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INTERNATIONAL ORGANIZATION OF LEGAL METROLOGY

First Committee Draft of a Recommendation on

Protein Measuring Instruments for Cereal Grain and Oil Seeds

OIML TC17/SC8 Secretariat: Australia

Participating Nations:

Australia, Brazil, Canada, Czech Republic,
Germany, Japan, New Zealand, Poland, Republic of Korea,
Russia, Sweden, United States of America

Observing Nations:

Serbia and Montenegro, Slovakia

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Foreword

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This publication - reference OIML R XX - was developed by the OIML Technical Subcommittee TC 17/SC8 *Instruments for quality analysis of agricultural products*.

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1 Scope

This Recommendation specifies the metrological and technical requirements, test methods and maximum permissible errors for metrological control of measuring instruments used to determine the protein content of grain and oilseeds for commercial transactions.

2 Terminology

This section includes terms applicable to protein measuring instruments and some general terms included in the International Vocabulary of Basic and General Terms in Metrology (VIM, 1993).

2.1 Adjustment

Operation of bringing a measuring instrument into a state of performance suitable for its use (VIM, 4.30).

2.2 Certified Measuring Instrument

A measuring instrument tested and certified under national legislation.

2.3 Certified Reference Material

A sample whose property value (in this context, protein content) has been certified under national legislation.

2.4 Error of Indication

The indication of a measuring instrument minus the (conventional) true value of the measurand (VIM, 5.20).

2.5 Fault

The difference between the error of measurement and the intrinsic error of the measuring instrument.

Note: Principally a fault is the result of an undesired change of data contained in, or flowing through, an electronic measuring instrument.

2.6 Grain

For the purpose of this document, the term grain is taken to mean wheat, barley, rice, and corn.

2.7 Indicator

A device that displays the measured protein concentration.

2.8 Influence Quantity

A quantity that is not the measurand but that affects the result of the measurement (VIM, 2.7).

2.9 Influence Factor

An influence quantity having a value within the rated operating conditions of the measuring instrument, specified in this document.

2.10 Disturbance

An influence quantity having a value within the limits specified in this document, but outside the specified rated operating conditions of the measuring instrument.

Note: An influence quantity is a disturbance if for that influence quantity the rated operating conditions are not specified.

2.11 Initial Intrinsic Error

The intrinsic error of a measuring instrument as determined prior to performance tests.

2.12 Intrinsic Error

The error of a measuring instrument determined under reference conditions (VIM, 5.24).

2.13 Maximum Permissible Error

The extreme values (positive and negative) of the error of measurement permitted by regulation. The absolute value of the maximum permissible error is the same value without sign (VIM, 5.21).

2.14 Measuring Device

A device that makes each individual measurement of protein concentration.

2.15 Networked Instrument

An instrument that is linked, either electronically or manually under a quality system, to a certified measuring instrument and/or a whole grain certified reference material and/or the reference method of Annex A so that its performance may be monitored on a daily basis or according to a schedule set by the quality system administrator.

2.16 Oil Seeds

For the purpose of this document, the term oil seeds is taken to mean soya bean.

2.17 Protein Content

The concentration of protein in a sample expressed as a percentage by mass.

2.18 Protein Measuring Instrument

An instrument that determines the concentration of protein in a sample of grain.

2.19 Rated Operating Conditions

Conditions of use (giving the range of values of influence quantities) for which the metrological characteristics of a measuring instrument are intended to lie within the specified maximum permissible errors (VIM, 5.5).

2.20 Reference Conditions

Conditions of use prescribed for testing the performance of a measuring instrument or for comparison of results of measurements (VIM, 5.7).

2.21 Significant Fault

A fault greater than the absolute value of the maximum permissible error for the quantity delivered.

The following faults are not considered to be significant, even when they exceed the value defined above:

(a) faults implying the impossibility to perform any measurement; and

(b) faults giving rise to variations in the measurement result so serious that they are bound to be noticed by all those interested in the result of the measurement.

2.22 Test

A series of operations intended to verify the compliance of the equipment under test with certain requirements.

2.23 Test Procedure

A detailed description of the tests.

2.24 Test Program

A description of a series of tests for certain type of equipment.

2.25 Performance Test

A test intended to verify whether the equipment under test is able to accomplish its intended functions.

3 Description of category of instrument

(to be inserted if necessary)

4 Units of Measurement

The unit of measurement used for protein concentration is percentage protein by mass. The protein concentration (P) must be converted to a reference moisture concentration, according to the formula:

$$P = P_m * (100-M_{ref})/(100-m)$$

where Pm is the measured protein concentration at a moisture concentration of m% and M_{ref} is the reference moisture concentration. The reference moisture concentration Mref and the method used to determine this value is to be decided and published by the national authority.

