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Moisture meters for cereal grain and oilseeds

Humidimètres pour grains de céréales et graines oléagineuses



Foreword

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MOISTURE METERS for CEREAL GRAINS and OILSEEDS

1. Scope

This Recommendation deals with moisture meters for cereal grains and oilseeds, that is to say instruments measuring and indicating, either directly or by means of conversion tables and (or) correction tables, the moisture content of cereal grains and the moisture and volatile matter content of oilseeds.

2. Field of application

This Recommendation applies only to moisture meters used for measurements on statical samples. The moisture meters are subdivided in two categories for which the different technical specifications differ.

2.1. Category A : Automatic moisture meters which are provided with printing devices for the results of the measurements and with various securities (see point 5).

2.2. Category B : Moisture meters which do not comply with the requirements relating to moisture meters of category A, but are provided with minimum securities (see point 6).

3. General

3.1. Definitions of the moisture content and of the moisture and volatile matter content (both called « moisture content » in this Recommendation).

The moisture content of a sample of cereal grains is conventionally defined as the loss in mass expressed as a percentage of the mass of a sample, % mass, of a product under test conditions specified in Appendix I.

The moisture and volatile matter content of a sample of oilseeds is conventionally defined as the loss in mass expressed as a percentage of the mass of a sample, % mass, of a product under test conditions specified in Appendix II.

3.2. Other definitions

3.2.1. Conversion tables

The name « conversion table » is given to any system - table, graph, abacus or slide rule - used for the determination of the moisture content from the value indicated by the moisture meter, when the latter is not fitted with a device for selecting the species and the relationship between the indications of the moisture meter and the moisture content differs according to the species of grains or seeds on which the measurement is carried out.

3.2.2. Conventional scale

If, to obtain the moisture content, the use of conversion tables is necessary, the indicating scale of the moisture meter is called the « conventional scale ». The values indicated on this scale are dimensionless ⁽¹⁾.

⁽¹⁾ The principle of measurement of a moisture meter may be such that the indicated values have a dimension corresponding to a quantity actually measured (mass, electrical capacity...). However, in order to avoid any confusion between such a moisture meter and a balance or a capacitance meter, the scale shall remain dimensionless and consequently be graduated in pure numbers.

3.2.3. Correction tables

The name « correction table » is given to any system - table, graph, abacus or slide rule - used for the determination of the moisture content from the value indicated by the moisture meter, when this indicated value is altered by an influence quantity which is not automatically taken into account by the moisture meter (for example, temperature of the sample).

3.2.4. Zero value and test value

3.2.4.1. The value 0 % mass can, in practice, never be reached by the quantity which represents the moisture content of a sample of grains or seeds. However, moisture meters may give a « zero » indication. This zero is mechanical or electrical according to the principle of measurement of the instrument. For moisture meters with direct indication of the moisture content - that is to say not requiring the use of conversion tables - zero may represent the result of a measurement when the measuring cell is empty or the indication of the instrument when the measuring operations have not yet been initiated.

For moisture meters provided with conversion tables, zero may also represent the indication appearing on the conventional scale when the value of the measured quantity ⁽¹⁾ is zero.

3.2.4.2. A device enabling the determination of a test value is a device aiming at verifying the smooth running of the measuring part. It must be possible to use the device without the operator having at his disposal a sample of grains.

The test value is obtained by one or more indications of the indicating device which are the result of a measurement simulation. This simulation shall correspond to the operation of those elements which determine the parameters having a critical effect on the measurement.

3.3. Requirements

Moisture meters shall comply with the general and special requirements of this Recommendation. When required by national regulations, they shall be subject to pattern approval and shall be submitted to initial and periodic verification or inspection (see Appendix III).

3.4. Principle of measurement

The principle of measurement of moisture meters may be based on any physical or physico-chemical method which enables an indication of the moisture content of a sample of whole grains or seeds to be obtained directly or indirectly ⁽²⁾.

4. General technical requirements

4.1. Construction

4.1.1. Moisture meters shall be strong and well built. Their main parts shall be made of materials assuring adequate strength and stability.

