INTERNATIONAL RECOMMENDATION

OIML R 59-3

Edition 2016 (E)

Moisture meters for cereal grains and oilseeds.

Part 3: Test report format

Humidimètres pour grains de céréales et graines oléagineuses.

Partie 3: Format du rapport d'essais

ORGANISATION INTERNATIONALE DE MÉTROLOGIE LÉGALE

INTERNATIONAL ORGANIZATION OF LEGAL METROLOGY

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Foreword

The International Organization of Legal Metrology (OIML) is a worldwide, intergovernmental organization whose primary aim is to harmonize the regulations and metrological controls applied by the national metrological services, or related organizations, of its Member States.

The main categories of OIML publications are:

- **International Recommendations (OIML R),** which are model regulations that establish the metrological characteristics required of certain measuring instruments and which specify methods and equipment for checking their conformity. OIML Member States shall implement these Recommendations to the greatest possible extent;
- **International Documents (OIML D),** which are informative in nature and which are intended to harmonize and improve work in the field of legal metrology;
- **International Guides (OIML G),** which are also informative in nature and which are intended to give guidelines for the application of certain requirements to legal metrology; and
- **International Basic Publications (OIML B),** which define the operating rules of the various OIML structures and systems.

OIML Draft Recommendations, Documents and Guides are developed by Project Groups linked to Technical Committees or Subcommittees which comprise representatives from the Member States. Certain international and regional institutions also participate on a consultation basis. Cooperative agreements have been established between the OIML and certain institutions, such as ISO and the IEC, with the objective of avoiding contradictory requirements. Consequently, manufacturers and users of measuring instruments, test laboratories, etc. may simultaneously apply OIML publications and those of other institutions.

International Recommendations, Documents, Guides and Basic Publications are published in English (E) and translated into French (F) and are subject to periodic revision.

Additionally, the OIML publishes or participates in the publication of **Vocabularies (OIML V)** and periodically commissions legal metrology experts to write **Expert Reports (OIML E)**. Expert Reports are intended to provide information and advice, and are written solely from the viewpoint of their author, without the involvement of a Technical Committee or Subcommittee, nor that of the CIML. Thus, they do not necessarily represent the views of the OIML.

This publication – reference OIML R 59-3, Edition 2016 – was developed by Project Group 1 in OIML Technical Subcommittee TC 17/SC 1 *Humidity*. It was approved for final publication by the International Committee of Legal Metrology in 2016 and was submitted to the International Conference on Legal Metrology in 2016 for formal sanction. It supersedes the previous edition of R 59 dated 1984.

OIML Publications may be downloaded from the OIML website in the form of PDF files. Additional information on OIML Publications may be obtained from the Organization's headquarters:

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Introduction

[1]Moisture content is one of the most critical grain quality measurements because of the direct economic significance of the fraction of the total product weight that is water and because moisture content largely determines the rates at which the grain will degrade during handling and storage. Grain is bought and sold on the basis of weight. Accurate moisture determinations serve as the basis for appropriate price adjustments.

[1]If the moisture content is above the level that ensures safe storage, the grain must be dried to a suitable level. The energy and handling costs associated with drying grain and the reduction in weight of the grain during drying result in substantially reduced prices for high moisture grain. Concomitantly, overly dry grain is discounted from its weight basis and this dockage is partially justified by the increased susceptibility to breakage during handling for drier grain. The direct discounts assessed for moist grain and the indirect penalty (giving away dry matter) for dry grain are powerful inducements to deliver grain with a moisture content that is very close to the established safe storage level. Because of its significance, moisture content is determined virtually every time grain is bought and sold.

[1]Many technologies have been applied to rapid grain moisture measurement. Rapid indirect methods measure some physical parameter (such as electrical or optical sensing) and predict moisture content using calibration equations or charts. These calibrations can change due to changes in crop varieties planted and seasonal variation in climatic conditions. Invariably, other sample constituents or sample geometry interfere with the signal caused by water. Temperature usually affects both the water signal and the interfering signals. Therefore, calibration equations attempt to achieve a best fit between the measured parameters and the moisture content as defined by an accepted moisture reference method. Accurate grain moisture measurements depend upon successfully overcoming the effects of interfering factors such as density, temperature, chemical composition and impurities.

This 2016 edition of OIML R 59 contains significant changes to the 1984 edition, notably to reflect new measuring technologies and aspects of actual grain analysis.

As noted above, grain moisture meters do not measure moisture directly. An electrical or optical response to the moisture in a grain type is measured and moisture is predicted using calibration equations. As such, these instruments must be calibrated to predict the moisture of each grain type used on the instrument. Grains vary from season to season and also grain types may vary widely from country to country; therefore, a program to address calibration updates is needed to ensure that grain moisture meter calibrations represent the current crops. If grain moisture instruments are sold to other countries the calibrations will need to be verified within that country to ensure that the calibrations are representative of the grains within that particular country. This Recommendation does not address an ongoing calibration program for these instruments. Ongoing calibration programs may be subject to metrological controls by the national responsible body.

[1] *An Investigation of the Nature of the Radio Frequency Dielectric Response in Cereal Grains and Oilseeds with Engineering Implications for Grain Moisture Meters, A Dissertation in Physics and Engineering*, David B. Funk, Ph.D., D.H.C.

Moisture meters for cereal grain and oilseeds
Part 3: Test report format

1 Introduction

Implementation of this test report format is informative with regard to the implementation of OIML Recommendation R 59 in national regulations; however, its implementation is mandatory within the framework of the *OIML Basic Certificate System for OIML Type Evaluation of Measuring Instruments*.

Note concerning the references: All references are to OIML R 59:2016, in the text of this test report format (referred to as "R 59").

This test report format applies to any kind of instrument for measuring cereal grain and oilseeds moisture (independent of its technology). It presents a standardized format for the results of the various tests and examinations, described in Annex A of R 59-2:2016, to which a type of an instrument for measuring cereal grain and oilseed moisture shall be submitted with a view to its approval based on this OIML Recommendation.