5 Metrological Requirements

5.1 Reference Conditions

For reference conditions see clause B.2.

5.2 Maximum Permissible Errors

The national authority should specify the reference method used and ensure that the wholegrain reference material used to determine the performance of instruments is adequate for this purpose.

Table 1. Maximum Permissible Errors

Grain type	MPE (type approval)	MPE (repeatability)	MPE (in-field)
wheat	± 0.3%	± 0.15%	± 0.4%
Barley	± 0.4%	± 0.2%	± 0.5%
Rice	± 0.5%	± 0.25%	± 0.5%
Corn	± 0.5%	± 0.25%	± 0.8%
Soya bean	± 0.55%	± 0.3%	± 0.8%

These maximum permissible errors apply to all instruments irrespective of their principles of operation.

5.3 Rated Operating Conditions for Influence Factors

Instruments shall be designed and manufactured so that all functions continue to operate as designed and that they do not exceed the maximum permissible errors when tested over the following ranges of influence factors:

- mains power voltage variations: −15% to +10% of nominal voltage; and
- minimum air temperature variations: 10°C to 30°C. For in-field use, the temperature range is to be specified by the national authority.

A battery-operated instrument shall either continue to function correctly, or not provide a measurement, when the voltage is below the battery manufacturer's specified nominal voltage.

5.4 Sample grain temperature

The instrument must operate within the maximum permissible errors specified above for grain at temperatures from 0°C to 60°C.

5.5 Humidity

Instruments shall be designed and manufactured so that all functions continue to operate as designed and that they do not exceed the maximum permissible errors when subjected to a damp heat, steady state test as described in clause B.3.3.

5.6 Disturbances

Instruments shall be designed and manufactured such that when exposed to the disturbances listed in Annex B, the following apply:

(a) all functions continue to operate as designed and significant faults do not occur, that is the difference in the measured quantity without the disturbance applied and with the disturbance applied shall not exceed the absolute value of the maximum permissible error; or

(b) significant faults are detected and the instrument made inoperative automatically or a visual or audible indication is provided automatically and shall continue until such time as the user takes action or the fault disappears.

The choice whether (a) or (b) is applied is left to the manufacturer.

5.7 Level indicating means

Analysers shall be equipped with a level indicator and levelling adjustments if its performance is changed by an amount greater than the tolerance requirement when the instrument is moved from a level position into a position that is out of level in any upright direction by up to 5% (approximately 3 degrees). The level-indicating means shall be readable without removing any instrument parts requiring a tool.

5.8 Tests

A pattern of an instrument is presumed to comply with the requirements of this section if it has passed the examination and tests specified in Annex B.

6 Technical Requirements

6.1 Suitability

6.1.1 Suitability for Purpose

An instrument shall be designed to be suitable for the purpose for which it is intended to be used and shall be constructed to be suitable for service in normal conditions of use.

6.1.2 Suitability for Verification

An instrument shall be designed to enable the performance requirements of these rules to be applied.

6.2 Operational Safeguards

6.2.1 Fraudulent Use

Instruments shall not facilitate fraudulent use by either accidental means or by deliberate means when using the instrument in the normal manner.

6.2.2 Operational Controls

Stand alone and networked instruments shall be subject to verification and reverification as described in clause 7.2.

6.2.3 Operational Adjustment

Networked instruments that are subject to a quality control system may be adjusted within the range of the maximum permissible error to improve the accuracy of the instrument in accordance with the procedures of the document referenced in clause 7.2.3. An audit trail of such adjustments must be available for inspection by the relevant trade measurement authorities.

6.3 Marking

6.3.1 Information to be marked

Instruments shall be clearly and permanently marked with the following:

(a) manufacturer's name or mark;

(b) model designation;

(c) serial number; and

(d) approval marking of the national authority.

6.3.2 Location of Markings

Markings shall be grouped together in a clearly visible location, either on a permanently attached nameplate or on part of the instrument.

6.3.3 Style of Markings

The letters and numbers shall be marked in a font whose capitals are not less than 2 mm high.

Numbers and symbols of units shall be presented in accordance with *ISO 1000-1998. The International System of Units (SI) and its Application*.

6.4 Verification/Certification Marks and Sealing

6.4.1 General

Provision shall be made for the application of a verification/certification mark and for sealing of any adjustment device or control device that could affect the measurement.

Sealing may be by password or other means acceptable to the national authority.