4.1.2. The housing of moisture meters shall be strongly built and so constructed that the main components of the instrument are out of reach and protected from dust and moisture.

⁽¹⁾ The measured quantity may be a quantity or a function of various quantities : mass, volume, temperature, electrical resistance or capacity.

⁽²⁾ When the principle of measurement of a moisture meter requires the use of a grinding mill, the mill shall be considered as part of the moisture meter. Its design, method of use and integration with the measuring device shall be such that any uncontrolled change in moisture content because of its use is avoided.

4.2. Direct and indirect indication of moisture content

4.2.1. Moisture meters with direct indication of moisture content

When the moisture meters indicate the moisture content directly, without the use of conversion tables for the different species, and are fitted with a device allowing the selection of the species of grain or seeds on which the measurement is being carried out, this device shall be built to make its operation clearly visible to all parties present and to indicate clearly the name of the selected species.

4.2.2. Moisture meters with indirect indication of moisture content

When the moisture meters do not indicate the moisture content directly, they shall be provided with conversion table(s) necessary to obtain the moisture content for each species.

The requirements concerning the scale interval (point 4.4.1.) and the maximum permissible errors (point 8) apply to the results of the moisture content read in the conversion tables and expressed as a percentage (% mass) and not to the results given by the conventional scale of the moisture meter.

4.3. General requirements concerning the conversion and correction tables

4.3.1. When a moisture meter requires the use of conversion or correction tables, the following requirements apply :

- 1) These tables shall be approved by the competent National Metrology Service.
- 2) The manufacturer shall provide on a visible part of the moisture meter, next to the indicating device, a written instruction indicating the necessity of the use of this (these) table(s).
- 3) When these tables are not made, by the manufacturer, integral with the moisture meter, they shall bear the general inscriptions shown on the moisture meter, the list of which is given in point 7.1.
- 4) The moisture meter shall be provided with clear and detailed operating instructions.

4.3.2. When a moisture meter requires the use of correction tables, any conversion tables excluded, its scale of indication shall be graduated in per cent (% mass).

4.4. Indicating device

4.4.1. Scale interval

The scale interval shall be chosen from the following values : 0.1 % mass, 0.2 % mass or 0.5 % mass, so that, whatever the value of the moisture content indicated directly or indirectly by the moisture meter, this number remains smaller than or equal to half the maximum permissible error prescribed on pattern approval for class I moisture meters.

4.4.2. Test value

Moisture meters of which the principle of measurement is not that of drying by heat shall be fitted with a device allowing the determination of a test value.

4.4.3. Zero setting

When a zero setting device is provided it shall be practically continuous.

4.4.4. Analogue indicating devices - dial provided with a scale and an index

The scale spacing shall be at least equal to 1.25 mm for scales graduated in per cent (% mass) as well as for conventional scales. The scale marks shall be thin and of equal thickness. The index shall be clearly visible and its thickness shall be at most equal to 1/4 of the scale spacing. Its end shall cover at least 1/3 of the length of the shortest scale marks. It shall be possible to adjust the test value and possibly zero to within half of the scale spacing. In addition to these requirements, other different requirements shall be added depending whether the scale is graduated directly in per cent (% mass) or is conventional.

4.4.4.1. Direct indication of moisture content

The scale shall be numbered at each whole value of the moisture content expressed in % mass. The scale marks which correspond to whole values of the moisture content shall be longer. When the movement of the index is continuous, the zero indication shall be marked by a line and the displacement of the index below zero shall correspond to at least 0.2 % mass.

4.4.4.2. Indirect indication of moisture content

The scale interval of the conventional scale - value converted into units of moisture content - shall be less than or equal to the scale interval defined in point 4.4.1. whatever the species chosen. The scale marks which are numbered shall be longer. All the numbers shown on the conventional scale shall also be shown in the conversion tables in the « entry » column.