It is recommended that all metrology services or laboratories evaluating and/or testing types of instruments for measuring cereal grain and oilseeds moisture according to OIML R 59, or to national or regional regulations based on R 59, use this test report format, directly or after translation into a language other than English or French. In the case of a translation, it is highly recommended to leave the structure and the numbers of the clauses unchanged: in this case most of the contents is also understandable for those who cannot read the language of the translation. The user is free to change the length of the cells (for instance "Remarks") as required in a specific case.

In the practical application of the test report format, it is not necessary to include Sections 1, 2 and 3 of R 59-3. They can be replaced by a cover page by the Issuing Authority and/or in accordance with national custom or legislation. So only R 59-3, 4 to 13.18.2 and the Summary of the Type Evaluation Test Results shall be included.

It is also recommended that this test report format in English or in French (or in both languages) be transmitted by the country performing the tests to the relevant authorities of another country, when requested for issuing a national or regional type approval.

2 Applicability of this report format

In the framework of the *OIML Certification System (OIML-CS)* applicable to instruments for measuring cereal grain and oilseeds moisture in conformity with R 59, use of this Report Format is mandatory, in French and/or in English with translation into the national languages of the countries issuing such certificates, if appropriate.

3 Guidance for the application of this test report format

The results of the tests shall be recorded according to the following example:

Action	Passed	Failed
When the instrument has passed the test:	×	
When the instrument has failed the test:		×
When the test is not applicable:	NA	NA
Not able to conduct the test:	⊘	⊘

4 Applicant information, responsible authority and other testing laboratories

Applicant

Company name:

_____

Address:

_____

City: _____State: _____Zip Code: _____

Country: _____ Representative or Contact:_____

Telephone (if applicable, include extension): _____ Fax: _____

Email: _____Website: _____

Responsible laboratory authority for OIML report:

Name: _____

Address: _____

Report number: _____ Application number: _____

Date of tests: _____Date report issued:_____

Person responsible for test report: _____

Other laboratories performing testing (complete information for all laboratories performing testing)

Name: _____

Address: _____

Application number: _____

Test(s) performed by this laboratory: _____

_____

Date of tests: _____

Laboratory accredited by: _____

Accreditation number and expiration date: _____ or peer assessment date: _____

Location and types of tests conducted outside the premises of the laboratory: _____

_____

Name and signature of responsible person: _____

Date of signature: _____

Remarks:

_____
_____
_____

5 General information concerning the type

Measurement technology (NIR, dielectric meters, etc.):

_____

Manufacturer (if different from Applicant):

_____

Model: _____Serial No. (Device to be tested): _____

Prototype Device: ❒ Production device: ❒ Operating manual submitted (if available): ❒ Yes ❒ No

6 Features

Mark each feature as S for standard features, O for optional features (i.e. features available in addition to those included as part of the standard device), and leave blank if not applicable. Check all that apply. List additional features at the end of this list under “Other”.

6.1 Display, controls and recording element

_____Moisture percentage display

_____Printer interface capability

_____Error message(s) display

_____Variable print format

_____Alphanumeric display

_____Integral printer

_____Liquid crystal display. If so, indicate type/capabilities:

_____Remote customer display

_____Ticket printer

_____LED display

_____Tape printer

_____Method of grain selection

_____Label printer

_____Menu

_____Thermal printer

_____Other

_____Dot matrix printer

_____Alphanumeric keypad

_____Prints time and date

_____Prints identification number

_____Consecutive ticket numbering

_____Other:_____

6.2 Other features

_____Audit trail

_____Battery power supply AC to DC

_____Adapter

_____Battery saving feature

_____(Automatic shut-off)

Comments:_____
_____
_____

7 Temperature ranges

Specified temperature range (environment):

_____

Specified temperature difference (room temp. to grain temp.):

Specified grain temperature range:

_____

8 Moisture increment, character height, level indicator, sample size and warm-up

Value of minimum moisture increment:

_____

Digital display character height:

_____

Is device equipped with a level indicator: ❒ Yes ❒ No

Stated minimum sample size:

_____

State warm-up time:

_____

9 Power

Instrument power requirements:

Nominal voltage:

_____

Nominal frequency:

_____

Battery operation specified voltage range: _____

Battery operated? ❒ Yes ❒ No

10 Remote communication and method of sealing

Remote communication capability? ❒Yes ❒No

Means of sealing; indicate all that apply and briefly describe:

_____

_____

❒ Audit trail

❒ Wire security seal

❒ Other: _____

11 Grain types and moisture ranges for which the instrument will be approved

*Grain types	* Type evaluation required moisture range	Manufacturer specified moisture range	Indicate grain(s) for which calibration data is being submitted
Corn	12–18 %		
Soybeans	10–16 %		
Hard red winter wheat	10–16 %		
Durum wheat	10–16 %		
Soft white wheat	10–16 %		
Hard red spring wheat	10–16 %		
Soft red winter wheat	10–16 %		
Hard white Wheat	8–14 %		
Two-row barley	10–16 %		
Six-row barley	10–16 %		
Oats	8–14 %		
Sunflower seed (oil type)	6–12 %		
Long grain rough rice	10–16 %		
Medium grain rough rice	10–16 %		
Grain sorghum or milo	10–16 %		

* These columns are for example only. The national responsible body may select the grains and moisture ranges that will be included in the type evaluation program in accordance with R 59-1, 5.1 and R 59-2, 1.1

12 Reference method

Identify the laboratory reference method for moisture: _____

13 Test report

13.1 Power supply

	Equipment needed	2 variable auto-transformers, voltmeter
Temperature	**Instruments**	22 ºC ± 2 ºC
	Grain	22 ºC ± 2 ºC
Sample used	*** Grain**	HRW wheat
	*** Moisture range**	12 % –14 %
Separate sample required for each model:		No
Separate sample required for each instrument:		Yes
Number of repetitions:		10