6.4.2 Position

A verification/certification mark shall be easily accessible and situated such that:

(a) the part on which it is located cannot be removed from the instrument without damaging the mark;

(b) it can be easily affixed without affecting the metrological properties of the instrument; and

(c) it is visible without moving the instrument when it is in use.

6.4.3 Mounting

The area provided for the verification/ certification mark shall be at least 200 mm^2, with an aspect ratio of not more than 2:1.

6.4.4 Electronic Sealing

If the adjustment or control of any function that affects the measurement is provided by electronic means (e.g. computer software) the following shall apply:

(a) access by authorised persons shall be protected by some form of physical key, a password or access code (e.g. a four digit code);

(b) access to alter protected parameters shall be automatically recorded (e.g. by means of an audit trail);

(c) the audit record shall be readily accessible;

(d) the audit record shall be readily identifiable as such and shall not be easily confused with other indications of the instrument; and

(e) the audit record shall also be stored, where practicable, in a separate location.

7 Metrological Controls

7.1 Type approval

7.1.1 Application

General application requirements are available from national authorities. The application for type approval shall be accompanied by:

(a) at least one sample instrument representative of the submitted pattern; and

(b) descriptive documents and drawings.

7.1.2 Descriptive documentation

Descriptive documents shall include:

(a) drawings of the general arrangement and details of metrological interest including details of any interlocks, safeguards, auxiliary devices etc;

(b) a short functional description of the instrument;

(c) a short technical description including, if necessary, schematic diagrams of the method of operation; and

(d) a list of grain types for which approval is required.

(e) the operating conditions for which approval is required.

7.1.3 Sample instrument

The sample instrument shall be in full working order and shall include all functions to be examined for pattern approval.

Note: If the measuring instrument is part of a system that includes other than metrological functions, only that part which controls the metrological functions may be submitted for evaluation.

7.1.4 Type evaluation

The submitted documents shall be examined to verify compliance of the instrument type with the requirements of this recommendation. The instrument shall be tested in accordance with these requirements and the test procedures of Annex B. If testing of a complete instrument is not possible, such as an in-line grain testing instrument, tests may, as agreed by the national authority and the applicant, be performed on a simulated set-up or on modules or main devices separately.

7.2 Verification

7.2.1 Measurement standards

National authorities may provide access for verifying authorities and instrument owners to whole grain certified reference materials for verification purposes. Each such reference material would normally be based on repeated measurements of a bulk sample of grain on an ensemble of reference instruments according to Annex A and using the measurement campaign approach of ISO Guide 35. The measurement campaign should be such that the uncertainty for the reference materials, calculated with a coverage factor of two, should be appropriate for verification.

7.2.2 Stand-alone instruments

Where stand-alone instrument are used for trade they shall be verified individually using grain samples approved by the national authority for that purpose.

Instruments shall be adjusted to within the verification maximum permissible error and as close to zero error as practicable across the protein concentration range.

National authorities may determine the frequency and other requirements for stand-alone instruments. In particular, national authorities may determine the minimum numbers of instruments linked to a reference laboratory that constitutes a network for the purpose of section 8.2.3.

7.2.3 Networked instruments

Networked instruments shall be the subject of verification procedures specified by national authorities. The national authorities may audit the collected data from instrument monitoring that forms part of the quality system for the network in lieu of traditional verification.

7.3 Instrument Monitoring

The national authority shall determine the instrument monitoring process and the action points required when instrument failures are detected.

For example, when receiving grain using networked receival instruments, the instruments may be monitored in alternative ways. Either grain samples may be returned to the reference laboratory of the network for analysis, or the receival instrument may measure, on a daily basis, at least three wholegrain reference materials covering the range of protein concentration and the results returned to the reference laboratory. In the former case, the following number of samples per day may be retained and sealed for subsequent analysis by the reference laboratory:

(a)	up to 5 000 t/day	one
(b)	5 000 t/day to 10 000 t/day	two
(c)	10 000 t/day and above	three

Information obtained in this way may be used to justify operational adjustments under national law.

8 Test Method and Model Test Report

8.1 Instrument Tests

All instruments shall be tested to ensure that they perform within maximum permissible errors (see paragraph 5.2) and for the effect of influence factors. Annex B specifies the performance tests. Samples of grain having at least three protein concentrations (high, medium and low) and at least two moisture contents for each protein concentration (with a ‘separation’ of at least 3% between the two values) shall be used for approval testing.

Instruments should also be tested with grain samples at minimum and maximum grain sample temperatures (see 5.4).

10.2 Repeatability

Measurements of the above samples of grain shall be repeated five times under reference conditions. For each sample the difference between the highest and lowest determination of protein concentration shall not exceed half of the absolute value of the maximum permissible error.