4.4.5. Digital indicating devices

On a discontinuous indicating device, with aligned figures, the figures shall have a height of at least 10 mm, the indication of the moisture content being either direct or indirect. In the case of a conventional scale, all the numbers likely to appear on the digital indicating device shall be shown in the conversion tables in the « entry » column.

4.4.6. The indication of the result of the measurement shall never be ambiguous.

4.5. Requirements relating to security

4.5.1. Adjusting devices, the operation of which may alter the results of the measurement shall be designed to make any accidental or fraudulent intervention difficult and, in any case, easily visible to all parties present.

4.5.2. Protection against the various influence quantities

4.5.2.1. Moisture meters shall be insensitive to variations from – 15 % to + 10 % of the nominal voltage of the electric power supply and, if necessary, to variations from – 2 % to + 2 % of its nominal frequency.

Moisture meters supplied by a battery shall be fitted with a device indicating clearly the threshold condition below which the results of the measurement may be altered and the battery must be recharged or replaced.

4.5.2.2. The manufacturer shall specify, in the descriptive notice, the range of the operating temperature of the moisture meter. He shall also specify, if appropriate, the limits which the other parameters, likely to influence the results of the measurement, shall not exceed (hygrometry, electro-magnetic interference).

4.6. Additional requirements relating to moisture meters using the principle of drying by heat

Moisture meters with a drying device and a weighing device shall comply with the following additional requirements :

- 4.6.1. The mass of the sample intended for the measurement of the moisture content shall not be less than 5 grammes.
- 4.6.2. The accuracy of the balance and of the weights shall correspond to the accuracy proposed for the moisture meter by the manufacturer.
- 4.6.3. The dishes for drying and the balance pans shall be made of non-corrodible material which does not absorb moisture.
- 4.6.4. The maximum differences of temperature allowed inside the oven shall be specified by the manufacturer in the descriptive notice. They shall not affect the result of the measurement.
- 4.6.5. When the measurement process is not automatic, the end of drying shall be indicated without ambiguity, by a visual or audible signal.

5. Moisture meters of category A

In addition to the requirements stated in point 4, which shall be met by all moisture meters, the moisture meters of category A are subject to the following requirements.

- 5.1. The moisture meters of category A shall be entirely automatic ; they shall be designed as one integral instrument and all the parts used either to treat the sample (grinding, heating, etc.) or to measure the physical or chemical parameters involved in the calculation of the final result of the moisture content (weighing device, temperature sensor, etc.) shall be incorporated in the same instrument. If sorting and cleaning devices are used, they may be separate from the moisture meter itself.
- 5.2. The moisture meters shall be fitted with a printing device ; this device shall either be integral with the moisture meter or be located next to it (see point 11.2.2.). The result of measurement shall be printed in aligned figures and rounded to the nearest scale interval. The printout shall be a replica of the indication, if the latter is digital. The designation of the grains or seeds shall be specified on the printed ticket if the moisture meter is provided with a device for the selection of the species.
- 5.3. Various security devices are mandatory.
 - 5.3.1. Security of printing
 - Printing of the result shall not be possible before the end of the measurement when the indicator is analogue.
 - Indication and printing of the result shall not be possible before the end of the measurement when the indicator is digital.
 - 5.3.2. Measuring range

It shall not be possible to print the result outside the authorized measuring range (fixed in the pattern approval notice, if provided).

In addition, a continuous device, on the indicating device or next to it, shall reveal incorrect use : for example, a warning light for a digital indicating device, red colour of the area outside the authorized measuring range for an analogue indicating device.

5.3.3. When zero adjustment is provided it shall not facilitate fraud ⁽¹⁾.

5.3.4. The moisture meter shall be designed so that it is not possible to carry out a new measurement before the measuring cell is completely empty.

5.3.5. In case of moisture meters using drying by heat, a device (visual or audible indicator) shall indicate that measurement is prohibited until the conditions, specified in the descriptive notice (in particular the temperature at the beginning of drying), have been reached and it shall not be possible for the indicating device to provide a result of measurement before the drying period has ended.