Instrument ID	**Measurements**			**Calculations**				**Results**				
				Mean meter moist. value at nom. voltage	**Mean meter moist. value at low voltage**	**Mean meter moist. value at high voltage**	**Moist. value diff. between nom, low and high**	**SD of repeat msmts (Max = 0.10 %)**	**MPE for max. diff bet. nom, low and high**	**Passed**	**Failed**	**Comments**
(1)	**Nom. voltage** _____	1	6									
		2	7									
		3	8									
		4	9									
		5	10									
	Low voltage _____	1	6									
		2	7									
		3	8									
		4	9									
		5	10									
	High voltage _____	1	6									
		2	7									
		3	8									
		4	9									
		5	10									

Instrument ID	Measurements			Calculations				Results				
				Mean meter moist. value at nom. voltage	Mean meter moist. value at low voltage	Mean meter moist. value at high voltage	Moist. value diff. between nom, low and high	SD of repeat msmts (Max = 0.10 %)	MPE for max. diff bet. nom, low and high	Passed	Failed	Comments
(2)	Nom. voltage _____	1	6									
		2	7									
		3	8									
		4	9									
		5	10									
	Low voltage _____	1	6									
		2	7									
		3	8									
		4	9									
		5	10									
	High voltage _____	1	6									
		2	7									
		3	8									
		4	9									
		5	10									

Additional comments: _____

_____

_____

_____

13.2 Storage temperature

	Equipment needed	Environmental cabinet
Temperature	**Instruments**	22 ºC ± 2 ºC
	Grain	22 ºC ± 2 ºC
Sample used	*** Grain**	HRW wheat
	*** Moisture Range**	12 % –14 %
Separate sample required for each model:		No
Separate sample required for each instrument:		Yes
Number of repetitions:		10

Instrument ID	**Measurements**			**Calculations**			**Results**			
				Mean before temp cycling	**Mean after temp. cycling**	**Diff. in mean values of before and after temp cycling**	**MPE for diff bet. Mean values of before and after temp cycling R 59-1, Table 4.4.1 Column 3**	**Passed**	**Failed**	**Comments**
(1)	**Before temp. cycling**	1	6							
		2	7							
		3	8							
		4	9							
		5	10							
	After temp. cycling	1	6							
		2	7							
		3	8							
		4	9							
		5	10							
(2)	**Before temp. cycling**	1	6							
		2	7							
		3	8							
		4	9							
		5	10							
	After temp. cycling	1	6							
		2	7							
		3	8							
		4	9							
		5	10							

*For example only. The national responsible body may select the grains and moisture ranges that will be included in the type evaluation program in accordance with R 59, 5.1 and R 59-2, 1.1

Additional comments: _____

_____

_____

_____

13.3 Instrument leveling (instruments without a level)

	Equipment needed	Shims
Temperature	**Instruments**	22 ºC ± 2 ºC
	Grain	22 ºC ± 2 ºC
Sample used	*** Grain**	HRW wheat
	*** Moisture Range**	12 % –14 %
Separate sample required for each model:		No
Separate sample required for each instrument:		No
Reference tilt		Instrument level to 0.1º
Degree of tilt (front or back) and (right or left) Min 2 orientations of tilt		5 %
Number of repetitions		5

Instrument ID	**Measurements**			**Calculations**			**Results**			
	Tilt position	**At tilt**	**At reference**	**Mean at tilt**	**Mean at reference**	**Mean diffs. between tilts and ref.**	**MPE for max. diff bet. tilt and ref. mean values R 59-1, Table 4.4.1 Column 3**	**Passed**	**Failed**	**Comments**
(1)	**Level**		1							
			2							
			3							
			4							
			5							
	Right or left tilt (choose direction w/greatest effect)	1	1							
		2	2							
		3	3							
		4	4							
		5	5							
	Front or back tilt (choose direction w/greatest effect)	1	1							
		2	2							
		3	3							
		4	4							
		5	5							

Instrument ID	Measurements			Calculations			Results				
	Tilt position	At tilt	At reference	Mean at tilt	Mean at reference	Mean diffs. between tilts and ref.	MPE for max. diff bet. tilt and ref. mean values R 59-1, Table 4.4.1 Column 3	Passed	Failed	Comments
(2)	Level		1							
			2							
			3							
			4							
			5							
	Right or left tilt – (choose direction w/greatest effect)	1	1							
		2	2							
		3	3							
		4	4							
		5	5							
	Front or back tilt (choose direction w/greatest effect)	1	1							
		2	2							
		3	3							
		4	4							
		5	5							

*For example only The national responsible body may select the grains and moisture ranges that will be included in the type evaluation program in accordance with R 59-1, 5.1 and R 59-2, 1.1

Additional comments: _____

_____

_____

_____

13.4 Instrument leveling (instruments with a level indicator)

	Equipment needed	Shims
Temperature	**Instruments**	22 ºC ± 2 ºC
	Grain	22 ºC ± 2 ºC
Sample used	*** Grain**	HRW wheat
	*** Moisture range**	12 % –14 %
Separate sample required for each model:		No
Separate sample required for each instrument:		No
Reference tilt		Instrument level to 0.1º
Degree of tilt (front or back) and (right or left) Min 2 orientations of tilt		Tested to the limits of the level indicator
Number of repetitions		5

Instrument ID	**Measurements**			**Calculations**			**Results**			
	Tilt position	**At tilt**	**At reference**	**Mean at tilt**	**Mean at reference**	**Mean diffs. between tilts and ref.**	**MPE for max. diff bet. tilt and ref. mean values R 59-1, Table 4.4.1 Column 3**	**Passed**	**Failed**	**Comments**
(1)	**Level**		1							
			2							
			3							
			4							
			5							
	Right or left tilt (choose direction w/greatest effect)	1	1							
		2	2							
		3	3							
		4	4							
		5	5							
	Front or back tilt (choose direction w/greatest effect)	1	1							
		2	2							
		3	3							
		4	4							
		5	5							