9 Practical Instructions

9.1 Sampling

Sampling from trucks shall be as described in Annex C. For sampling procedures from other sources e.g. bagged product, rail wagons, barges, etc. refer to the relevant ISO documents.

Annex A

(Informative)

Reference Method

A. Dumas Combustion — Total Nitrogen Determination

Refer to AACC Method 46-30

Note: Dumas (combustion) nitrogen values may be greater than corresponding Kjeldahl values, particularly at higher nitrogen levels.

B. Improved Kjeldahl Method — Total Nitrogen Determination

Refer to AACC Method 46-10

Annex B

PERFORMANCE TESTS

(Mandatory)

B.1 General

This annex defines the program of performance tests intended to ensure that electronic protein measuring instruments perform and function as intended in a specified environment and under specified conditions. Each test indicates, where appropriate, the reference conditions under which the intrinsic error is determined.

When the effect of one influence quantity or disturbance is being evaluated, all other influence quantities and disturbances are to be held relatively constant, at values close to reference conditions.

The instrument shall be stabilised according to the manufacturer's specifications. If the manufacturer does not recommend a warm-up time, assume that accurate results will be provided immediately after the instrument is turned on.

B.2 Reference Conditions

Ambient temperature: 22°C ± 5°C
Relative humidity: 60% ± 10%
Atmospheric pressure: 86 kPa to 106 kPa
Power voltage: nominal voltage, V_{nom}
Power frequency: nominal frequency, F_{nom}
During each test the temperature and relative humidity shall not vary by more than 5°C and 10% respectively within the reference ranges.

B.3 Performance Tests

The following performance tests can be carried out in any order:
(a) dry heat (influence factor) — see clause B.3.1;
(b) cold (influence factor) — see clause B.3.2;
(c) damp heat, steady state (influence factor) — see clause B.3.3;
(d) power voltage variation (influence factor) — see clause B.3.4;
(e) short time power reductions (disturbance) — see clause B.3.5;
(f) bursts (disturbance) — see clause B.3.6;
(g) electrostatic discharge (disturbance) — see clause B.3.7;
(h) electromagnetic susceptibility (disturbance) — see clause B.3.8; and
(i) disturbances on d.c. voltage powered equipment — see clause B.3.9.
(j) accuracy, precision and reproducibility requirements – see clause B.3.10
(k) sample temperature sensitivity – see clause B.3.11
(l) dust ingress – see clause B.3.12
(m) vibration and mechanical shock - see clause B.3.13

B.3.1 Dry Heat (non-condensing)

Object of the Test

To verify compliance with the general requirements for electronic measuring instruments under conditions of high temperature.

References

IEC 60068-2-2 (1974). Background information concerning dry heat tests is given in IEC 60068-3-1 (1974) and first supplement IEC 60068-3-1A (1978). General background information on basic environmental testing procedures is given in IEC 60068-1 (1988), which is equivalent to AS 1099.1-1989.

Test Procedure in Brief

The test consists of exposure of the EUT to a temperature of 40°C under 'free air' conditions for a 2 h period after the equipment under test has reached temperature stability.

The change of temperature shall not exceed 1 °/min during heating up and cooling down. The equipment under test shall be tested for at least 10 measurements:

(a) at the reference temperature of 20°C following conditioning;
(b) at the temperature of 40°C, 2 h after temperature stabilisation; and
(c) after recovery of the equipment under test at the reference temperature of 20°C.

Test Severities

Temperature: 40°C
Duration: 2 h

Number of Test Cycles

One cycle.

Maximum Allowable Variations

All operational functions shall operate as designed (e.g. indicators).

All errors shall be within the maximum permissible errors.

[Refer to B.3.3 for the Instrument Temperature Sensitivity test and the sample temperature sensitivity test]

B.3.2 Cold

Object of the Test

To verify compliance with the general requirements for electronic measuring instruments under conditions of low temperature.

References

IEC 60068-2-1 (1990). Background information concerning cold tests is given in IEC 60068-3-1 (1974) and first supplement IEC 60068-3-1A (1978). General background information on basic environmental testing procedures is given in IEC 60068-1 (1988) which is equivalent to AS 1099.1–1989.

Test Procedure in Brief

The test consists of exposure of the EUT to a temperature of 5°C under 'free air' conditions for a 2 h period after the equipment under test has reached temperature stability.

The change of temperature shall not exceed 1 °C/min during heating up and cooling down.
IEC specifies that the power to the EUT shall be switched off before the temperature is raised.