6. Moisture meters of category B

Moisture meters which do not comply with the requirements in point 5 belong to category B provided they meet the following requirements in addition to the general requirements in point 4. They may be automatic, semi-automatic or manual, and may include several separate devices with manual operation.

6.1. When the principle of measurement of the moisture meter requires the introduction of a sample of grains or seeds of fixed mass into the measuring cell, the weighing device used shall be strongly built and shall allow the determination of the mass of the sample with an accuracy which will be fixed during pattern approval with reference to the proposal of the manufacturer.

6.2. When the principle of measurement of the moisture meter requires the taking of temperature of the measured sample, this temperature measuring device shall be strongly built and be integral with the whole measuring unit. The accuracy for the determination of the temperature will be fixed, during pattern approval, with reference to the proposal of the manufacturer.

6.3. When the moisture meter is provided with a zero adjusting device, this device may be accessible to the user but designed so that its operation is clearly visible to all parties present.

7. Inscription

7.1. General inscriptions

Each moisture meter shall bear the following markings :

- a) identification or trade-mark of the manufacturer,
- b) designation of its pattern, given by the manufacturer, and serial number,
- c) pattern approval sign, if approval is mandatory.

7.2. Identification

A fixed data plate shall show :

- the category in which the pattern was classified by the National Metrology Service.

⁽¹⁾ Here are, as example, two zero adjusting devices which make fraud difficult :

- adjusting knob accessible to the user, designed and located in such a way that its operation can be easily noticed and can affect the result indicated by the moisture meter only if the measuring cell is empty or if the measurement has not yet been initiated.
- adjusting device the operation of which is made possible only by using a tool, the tool being kept separate from the moisture meter during normal use of the meter.

- the accuracy class of the instrument,
- either the species of grains and seeds for which the moisture meter was calibrated and for each of them the measuring range, if this is not shown clearly on the indicating device, or when there are too many of these markings, to be shown clearly on the data plate, the following inscription : « the species and the measuring ranges for which this moisture meter was approved are shown in the descriptive notice »,
- the nominal value(s) of the test value(s) and possibly the upper and lower permissible limits for this (these) value(s),
- the temperature range for which the moisture meter was built.

7.3. Supervision

Each moisture meter shall have a place for the application of the initial and periodic verification marks when required by national regulations.

8. Maximum permissible errors

The absolute error of a moisture meter for a given sample of grains or seeds is the algebraic difference between the result of a measurement and a conventionally true value of the moisture content obtained using the reference methods described in Appendices I and II. Moisture meters, either of category A or of category B, belong to one of the accuracy classes, class I or class II, for which the values of the maximum permissible error are given below.

8.1. Maximum permissible errors during pattern approval testing carried out under reference conditions specified in Appendix III

The absolute maximum permissible error, plus or minus, on the moisture content shall be equal to :

8.1.1. Class I

- cereal grains other than maize, rice and sorghum and oilseeds other than sunflower :
 - 0.3 % mass if the moisture content is less than or equal to 10 % mass,
 - 3/100 of the moisture content if the latter is more than 10 % mass,
- maize, rice, sorghum, sunflower :
 - 0.4 % mass if the moisture content is less than or equal to 10 % mass,
 - 4/100 of the moisture content if the latter is more than 10 % mass.

8.1.2. Class II

- cereal grains other than maize, rice and sorghum and oilseeds other than sunflower :
 - 0.4 % mass if the moisture content is less than or equal to 10 % mass,
 - 4/100 of the moisture content if the latter is more than 10 % mass,
- maize, rice, sorghum, sunflower :
 - 0.5 % mass if the moisture content is less than or equal to 10 % mass,
 - 5/100 of the moisture content if the latter is more than 10 % mass.

8.2. Maximum permissible errors during pattern approval testing, including influence quantities, and on initial verification

The absolute maximum permissible error, plus or minus, on the moisture content shall be equal to the error stated in point 8.1. increased by 0.2 % mass.