Instrument ID	Measurements			Calculations			Results			
	Tilt position	At tilt	At reference	Mean at tilt	Mean at reference	Mean diffs. between tilts and ref.	MPE for max. diff bet. tilt and ref. mean values R 59-1, Table 4.4.1 Column 3	Passed	Failed	Comments
(2)	Level		1							
			2							
			3							
			4							
			5							
	Right or left tilt – (choose direction w/greatest effect)	1	1							
		2	2							
		3	3							
		4	4							
		5	5							
	Front or back tilt (choose direction w/greatest effect)	1	1							
		2	2							
		3	3							
		4	4							
		5	5							

*For example only. The national responsible body may select the grains and moisture ranges that will be included in the type evaluation program in accordance with R 59-1, 5.1 and R 59-2, 1.1

Additional comments: _____

_____

_____

_____

13.5 Instrument warm-up

	Equipment needed	N/A
Temperature	**Instruments**	22 ºC ± 2 ºC
	Grain	22 ºC ± 2 ºC
Sample used	*** Grain**	HRW wheat
	*** Moisture range**	12 % –14 %
Separate sample required for each model:		No
Separate sample required for each instrument:		No
Number of repetitions:		5

Instrument ID	**Measurements**		**Calculations**			**Results**			
			Mean after warm-up	**Mean after 1 h or twice manufacturer specified warm-up**	**Diff. in mean values of warm-ups**	**MPE for diff bet. Mean values of warm-ups R 59-1, Table 4.4.1 Column 3**	**Passed**	**Failed**	**Comments**
(1)	**After warm-up**	1							
		2							
		3							
		4							
		5							
	1 h after instrument is turned on or twice the manu-facturer's warm-up (whichever is greater)	1							
		2							
		3							
		4							
		5							
(2)	**After warm-up**	1							
		2							
		3							
		4							
		5							
	1 h after instrument is turned on or twice the manu-facturer's warm-up (whichever is greater)	1							
		2							
		3							
		4							
		5							

*For example only. The national responsible body may select the grains and moisture ranges that will be included in the type evaluation program in accordance with R 59-1, 5.1 and R 59-2, 1.1

Additional comments: _____

_____

_____

_____

13.6 Humidity

	Equipment needed	Environmental chamber
Temperature	**Instruments**	22 ºC ± 2 ºC
	Grain	22 ºC ± 2 ºC
Sample used	*** Grain**	HRW wheat
	*** Moisture range**	12 % –14 %
Separate sample required for each model:		No
Separate sample required for each instrument:		No
Number of repetitions:		10

Instrument ID	**Measurements**			**Calculations**			**Results**			
				Mean at 20 % humidity	**Mean at 90 % humidity**	**Diff. in mean values of 20 % and 90 % humidity**	**MPE for diff. bet. Mean values of 20 % and 90 % humidity R 59-1, Table 4.4.1 Column 3**	**Passed**	**Failed**	**Comments**
(1)	**20 % humidity**	1	6							
		2	7							
		3	8							
		4	9							
		5	10							
	90 % humidity	1	6							
		2	7							
		3	8							
		4	9							
		5	10							
(2)	**20 % humidity**	1	6							
		2	7							
		3	8							
		4	9							
		5	10							
	90 % humidity	1	6							
		2	7							
		3	8							
		4	9							
		5	10							

*For example only. The national responsible body may select the grains and moisture ranges that will be included in the type evaluation program in accordance with R 59-1, 5.1 and R 59-2, 1.1.

Additional comments: _____

_____

_____

_____

13.7 Humidity

	Equipment needed	Environmental chamber
Temperature	**Instruments**	22 ºC ± 2 ºC
	Grain	22 ºC ± 2 ºC
Sample used	*** Grain**	HRW wheat
	*** Moisture range**	12 % –14 %
Separate sample required for each model:		No
Separate sample required for each instrument:		No
Number of repetitions:		10

Instrument ID	**Measurements**			**Calculations**			**Results**			
				Mean at 20 % humidity	**Mean at 90 % humidity**	**Diff. in mean values of 20 % and 90 % humidity**	**MPE for diff. bet. Mean values of 20 % and 90 % humidity R 59-1, Table 4.4.1 Column 3**	**Passed**	**Failed**	**Comments**
(1)	**20 % humidity**	1	6							
		2	7							
		3	8							
		4	9							
		5	10							
	90 % humidity	1	6							
		2	7							
		3	8							
		4	9							
		5	10							
(2)	**20 % humidity**	1	6							
		2	7							
		3	8							
		4	9							
		5	10							
	90 % humidity	1	6							
		2	7							
		3	8							
		4	9							
		5	10							

*For example only. The national responsible body may select the grains and moisture ranges that will be included in the type evaluation program in accordance with R 59-1, 5.1 and 59-2, 1.1.

Additional comments: _____

_____

_____

_____

13.8 Instrument stability

	Equipment needed	N/A
Temperature	**Instruments**	22 ºC ± 2 ºC
	Grain	22 ºC ± 2 ºC
Sample used	*** Grain**	HRW wheat
	*** Moisture range**	HRW wheat 1 each at 10 % – 12 %, 12 % – 14 %, and 14 % – 16 %
Separate sample required for each model:		Yes
Separate sample required for each instrument:		No
Number of repetitions:		5

Instrument ID	*** Grain type**	*** 6 % moisture range**	**Msmts after warm-up**	**Msmts after type evaluation (4-6 weeks)**	**Avg of 15 msmts After warm-up**	**Avg of 15 measurements after type evaluation (4-6 weeks)**	**Results**			
							Diff between Avg after warm-up and Avg after type evaluation	**Passed**	**Failed**	**Comments**
Instrument 1	**HRW wheat**	**10-12 %**	**1**	**1**						
			2	**2**						
			3	**3**						
			4	**4**						
			5	**5**						
		12-14 %	**1**	**1**						
			2	**2**						
			3	**3**						
			4	**4**						
			5	**5**						
		14-16 %	**1**	**1**						
			2	**2**						
			3	**3**						
			4	**4**						
			5	**5**						

