination, 7.1) and $w_{H_2O,C}$ (final determination, 7.4);

The difference between the values obtained shall not be more than 0,3 % ($\left|w_{H_2O,B} - w_{H_2O,C}\right| \leqslant 0{,}3$ %).

If the difference is greater, repeat the test.

The mean of these two values, i.e. $(w_{H_2O,B} + w_{H_2O,C})/2$, constitutes the true value ($\bar{w}_{H_2O}$) of the moisture content of the test sample.

b) Three or more measurements $w_{H_2O,m}$ from the moisture meter (7.3):

For each test sample, calculate the difference between each measurement conducted with the moisture meter and the true value of the sample, $\bar{w}_{H_2O}$, i.e. $w_{H_2O,m_i} - \bar{w}_{H_2O}$, where i is the measurement number.

9 Maximum permissible errors

As a matter of principle, the $w_{H_2O,m_i} - \bar{w}_{H_2O}$ values shall be lower than the following maximum permissible errors (MPEs), but local regulation may impose other MPE.

a) Cereal grains other than maize, rice and sorghum:

   1) 0,7 % (mass fraction, constant value) for a moisture content, $\bar{w}_{H_2O} \leqslant 10$ % (mass fraction);

   2) 3 % (mass fraction, relative value) plus 0,4 % (mass fraction, constant value) for a moisture content, $\bar{w}_{H_2O} > 10$ % (mass fraction).

b) Maize, rice and sorghum:

   1) 0,8 % (mass fraction, constant value) for a moisture content, $\bar{w}_{H_2O} \leqslant 10$ % (mass fraction);

   2) 4 % (mass fraction, relative value) plus 0,4 % (mass fraction, constant value) for a moisture content $\bar{w}_{H_2O} > 10$ % (mass fraction).

NOTE When the numerical value of w_{H_2O} is associated with the units "% (mass fraction, constant value)", it means the measured value. When the numerical value of w_{H_2O} is associated with the units "% (mass fraction, relative value)", it means the percentage of the true value of the moisture content of the sample.

EXAMPLE 1 If the reference moisture content of a wheat sample, measured using the routine method in accordance with ISO 712, is 15 % (mass fraction), the maximum permissible error will be:

$\pm [0,4 + (0,03 \times 15)] = \pm [0,4 + 0,45] = \pm 0,85$ % (mass fraction)

EXAMPLE 2 For a wheat sample having a reference moisture content up to 10 % (mass fraction), the maximum permissible error is ± 0,7 % (mass fraction).

10 Test report

The test report shall contain at least the following information:

a) all the information necessary for the complete identification of the moisture meter checked (trade name, type, No. of series, etc.);

b) the date and place of the checking;

c) the name of the person who checked the moisture meter;

d) all the information necessary for the complete identification of the samples used;

e) the test method used, with reference to this part of ISO 7700 (i.e. ISO 7700-1);

f) the temperature at which the test was performed;

g) the results obtained, together with the values obtained for each measurement;

h) all operating details not specified in this part of ISO 7700, or regarded as optional, together with details or any incidents which may have influenced the test results.