

FINAL DRAFT
RECOMMENDATION

51st CIML Meeting

Strasbourg 2016

**SUBMITTED
FOR CIML
APPROVAL**

Revision of R 59:

Moisture meters for cereal grain and oilseeds

Part 3: Test report format
(Clean)



ORGANISATION INTERNATIONALE
DE MÉTROLOGIE LÉGALE

INTERNATIONAL ORGANIZATION
OF LEGAL METROLOGY

Contents

Foreword	4
Introduction	5
Moisture meters for cereal grain and oilseeds	6
Part 3: Test report format	6
1 Introduction	6
2 Applicability of this report format	6
3 Guidance for the application of this test report format	7
4 Applicant information, responsible authority and other testing laboratories	7
5 General information concerning the type	8
6 Features	8
6.1 Display, controls and recording element	8
6.2 Other features	9
7 Temperature ranges	9
8 Moisture increment, character height, level indicator, sample size and warm-up	9
9 Power	10
10 Remote communication and method of sealing	10
11 Grain types and moisture ranges for which the instrument will be approved	11
12 Reference method	12
13 Test report	13
13.1 Power supply	13
13.2 Storage temperature	15
13.3 Instrument leveling (instruments without a level)	17
13.4 Instrument leveling (instruments with a level indicator)	19
13.5 Instrument warm-up	21
13.6 Humidity	23
13.7 Humidity	25
13.8 Instrument stability	27
13.9 Instrument temperature sensitivity	29
13.10 Sample temperature sensitivity (page 1 of 2)	30
13.11 Accuracy test	34
13.12 Repeatability	36
13.13 Reproducibility	38
13.14 Bursts (transients) on AC mains voltage supply	42
13.15 Radiated, radio-frequency, electromagnetic fields	44
13.16 Conducted, radio-frequency fields	47
13.17 Electrostatic discharge	50

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 20xx - was developed by Project Group 1 in Technical Subcommittee **TC 17/SC 1**. It was approved for final publication by the International Committee of Legal Metrology in **201x** and will be submitted to the International Conference of Legal Metrology in **201y** 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:

Bureau International de Métrologie Légale
11, rue Turgot - 75009 Paris – France
Telephone: 33 (0)1 48 78 12 82
Fax: 33 (0)1 42 82 17 27
E-mail: biml@oiml.org
Internet: www.oiml.org

Introduction

¹Moisture 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.

¹If 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.

¹Many 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 200X 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 59:201x 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 59-2:201x, 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 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 59-2, Annex A. They can be replaced by a cover page by the Issuing Authority and/or in accordance with national custom or legislation. So only R 59-2, A.4 to A.13.17.2 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 Certificate 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 (see Section 10 below):

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 °C ± 2 °C
	Grain	22 °C ± 2 °C
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									

(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 °C ± 2 °C
	Grain	22 °C ± 2 °C
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 °C ± 2 °C
	Grain	22 °C ± 2 °C
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 0.1°
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							

(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 °C ± 2 °C
	Grain	22 °C ± 2 °C
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 0.1°
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							

(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 °C ± 2 °C
	Grain	22 °C ± 2 °C
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 manufacturer’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 manufacturer’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 °C ± 2 °C
	Grain	22 °C ± 2 °C
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 °C ± 2 °C
	Grain	22 °C ± 2 °C
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 °C ± 2 °C	
	Grain	22 °C ± 2 °C	
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 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 °C ± 2 °C, ± Manufacturer specified low and high operating limits
	Grain	22 °C ± 2 °C ± 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 °C msmts	Cold 22 °C - Δt grain and instrument msmts	Hot 22 °C + Δt grain and instrument msmts	Results								
						Avg values at 22 °C, 22°C - Δt, 22°C + 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 °C	22 °C – Δt	22 °C + Δt						
			2	2	2									
			3	3	3									
		12–14 %	1	1	1	22 °C	22 °C – Δt	22 °C + Δt						
			2	2	2									
			3	3	3									
		14–16 %	1	1	1	22 °C	22 °C – Δt	22 °C + Δt						
			2	2	2									
			3	3	3									
Instrument 2	HRW Whet	10–12 %	1	1	1	22 °C	22 °C – Δt	22 °C + Δt						
			2	2	2									
			3	3	3									
		12–14 %	1	1	1	22 °C	22 °C – Δt	22 °C + Δt						
			2	2	2									
			3	3	3									
		14-16 %	1	1	1	22 °C	22 °C – Δt	22 °C + 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: _____