8.3. Maximum permissible errors in service

The absolute maximum permissible error, plus or minus, on the moisture content shall be equal to the error stated in point 8.1. increased by 0.4 % mass.

9. Seals for protection and guarantee, table certification marks

9.1. The housing containing the mechanical, electrical and electronic parts of moisture meters shall be constructed to enable sealing by means of lead seals or protection and guarantee marks. If necessary however, it must be possible to recharge or to replace the battery without destroying or damaging the seals.

9.2. Any mandatory data plates and stamping plates shall be fixed to the housing and be protected by guarantee marks.

9.3. National requirements shall specify, possibly in the pattern approval notices :

- the location of the seals,
- the nature and form of the guarantee marks.

9.4. The conversion and correction tables which are provided with the moisture meters shall bear the certification marks proving that they were checked by the competent National Metrology Service.

10. Sanction of the controls - Stamping

The results of the controls shall be sanctioned by applying one or more verification marks on the moisture meters which comply with the statutory requirements. These marks and the additional markings shall be applied in conformity with national regulations, for example, on a special plate.

11. Provisions to assure fairness of the measurement operations

The requirements which follow apply to moisture meters used in the grain trade. Moisture meters which have not received approval of the National Metrology Service may not be used for commercial transactions and shall bear on the front face a clearly visible small plate with an inscription stating that their use for commercial transactions in grain is prohibited.

11.1. Minimum guarantees offered by the sellers of moisture meters

New commercial moisture meters shall be provided with the following elements :

- all the accessories mentioned in the pattern approval notice and in the descriptive notice, and necessary for the correct performance of the measurement operations,
- any conversion and correction tables which may be required, bearing the statutory inscriptions,
- a detailed descriptive notice describing clearly the conditions of installation and use of the moisture meter and its accessories ; this notice must have received prior approval of the National Metrology Service on all points relating to the metrological qualities of the instrument.

11.2. Conditions of installation

11.2.1. Place of installation and environment

The moisture meter shall be installed in conformity with the requirements given in the descriptive notice provided by the manufacturer. Among these requirements, which differ according to the principle of measurement of the moisture meter, the following ones are most frequently retained :

- the support of the moisture meter shall be flat, strong and stable ; it shall be protected especially against vibrations when the moisture meter is either equipped or used with a balance,
- the moisture meter shall be installed as far as possible from any powerful source of magnetic field (for example, heavy current electric cables) and of electro-magnetic radiation ; it shall be protected against air currents and be located in premises where it does not risk being subjected to appreciable or sudden variations in temperature.

11.2.2. Visibility of the moisture meter and of the measurement operations

Moisture meters in service shall be so placed that all parties present have the possibility of seeing simultaneously all the measurement operations. When the measuring chain (some moisture meters of category B) is too extended for the measurement operations and the indicating or printing device to be seen at the same time, the necessary steps shall be taken to remedy this and to avoid, in any case, every possibility of error or fraud.

11.2.3. Displaying the descriptive notice

The descriptive notice showing the conditions of installation and the exact operating method of the moisture meter shall be displayed in the premises in which the moisture meter is installed. It shall be easily visible to all parties present at the time of the measurement. The conversion and correction tables which may be required shall be attached to it.

11.2.4. Accessibility of the instrument for the legal metrological controls

The moisture meter shall be placed and arranged so that, on the one hand, the conformity of the official verification marks on the stamping plate and on the lead seals may easily be verified and, on the other hand, the metrological controls may be carried out under optimum conditions when requested by the officers of the National Metrology Service. In case of difficulties of access to the moisture meter during the control operations or for the means necessary for this control, the owner should make the necessary arrangements for the control to be possible on request of these officers.

11.3. Choice and preparation of the sample for measurement

11.3.1. Sampling

For the result of measurement of moisture content to be significant, the user of the moisture meter shall arrange for the measured sample to be representative of the load of grains which is the object of the commercial transaction. Therefore, the use of an adequate sampling device is necessary when there is a risk that the humidity of the load of grains is heterogeneous.