Instrument ID	* Grain type	* 6 % moisture range	Msmts after warm-up	Msmts after type evaluation (4-6 weeks)	Avg of 15 msmts After warm-up	Avg of 15 measurements after type evaluation (4-6 weeks)	Results			
							Diff between Avg after warm-up and Avg after type evaluation	Passed	Failed	Comments
Instrument 2	HRW wheat	10-12 %	1	1						
			2	2						
			3	3						
			4	4						
			5	5						
		12-14 %	1	1						
			2	2						
			3	3						
			4	4						
			5	5						
		14-16 %	1	1						
			2	2						
			3	3						
			4	4						
			5	5						

*For example only. The national responsible body may select the grains and moisture ranges that will be included in the type evaluation program in accordance with R 59-1, 5.1 and R 59-2, 1.1

13.9 Instrument temperature sensitivity

	Equipment needed	Thermometers, grain sample divider, environmental chamber
Temperature	**Instruments**	22 ºC ± 2 ºC, ± Manufacturer specified low and high operating limits
	Grain	22 ºC ± 2 ºC ± Manufacturer specified low and high operating limits
Sample used	*** Grain**	HRW wheat
	*** Moisture ranges**	HRW wheat: 1 each at 10 % – 12 %, 12 % – 14 %, 14 % – 16 %
Separate sample required for each model:		No
Separate sample required for each instrument:		No
Repetitions:		3

Instrument ID	*** Grain Type**	*** 6 % moisture range**	**At room temp grain 22 ºC msmts**	**Cold 22 ºC - Δt grain and instrument msmts**	**Hot 22 ºC + Δt grain and instrument msmts**	**Results**								
						Avg values at 22 ºC, 22ºC - Δt, 22ºC + Δt			**MPE for diff bet mean temps R 59-1, Table 4.4.1 Column 2 × 0.8**	**Mean diff of room temp msmts-cold temp msmt**	**Mean diff of Rm temp msmt-hot temp msmt**	**Passed**	**Failed**	**Comments**
Instrument 1	**HRW wheat**	**10–12 %**	**1**	**1**	**1**	**22 ºC**	**22 ºC – Δt**	**22 ºC + Δt**						
			2	**2**	**2**									
			3	**3**	**3**									
		12–14 %	**1**	**1**	**1**	**22 ºC**	**22 ºC – Δt**	**22 ºC + Δt**						
			2	**2**	**2**									
			3	**3**	**3**									
		14–16 %	**1**	**1**	**1**	**22 ºC**	**22 ºC – Δt**	**22 ºC + Δt**						
			2	**2**	**2**									
			3	**3**	**3**									
Instrument 2	**HRW Whet**	**10–12 %**	**1**	**1**	**1**	**22 ºC**	**22 ºC – Δt**	**22 ºC + Δt**						
			2	**2**	**2**									
			3	**3**	**3**									
		12–14 %	**1**	**1**	**1**	**22 ºC**	**22 ºC – Δt**	**22 ºC + Δt**						
			2	**2**	**2**									
			3	**3**	**3**									
		14-16 %	**1**	**1**	**1**	**22 ºC**	**22 ºC – Δt**	**22 ºC + Δt**						
			2	**2**	**2**									
			3	**3**	**3**									

*For example only. The national responsible body may select the grains and moisture ranges that will be included in the type evaluation program in accordance with R 59-1, 5.1 and R 59-2, 1.1.

Additional comments: _____

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13.10 Sample temperature sensitivity

Equipment needed		Thermometers, environmental cabinet
Temperature	**Instruments**	22 ºC ± 2 ºC
	Grain	22 ºC ± 2 ºC ± manufacturer temperature difference
Sample used	*** Grain**	HRW wheat, Soybeans, corn
	*** Moisture ranges**	HRW wheat: 2 each at 10 % – 12 %, 12 % – 14 %, 14 % – 16 % Soybeans: 2 each at 10 % – 12 %, 12 % – 14 %, 14 % – 16 % Corn: 2 each at 12 % – 14 %, 14 % – 16 %, 16 % – 18 %
Separate sample required for each model:		Yes
Separate sample required for each instrument:		No
Number of repetitions:		3

Instrument ID	**Grain type**	**6 % moisture range**	**At room temp grain 22 ºC Msmts**		**Cold 22 ºC - Δt grain msmts**		**Hot 22 ºC + Δt grain msmts**		**Results**					
			Sample 1	**Sample 2**	**Sample 1**	**Sample 2**	**Sample 1**	**Sample 2**	**Mean values of all 6 % at 22 ºC, 22 ºC - Δt, 22 ºC + Δt**	**Mean diff of Room temp msmt-cold temp msmt**	**Mean diff of Room temp msmt-hot temp msmt**	**Passed**	**Failed**	**Comments**
Instrument 1	**HRW wheat**	**10-12 %**	**1**	**1**	**1**	**1**	**1**	**1**	**22 ºC**					
			2	**2**	**2**	**2**	**2**	**2**						
			3	**3**	**3**	**3**	**3**	**3**						
		12-14 %	**1**	**1**	**1**	**1**	**1**	**1**	**22 ºC – Δt**					
			2	**2**	**2**	**2**	**2**	**2**						
			3	**3**	**3**	**3**	**3**	**3**						
		14-16 %	**1**	**1**	**1**	**1**	**1**	**1**	**22 ºC + Δt**					
			2	**2**	**2**	**2**	**2**	**2**						
			3	**3**	**3**	**3**	**3**	**3**						
	Soybeans	**10-12 %**	**1**	**1**	**1**	**1**	**1**	**1**	**22 ºC**					
			2	**2**	**2**	**2**	**2**	**2**						
			3	**3**	**3**	**3**	**3**	**3**						
		12-14 %	**1**	**1**	**1**	**1**	**1**	**1**	**22 ºC – Δt**					
			2	**2**	**2**	**2**	**2**	**2**						
			3	**3**	**3**	**3**	**3**	**3**						
		14-16 %	**1**	**1**	**1**	**1**	**1**	**1**	**22 ºC + Δt**					
			2	**2**	**2**	**2**	**2**	**2**						
			3	**3**	**3**	**3**	**3**	**3**						