13.10 Sample temperature sensitivity (page 1 of 2)

Equipment needed		Thermometers, environmental cabinet
Temperature	Instruments	22 °C ± 2 °C
	Grain	22 °C ± 2 °C ± 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 °C msmts		Cold 22 °C - Δt grain msmts		Hot 22 °C + Δt grain msmts		Results					
			Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2	Mean values of all 6 % at 22 °C, 22 °C - Δt, 22 °C + 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 °C						
			2	2	2	2	2	2	22 °C – Δt						
			3	3	3	3	3	3							
		12-14 %	1	1	1	1	1	1							
			2	2	2	2	2	2							
			3	3	3	3	3	3							
		14-16 %	1	1	1	1	1	1	22 °C + Δt						
			2	2	2	2	2	2							
			3	3	3	3	3	3							
	Soybeans	10-12 %	1	1	1	1	1	1	22 °C						
			2	2	2	2	2	2	22 °C – Δt						
			3	3	3	3	3	3							
		12-14 %	1	1	1	1	1	1							
			2	2	2	2	2	2							
			3	3	3	3	3	3							
		14-16 %	1	1	1	1	1	1	22 °C + Δt						
			2	2	2	2	2	2							
			3	3	3	3	3	3							
	Corn	12-14 %	1	1	1	1	1	1	22 °C						
			2	2	2	2	2	2	22 °C – Δt						
			3	3	3	3	3	3							
		14-16 %	1	1	1	1	1	1							
			2	2	2	2	2	2							
			3	3	3	3	3	3							
		16-18 %	1	1	1	1	1	1	22 °C + Δt						
			2	2	2	2	2	2							
			3	3	3	3	3	3							

13.10 Sample temperature sensitivity (Page 2 of 2)

Instrument ID	* Grain Type	* 6 % moistur e range	At room temp grain 22 °C msmts		Cold 22 °C – Δt grain msmts		Hot 22 °C + Δt grain msmts		Results					
			Sample 1	Sampl e 2	Sample 1	Sample 2	Sample 1	Sample 2	Mean values of all 6 % at 22 °C, 22 °C - Δt, 22 °C + 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 °C					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
		12-14 %	1	1	1	1	1	1	22 °C – Δt					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
		14-16 %	1	1	1	1	1	1	22 °C + Δt					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
	Soybeans	10-12 %	1	1	1	1	1	1	22 °C					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
		12-14 %	1	1	1	1	1	1	22 °C – Δt					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
		14-16 %	1	1	1	1	1	1	22 °C + Δt					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
	Corn	12-14 %	1	1	1	1	1	1	22 °C					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
		14-16 %	1	1	1	1	1	1	22 °C – Δt					
			2	2	2	2	2	2						
			3	3	3	3	3	3						
		16-18 %	1	1	1	1	1	1	22 °C + 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: _____

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.

$$\bar{y} = \frac{\sum_{i=1}^n (\bar{x}_i - r_i)}{n}$$

$$SDD = \sqrt{\frac{\sum_{i=1}^n (y_i - \bar{y})^2}{n-1}}$$

Additional comments: _____

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.

$$SD = \sqrt{\frac{\sum_{i=1}^n \sum_{j=1}^3 (x_{ij} - \bar{x}_i)^2}{2n}}$$

Additional comments: _____

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.

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

Additional comments: _____

13.14 AC

mains voltage dips and short interruptions

Observer	
Instrument 1 ID	
Instrument 2 ID	
Sample ID	

Temp:
RH
Date and time

At start	At end	
		°C
		%
		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	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
	New V	% reduction						
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	

Temp:
RH
Date and time

At start	At end	
		°C
		%
		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				
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					
L ↓ G									
N ↓ G									

PE ↓ G									

13.16 Radiated, radio-frequency, electromagnetic fields

Observer	
Instrument 1 ID	
Instrument 2 ID	
Sample ID	

	At start	At end	
Temp:			°C
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			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	n = 10 readings per position	Mean	26						
				2000						
	H			26						
				2000						
Left	V			26						

				2000						
	H			26						
Right	V			26						
				2000						
	H			26						
				2000						
Rear	V			26						
				2000						
	H			26						
				2000						

				2000						

			80*						
			0.15						
			80*						
			0.15						
			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	

Temp:
RH
Date and time

At start	At end	
		°C
		%
		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			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	+	n = 10 readings per position	Mean						
	–								

4	+								
	-								
6	+								
	-								
8	+								

	-								

13.18.2 Indirect application

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

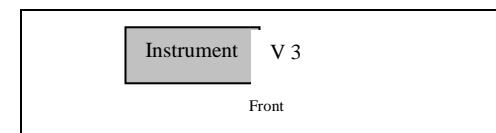
V = Vertical H = horizontal

Refer to diagram for vertical coupling plane positions

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

V1

V 2



V4

Settings		Measurements prior to disturbance (reference)		Test	Results				
Coupling plane position	Test V (kV)			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
		n = 10 readings per test V	Mean						
H	2								
	4								

[illegible]

	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			