11.3.2. Cleanness and sanitary state of the sample, cleaning and sorting

Samples used for the calibration of moisture meters by the manufacturer, or for the statutory metrological controls, shall be free from impurities and broken grains, and in an adequate sanitary state (see Appendix III point 1.2.1.2.).

For usual measurement, given that the sensitivity of moisture meters to impurities contained in the grains and to the sanitary state of the grains may vary from one pattern to another (see test specified in point 1.3.2. of Appendix III), the user shall follow any cleaning procedures included in the descriptive notice by the manufacturer.

When the cleaning device for the measured sample is separate from the moisture meter, it shall allow rapid cleaning, avoiding to the utmost the hygrometric exchanges between the ambient air and the sample.

11.3.3. Temperature stabilization of the sample

When the measured sample of grains is at a temperature very much lower than that of the premises in which the moisture meter is installed, there is risk of water condensation on the grains. To avoid the detrimental effect of this phenomenon on the measurement, it is necessary to keep the sample in a closed vessel until its temperature is close to that of the ambient air ⁽¹⁾. The same rule shall be applied when the temperature of the grains is outside the permissible limits specified in the descriptive notice.

11.4. Conditions of use

11.4.1. General conditions

Any owner of a moisture meter is bound to ensure the accuracy, good maintenance, correct operation and statutory use of his instrument.

11.4.2. Measurement

The moisture meter shall be used, in conformity with the specifications indicated in the descriptive notice provided by the manufacturer.

11.4.3. Choice of printing paper

In the case of moisture meters of category A, the printed tickets which are used shall be free from any previous indications relating to the result of a measurement of the moisture content or to the selected species.

11.4.4. Special precautions for moisture meters requiring manual operations

When the measurement requires a certain number of manual operations (it is mainly the case of moisture meters of category B) the descriptive notice shall be scrupulously followed in order to avoid any risk of uncontrolled variation of the moisture content of the sample.

⁽¹⁾ For species such as maize, harvested at a rather cold time of the year, it is advisable to install the moisture meter in cool premises in order to avoid condensation on the grain.

APPENDIX I

Practical reference methods for the verification of moisture meters used for the determination of moisture content of cereal grains

1. Scope

Moisture meters are verified by comparing the results they provide with those obtained by the methods described below using grains from the same batch.

2. Reference methods

2.1. Method applicable to cereals with small grains

The reference method defined in the ISO International Standard 712 - 1979 « Cereals and cereal products - Determination of moisture content (Routine method) » ⁽¹⁾ applies to the following species : durum and soft common wheat, rice (paddy or dehulled), barley, winter barley, sorghum, rye and oat.

2.2. Method applicable to maize

The reference method defined in Section I (basic reference method) of the ISO International Standard 6540-1980 « Maize -Determination of moisture content (on milled grains and on whole grains) » ⁽²⁾ applies to maize ⁽³⁾.

3. Adaptation of the ISO Standards to this Recommendation

To be adapted for use within the framework of this Recommendation, the Standards mentioned in points 2.1. and 2.2. shall be modified as follows :

- the expression « teneur en eau » shall be replaced by the expression « titre en eau » each time it appears in the two ISO Standards (French version only),
- points 7.1.2.1. and 7.1.2.2. of the ISO Standard 712 shall be modified so that predrying is made mandatory when the moisture content is greater than or equal to 15 % mass,
- the following paragraph shall be added to point 8 of the two ISO Standards « Expression of the results » after point 8.1. « Method of calculation and formula » :

« Validity of the conditioning carried out

In the case of preliminary conditioning, check that the moisture content of the sample is between 9 and 15 % mass, after conditioning, or :

$$9 \leq (m_0 - m_1) \frac{100}{m_0} \leq 15$$

If not, repeat the procedure ».

⁽¹⁾ First edition, 1 September 1979.

⁽²⁾ First edition, 1 November 1980.

⁽³⁾ It is also used at present for sorghum, while awaiting the official standardization of a method concerning this species.