Instrument ID	Grain type	6 % moisture range	At room temp grain 22 ºC Msmts		Cold 22 ºC - Δt grain msmts		Hot 22 ºC + Δt grain msmts		Results					
			Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2	Mean values of all 6 % at 22 ºC, 22 ºC - Δt, 22 ºC + Δt	Mean diff of Room temp msmt-cold temp msmt	Mean diff of Room temp msmt-hot temp msmt	Passed	Failed	Comments
	Corn	12-14 %	1	1	1	1	1	1	22 ºC					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
		14-16 %	1	1	1	1	1	1	22 ºC – Δt					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
		16-18 %	1	1	1	1	1	1	22 ºC + Δt					
			2	2	2	2	2	2						
			3	3	3	3	3	3						

Instrument ID	* Grain Type	* 6 % moisture range	At room temp grain 22 ºC msmts		Cold 22 ºC – Δt grain msmts		Hot 22 ºC + Δt grain msmts		Results						
			Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2	Mean values of all 6 % at 22 ºC, 22 ºC - Δt, 22 ºC + Δt	Mean diff of Rm temp msmt-cold temp msmt	Mean diff of Rm temp msmt-hot temp msmt	Passed	Failed	Comments
Instrument 2	HRW wheat	10-12 %	1	1	1	1	1	1	22 ºC					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
		12-14 %	1	1	1	1	1	1	22 ºC – Δt					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
		14-16 %	1	1	1	1	1	1	22 ºC + Δt					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
	Soybeans	10-12 %	1	1	1	1	1	1	22 ºC					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
		12-14 %	1	1	1	1	1	1	22 ºC – Δt					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
		14-16 %	1	1	1	1	1	1	22 ºC + Δt					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
	Corn	12-14 %	1	1	1	1	1	1	22 ºC					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
		14-16 %	1	1	1	1	1	1	22 ºC – Δt					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
		16-18 %	1	1	1	1	1	1	22 ºC + Δt					
			2	2	2	2	2	2						
			3	3	3	3	3	3						

*For example only. The national responsible body may select the grains and moisture ranges that will be included in the type evaluation program in accordance with R 59-1, 5.1 and R 59-2, 1.1.

Additional comments: _____

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13.11 Accuracy test

* Grain type	* 6 % moisture range	MPEs defined in R 59-1, Table 4.4.1 Column 2	No. of Samples per 2 % moist. interval	Analyze each sample 3× on each instrument tot. msmts.	Instrument ID (1)_____ (2)_____	Results						
						Meter Results	Reference Results	$\bar{y}$	SDD	Passed	Failed	Comments
Corn	12-14 %		10	30	(1)							
				30	(2)							
	14-16 %		10	30	(1)							
				30	(2)							
	16-18 %		10	30	(1)							
				30	(2)							
HRW wheat	10-12 %		10	30	(1)							
				30	(2)							
	12-14 %		10	30	(1)							
				30	(2)							
	14-16 %		10	30	(1)							
				30	(2)							
Soybeans	10-12 %		10	30	(1)							
				30	(2)							
	12-14 %		10	30	(1)							
				30	(2)							
	14-16 %		10	30	(1)							
				30	(2)							

* These columns are for example only. The national responsible body may select the grains and moisture ranges that will be included in the type evaluation program in accordance with R 59-1, 5.1 and R 59-2, 1.1 Add the appropriate number of cells to record results.

$$\bar{y} = \frac{\sum_{i=1}^{n} (\bar{x}_i - r_i)}{n} \qquad SDD = \sqrt{\frac{\sum_{i=1}^{n} \left(y_i - \bar{y}\right)^2}{n-1}}$$

Additional comments: _____

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13.12 Repeatability

* Grain type	* 6 % moisture range	MPEs defined in R 59-1, Table 4.4.1 Column 4	No. of Samples per 2 % moist. interval	Analyze each sample 3× on each instrument tot. msmts.	Instrument ID (1)_____ (2)_____	Results					
						SD	Pooled SD (1)	Pooled SD (2)	Passed	Failed	Comments
Corn	12-14 %		10	30	(1)						
				30	(2)						
	14-16 %		10	30	(1)						
				30	(2)						
	16-18 %		10	30	(1)						
				30	(2)						
HRW wheat	10-12 %		10	30	(1)						
				30	(2)						
	12-14 %		10	30	(1)						
				30	(2)						
	14-16 %		10	30	(1)						
				30	(2)						
Soybeans	10-12 %		10	30	(1)						
				30	(2)						
	12-14 %		10	30	(1)						
				30	(2)						
	14-16 %		10	30	(1)						
				30	(2)						

* These columns are for example only. The national responsible body may select the grains and moisture ranges that will be included in the type evaluation program in accordance with R 59-1, 5.1 and R 59-2, 1.1. Add the appropriate number of cells to record results.

$$SD = \sqrt{\frac{\sum_{i=1}^{n}\sum_{j=1}^{3}\left(x_{ij} - \overline{x_i}\right)^2}{2n}}$$

Additional comments: _____

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13.13 Reproducibility

* Grain type	* 6 % moisture range	MPEs defined in R 59-1, Table 4.4.1 Column 4	No. of Samples per 2 % moist. interval	Analyze each sample 3× on each instrument tot. msmts.	Instrument ID	Results				
						Avg.	SDD	Passed	Failed	Comments
Corn	12-14 %		10	30	(1)					
				30	(2)					
	14-16 %		10	30	(1)					
				30	(2)					
	16-18 %		10	30	(1)					
				30	(2)					
HRW wheat	10-12 %		10	30	(1)					
				30	(2)					
	12-14 %		10	30	(1)					
				30	(2)					
	14-16 %		10	30	(1)					
				30	(2)					
Soybeans	10-12 %		10	30	(1)					
				30	(2)					
	12-14 %		10	30	(1)					
				30	(2)					
	14-16 %		10	30	(1)					
				30	(2)					

* These columns are for example only. The national responsible body may select the grains and moisture ranges that will be included in the type evaluation program in accordance with OIML R 59, 5.1 and R 59-2, 1.1. Add the appropriate number of cells to record results.

$$SDD_I = \sqrt{\frac{\sum_{i=1}^{n} \left(d_i - \bar{d}\right)^2}{n-1}}$$

Additional comments: _____

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13.14 AC mains voltage dips and short interruptions

Observer	
Instrument 1 ID	
Instrument 2 ID	
Sample ID	

	At start	**At end**	
Temp:			**ºC**
RH			**%**
Date and time			**mm / dd / yr** **hh / mm /ss**

	n = 10		**mean**
Reference moisture			
Error shift limit **(see R 59-1, Table 4.4.1, column 3)**			

Note other details about the test

Settings				Results				
Test	Voltage reduction		Duration cycles					
	New V	% reduction		Moisture readings n = 10 readings per voltage reduction	Diff (Measured moisture – Ref moisture)	If diff ≤ Error shift limit Pass	If diff ≥ Error shift limit Fail	Comments
1	0	100	0.5					
2	0	100	1					
3	0	70	25/30					
4	0	100	250/300					

13.15 Bursts (transients) on AC mains voltage supply

Observer	
Instrument 1 ID	
Instrument 2 ID	
Sample ID	

	At start	**At end**	
Temp:			**ºC**
RH			**%**
Date and time			**mm / dd / yr hh / mm /ss**

L = phase, N = neutral, PE = protective earth, G= Ground

Error shift limit (see R 59-1, Table 4.4.1, column 3)	

Note other details about the test

Settings		**Pre-test and test measurements**			**Results**				
			Measurements prior to bursts	**Test**	**Diff (Measured moisture – ref moisture)**	**If diff ≤ error shift limit Pass**	**If diff > error shift limit Fail**	**Sig fault detected & acted upon**	**Comments**
Connections	**Test V (kV) & polarity**	**n = 10 readings per voltage reduction**	**Mean**	**n = 10 readings per voltage reduction**					
L ↓ G									
N ↓ G									

Settings		Pre-test and test measurements			Results				
Connections	Test V (kV) & polarity	Measurements prior to bursts		Test	Diff (Measured moisture – ref moisture)	If diff ≤ error shift limit Pass	If diff > error shift limit Fail	Sig fault detected & acted upon	Comments
		n = 10 readings per voltage reduction	Mean	n = 10 readings per voltage reduction					
PE ↓ G									

13.16 Radiated, radio-frequency, electromagnetic fields

Observer	
Instrument 1 ID	
Instrument 2 ID	
Sample ID	

	At start	**At end**	
Temp:			**ºC**
RH			**%**
Date and time			**mm / dd / yr hh / mm /ss**

V = Vertical H = Horizontal

Note other details about the test

Error shift limit (see R 59-1, Table 4.4.1, column 3)	

Settings		**Measurements prior to disturbance (reference)**		**Test**		**Results**				
Location	**Antenna polarization**	**n = 10 readings per position**	**Mean**	**Frequency (MHz)**	**Moisture measurement n = 10 per frequency**	**Diff (Measured moisture – mean ref moisture)**	**If diff ≤ error shift limit Pass**	**If diff > error shift limit Fail**	**Sig fault detected & acted upon**	**Comments**
Front	**V**			**26**						
				2000						
	H			**26**						
				2000						
Left	**V**			**26**						

Settings		Measurements prior to disturbance (reference)		Test		Results				
Location	Antenna polarization	n = 10 readings per position	Mean	Frequency (MHz)	Moisture measurement n = 10 per frequency	Diff (Measured moisture – mean ref moisture)	If diff ≤ error shift limit Pass	If diff > error shift limit Fail	Sig fault detected & acted upon	Comments
				2000						
	H			26						
				2000						
Right	V			26						
				2000						
	H			26						
				2000						
Rear	V			26						
				2000						

Settings		Measurements prior to disturbance (reference)		Test		Results				
Location	Antenna polarization	n = 10 readings per position	Mean	Frequency (MHz)	Moisture measurement n = 10 per frequency	Diff (Measured moisture – mean ref moisture)	If diff ≤ error shift limit Pass	If diff > error shift limit Fail	Sig fault detected & acted upon	Comments
	H			26						
				2000						

13.17 Conducted, radio-frequency fields

Observer	
Instrument 1 ID	
Instrument 2 ID	
Sample ID	

	At start	At end	
Temp:			**ºC**
RH			**%**
Date and time			**mm / dd / yr hh / mm /ss**

Note other details about the test

Error shift limit (see R 59-1, Table 4.4.1, column 3)	

Settings	**Measurements prior to disturbance (reference)**		**Test**		**Results**				
Name of cable or interference	**n = 10 readings**	**Mean**	**Frequency (MHz)**	**Moisture measurement n = 10 per frequency**	**Diff (Measured moisture – mean ref moisture)**	**If diff ≤ error shift limit Pass**	**If diff > error shift limit Fail**	**Sig fault detected & acted upon**	**Comments**
			0.15						
			80*						
			0.15						

Settings	Measurements prior to disturbance (reference)		Test		Results				
Name of cable or interference	n = 10 readings	Mean	Frequency (MHz)	Moisture measurement n = 10 per frequency	Diff (Measured moisture – mean ref moisture)	If diff ≤ error shift limit Pass	If diff > error shift limit Fail	Sig fault detected & acted upon	Comments
			80*						
			0.15						
			80*						
			0.15						

Settings	Measurements prior to disturbance (reference)		Test		Results				
Name of cable or interference	n = 10 readings	Mean	Frequency (MHz)	Moisture measurement n = 10 per frequency	Diff (Measured moisture – mean ref moisture)	If diff ≤ error shift limit Pass	If diff > error shift limit Fail	Sig fault detected & acted upon	Comments
			80*						