APPENDIX II

Routine reference method for the verification of moisture meters
used for the determination of moisture and
volatile matter content of oilseeds

1. Scope

Moisture meters are verified by comparing the results they provide to those obtained by the method described below using grains from the same batch.

2. Reference method

The reference method defined in the ISO International Standard 665 - 1977 « Oilseeds - Determination of moisture and volatile matter content »⁽¹⁾ applies to all types of oilseeds.

3. Adaptation of the ISO Standard to this Recommendation

To be adapted for use within the framework of this Recommendation, the Standard mentioned in point 2 shall be modified as follows :

- the expression « teneur en eau et matières volatiles » shall be replaced by the expression « titre en eau et matieres volatiles » each time it appears in the ISO Standard (French version only).

⁽¹⁾ First edition, 1 October 1977.

APPENDIX III

Metrological controls

This Appendix is given as an example since the procedure concerning metrological controls may vary from one country to another. A detailed description of a calibration method can be found in the following ISO Standards :

- ISO 7700/1 « Check of the calibration of moisture meters - Part 1 : Moisture meters for cereals » (First edition, 1984),
- ISO 7700/2 « Check of the calibration of moisture meters - Part 2 : Moisture meters for oil seeds » (being prepared).

1. Pattern approval

Pattern approval consists of a comprehensive examination of several prototypes of the same pattern of moisture meter in order to approve or not the manufacture of this pattern of meter in series. The tests to be carried out are as follows :

- 1.1. Tests of conformity with the requirements prescribed in point 4 and 5 or 6 (according to the category of the moisture meter).
- 1.2. Accuracy tests under reference conditions

To begin with, one verifies that under reference conditions (of temperature, voltage, ambient humidity, sanitary state of samples, etc.) the errors of the results obtained with the prototypes do not exceed those which are shown in point 8.1. of this Recommendation.

1.2.1. Preparation of samples

1.2.1.1. Choice of species and varieties

Tests shall be carried out on each species of grains or seeds for which the manufacturer of the pattern requires approval. The choice of varieties or blend of varieties on which the tests are carried out is defined by the National Metrology Service ⁽¹⁾.

1.2.1.2. Sanitary state of the sample

For cereal grains, the test sample shall not have too many impurities, broken, sprouted or heated grains.

For oilseeds, in addition to the above-mentioned conditions, the acidity index ⁽²⁾ shall be less than 2.

1.2.1.3. Choice of the moisture content of samples

For each species of grains ten samples with a different moisture content are prepared ⁽³⁾.

1.2.2. Test procedure

Pattern approval tests shall be carried out on three prototypes. Four successive measurements shall be carried out on each sample, the used test portions being replaced in the overall sample, after each measurement, if the measurement is nondestructive.

⁽¹⁾ For moisture meters with indirect principle of measurement the test samples shall be constituted of varieties of grain most common in a given country and in proportions corresponding to the tonnages collected at national level; this in order to use, for testing, samples which are representative of the national average.

⁽²⁾ The acidity index is the number of milligrammes of potassium hydroxide necessary to neutralize the free acidity of one gramme of fat substance.

⁽³⁾ To prepare the most humid samples, it may be necessary to re-humidify the grain. In such cases, one should refer to the ISO Standards 7700/1 and 2.

At the beginning and at the end of each set of four measurements, the moisture content shall be determined by means of the routine reference methods indicated in Appendices I and II.

The arithmetic mean of the two values determined by the reference methods mentioned above is considered as the true value of the moisture content ⁽¹⁾. This procedure shall be repeated after an interval of twenty four hours on a series of samples of which the moisture content is close to that of the samples in the preceding test.

1.3. Tests including the various influence quantities

For each influence quantity mentioned above, taken separately or as a whole, the tested prototypes shall give results with errors not exceeding those indicated in point 8.2. of this Recommendation.

1.3.1. Influence of temperature variations

These tests shall be carried out by bringing the prototypes to be tested as well as the batches of grains or seeds in a closed vessel, to the two extreme temperatures for which the manufacturer has requested pattern approval. The batches of grains or seeds chosen for this test shall have, at the reference temperature of the instrument, a moisture content close to 15 % mass for the cereal grains and 10 % mass for the oilseeds. In the two extreme cases, the result of the measurement shall be in conformity with the limits indicated in point 8.2. of this Recommendation.

1.3.2. Influence of impurities

This test is intended to provide the users of moisture meters based on the indirect principle of measurement with information on the large errors which may result when measurements are carried out on samples containing impurities. It concerns part or all of the following impurities : broken grains, germinating grains, frozen grains, overheated grains, stalks and cobs ⁽²⁾, grains of different species.

The results of the tests shall be recorded in the pattern approval notice to show when the maximum permissible errors may be exceeded owing to impurities (if, at present, such cases may occur at the collection centers in a given country). Each test result shall be associated with the following data : nature of impurities, ratio of impurities, difference between the moisture content of the impurities and that of the samples.

1.3.3. To these two tests which are specific to moisture meters, other tests shall be added, usually carried out on the measuring instruments containing electrical or electronic parts, to determine the effects of the characteristic variations of electric power supply (voltage and possibly frequency) and if possible, of the variations of the humidity of ambient air ⁽³⁾.

1.4. Influence of external disturbances

Additional tests are carried out on moisture meters containing electrical and electronic parts, to evaluate the disturbances caused by the external magnetic fields, electro-magnetic radiations, electrostatic discharges, failures of the electric power supply (interruptions of short duration, transient over-voltages, etc.) ⁽³⁾.

⁽¹⁾ Provided however that these two values do not vary by more than 0.2 % mass if the moisture content of the sample is lower than 20 % mass, or more than 0.3 % mass if the moisture content of the sample is higher than 20 % mass. If not, the test cannot be taken into consideration and shall be carried out again.

⁽²⁾ Applicable only to the French text.

⁽³⁾ See, for example, the draft prepared by OIML SP2-Sr6 « Electronic devices ».

1.5. Additional tests

The prototypes which have undergone the laboratory tests mentioned above shall then be tested under normal conditions of use. For this, they shall be installed during the harvest time following the laboratory tests, in collection centers where they are tested by the officers of the National Metrology Service.

The following tests shall be carried out :

- influence of various varieties of the same species on the results,
- influence of the climatological conditions (temperature, humidity),
- influence of the various methods of harvesting the grains or seeds,
- endurance tests on mechanical, electrical and electronic components under normal conditions of use of the moisture meters.

After this test campaign in the field, the prototypes shall again be tested in the laboratory according to the same criteria as before.

The pattern approval depends on the good working of each prototype throughout the tests.

1.6. Pattern approval

The pattern approval tests shall be endorsed by the pattern approval notice describing certain qualities of the moisture meters which vary according to the principle of operation or manufacture of the instruments and depending on them being automatic or semi-automatic.

Pattern approval notices shall fix, in particular :

- the measuring range according to the species of grains or seeds,
- the range of zero adjustment,
- the mass of grains or seeds to be introduced into the measuring cell when this mass influences the result of the measurement as well as the minimum accuracy of the weighing device,
- for moisture meters using drying by heat, the drying conditions predetermined for each species of grains or seeds as well as the accuracy in obtaining the predetermined temperatures or in programming the temperatures, if these must vary with time, in a controlled way.

2. Initial verification

Each new moisture meter corresponding to an approved pattern, shall be submitted to initial verification tests.

These tests shall ensure that the instruments comply with the prescribed accuracy and the requirements concerning manufacture, laid down in this Recommendation.

The accuracy tests shall be carried out in a room with a temperature between the limiting values for which the pattern was approved and with a relative humidity of air between 40 and 75 per cent. The samples used (2 or 3 for each species or for the most important species) shall have a moisture content within the range for which the pattern was approved.

3. Periodic verification

Moisture meters in service shall be submitted to periodic verification.

The tests to be carried out shall include all or part of the initial verification tests. The national regulations shall determine the periodicity of this verification, as well as the tests to be carried out and the methods and means to be used.

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