*** Testing up to 26 MHz is permitted. Refer to R 59-2, A.4.4**

13.18 Electrostatic discharge

13.18.1 Direct application

Observer	
Instrument 1 ID	
Instrument 2 ID	
Sample ID	

	At start	**At end**	
Temp:			**ºC**
RH			**%**
Date and time			**mm / dd / yr hh / mm /ss**

Contact discharge (Y or N)
Paint penetration (Y or N)
Air discharge (Y or N)

Error shift limit (see R 59-1, Table 4.4.1, column 3)	

Note other details about the test

Settings		**Measurements prior to disturbance (reference)**		**Test**	**Results**				
Test V (kV)	**Polarity**	**n = 10 readings per position**	**Mean**	**Moisture measurement n = 10 per polarity and test V**	**Diff (Measured moisture – mean ref moisture)**	**If diff ≤ error shift limit Pass**	**If diff > error shift limit Fail**	**Sig fault detected & acted upon**	**Comments**
2	+								
	–								

Settings		Measurements prior to disturbance (reference)		Test	Results				
Test V (kV)	Polarity	n = 10 readings per position	Mean	Moisture measurement n = 10 per polarity and test V	Diff (Measured moisture – mean ref moisture)	If diff ≤ error shift limit Pass	If diff > error shift limit Fail	Sig fault detected & acted upon	Comments
4	+								
	–								
6	+								
	–								

Settings		Measurements prior to disturbance (reference)		Test	Results				
Test V (kV)	Polarity	n = 10 readings per position	Mean	Moisture measurement n = 10 per polarity and test V	Diff (Measured moisture – mean ref moisture)	If diff ≤ error shift limit Pass	If diff > error shift limit Fail	Sig fault detected & acted upon	Comments
8	+								
	–								

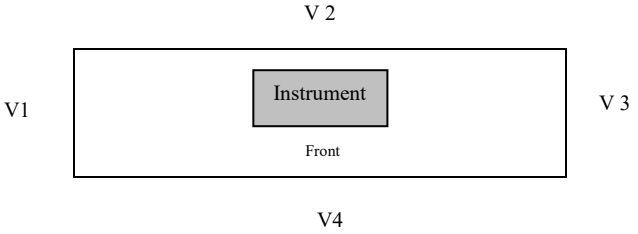
13.18.2 Indirect application

Observer			
Instrument 1 ID			
Instrument 2 ID			
Sample ID			
	At start	**At end**	
Temp:			**ºC**
RH			**%**
Date and time			**mm / dd / yr hh / mm /ss**

V = Vertical H = horizontal

Refer to diagram for vertical coupling plane positions

Error shift limit (see R 59-1, Table 4.4.1, column 3)	



Settings		**Measurements prior to disturbance (reference)**		**Test**	**Results**				
Coupling plane position	**Test V (kV)**	**n = 10 readings per test V**	**Mean**	**Moisture measurements n = 10 per Test V**	**Diff (Measured moisture – mean ref moisture)**	**If diff ≤ error shift limit Pass**	**If diff > error shift limit Fail**	**Sig fault detected & acted upon**	**Comments**
H	**2**								
	4								
	6								

Settings		Measurements prior to disturbance (reference)		Test	Results				
Coupling plane position	Test V (kV)	n = 10 readings per test V	Mean	Moisture measurements n = 10 per Test V	Diff (Measured moisture – mean ref moisture)	If diff ≤ error shift limit Pass	If diff > error shift limit Fail	Sig fault detected & acted upon	Comments
V1	2								
	4								
	6								
V2	2								
	4								
	6								

Settings		Measurements prior to disturbance (reference)		Test	Results				
Coupling plane position	Test V (kV)	n = 10 readings per test V	Mean	Moisture measurements n = 10 per Test V	Diff (Measured moisture – mean ref moisture)	If diff ≤ error shift limit Pass	If diff > error shift limit Fail	Sig fault detected & acted upon	Comments
V3	2								
	4								
	6								
V4	2								
	4								
	6								

Summary of type evaluation test results

Application number: _____

Type designation: _____

Clause R 59-2 Annex A	Tests	Report page	PASSED	FAILED	Remarks
A.1.2	Accuracy				
A.1.3	Repeatability				
A.1.4	Reproducibility				
A.2	Basic instrument test - influence factors				
A.2.2	Instrument stability				
A.2.3	Instrument warm-up time				
A.2.4	Instrument power supply				
A.2.4.1	Main voltage variation				
A.2.4.2	Low voltage of internal battery (not connected to the mains power)				
A.2.5	Instrument storage temperature				
A.2.6	Instrument leveling				
A.2.6.1	Instruments without level indicator				
A.2.6.2	Instruments with level indicator				
A.2.7	Humidity				
A.2.8	Instrument temperature sensitivity				
A.3	Sample temperature sensitivity				
A.4	Disturbance test for electronic instruments				
A.4.1	AC mains voltage dips, short interruptions and voltage variations				
A.4.2	Bursts (Transients) on AC mains voltage supply				
A.4.3	Radiated, radiofrequency, electromagnetic susceptibility				
A.4.4	Conducted radio frequency fields				
A.4.5	Electrostatic discharges				

Technical requirements checklist				
Clause R 59-1	**Technical requirement**	**Passed**	**failed**	**Comments**
5.1	Grains and minimum moisture ranges			
5.2	Selection of grain on the instrument			
5.3	Minimum sample size			
5.4	Determination of quantity and temperature			
5.5	Instrument warm-up period			
5.6	Digital display and recording elements			
5.7	Data storage			
5.8	External data storage			
5.9	Meter construction			
5.10	Marking			
5.11	Ambient temperature operating ranges			
5.12	Provision for sealing and calibration security			
5.13	Manufacturer’s manual			
5.14	Visibility of moisture meter and of measurement operations			
5.15	Power supply			
5.16	Battery operated instruments			
5.17	Level indicating means			
5.18	Software controlled electronic devices and security			