The equipment under test shall be tested for at least 10 measurements:

(a) at the reference temperature of 20°C following conditioning;
(b) at the temperature of 5°C, 2 h after temperature stabilisation; and
(c) after recovery of the equipment under test at the reference temperature of 20°C.

Test Severities

Temperature: 10°C
Duration: 2 h

Number of Test Cycles

One cycle.

Maximum Allowable Variations

All operational functions shall operate as designed (e.g. indicators).

All errors shall be within the maximum permissible errors.

[Refer to B.3.11 for the sample temperature sensitivity test.]

B.3.3 Damp Heat, Steady State Object of the Test

To verify compliance with the general requirements for electronic measuring instrument under conditions of high humidity and constant temperature.
The steady-state test should always be used where adsorption or absorption play the main part. When diffusion but not breathing is involved, either the steady-state or the cyclic test shall be prescribed depending on the type of EUT and its application.

References

IEC 60068-2- 78 (2001) which is equivalent to AS 1099.2.3-1990. Background information is given in IEC 60068-3-4 (2001).

Test Procedure in Brief

The test consists of exposure to the specified high temperature and the specified relative humidity for a period of two days. The handling of the EUT shall be such that

no condensation of water occurs on the equipment.

The power supply is on when the influence factor is applied. The equipment under test shall be tested for at least 10 measurements before and after the application of the damp heat and at the specified damp heat after two days at these conditions.

Test Severities

Upper temperature: 30°C
Humidity: 85%
Duration: two days

Number of Test Cycles

One cycle.

Maximum Allowable Variations

All operational functions shall operate as designed (e.g. indicators).

All errors shall be within the maximum permissible errors.

B.3.4 Power Voltage Variation

Test Method

Variation in a.c. mains power supply (single phase).

Object of the Test

To verify compliance with the provisions in clause 5.3 under conditions of varying a.c. mains power supply.

References

IEC.TR3 61000-2-1, IEC 61000-4-1

Test Procedure in Brief

The test consists of exposure of the EUT to the specified power condition for a period sufficient for achieving temperature stability and for performing the required measurements. voltage variations, while the equipment under test is operating under normal atmospheric conditions.

Test Severities

Mains voltage:

- upper limit: V_{nom} + 10%
- lower limit: V_{nom} − 15%

Number of Test Cycles

One cycle.

Maximum Allowable Variations

All operational functions shall operate as designed (e.g. indicators).

All errors shall be within the maximum permissible errors.

B.3.5 Short Time Power Reduction

Test Method

Short time interruptions and reductions in mains voltage.

Object of the Test

To verify compliance with the provisions in clause 5.5 under conditions of short time mains voltage interruptions and reductions.

References

No reference to an international standard can be given at the present time.

Test Procedure in Brief

The test consists of subjecting the equipment under test to voltage interruptions from nominal voltage to zero voltage for a duration equal to half a cycle of line frequency, and from nominal voltage to 50% of nominal for a duration equal to one cycle of line frequency. The mains voltage interruptions and reductions shall be repeated with a time interval less than the time required for a single measurement so that at least one voltage interruption occurs per delivery.

Test Severities

100% voltage interruption for a period equal to half a cycle.

50% voltage reduction for a period equal to one cycle.

Number of Tests

At least 10 deliveries shall be made with the voltage interruptions applied.

Maximum Allowable Variations

All operational functions shall operate as designed (e.g. indicators).

The effect of the disturbance shall not exceed the significant fault or the instrument shall detect and react to the fault (see clause 6.4).

B.3.6 Bursts

Test Method

Electrical bursts.

Object of the Test

To verify compliance with the general requirements for electronic measuring instruments under conditions where electrical bursts are superimposed on the mains voltage.

Reference

IEC 61000-4-1 (2000) IEC 61000-4-4 (1995)

Test Procedure in Brief

A burst generator shall be used with the performance characteristics as specified in the reference standard.

The test consists of exposure to bursts of voltage spikes for which the repetition frequency of the impulses and peak values of the output voltage on 50 Ω and 1000 Ω load are defined in the referred standard.

The characteristics of the generator shall be verified before connecting the EUT. Both positive and negative polarity of the bursts shall be applied. The duration of the test shall not be less than 1 minute for each amplitude and polarity. The injection network on the mains shall contain blocking filters to prevent the burst energy being dissipated in the mains.

If the EUT is an integrating instrument, the test pulses shall be continuously applied during the measuring time.

Test Severities

Amplitude (peak value): 1 000 V for residential, commercial and light industrial environment

2 000 V for industrial environment

Number of Test Cycles

At least 10 positive and 10 negative randomly phased bursts shall be applied at 1 000 V.

The burst are applied during all the time necessary to perform a measurement. At least 10 measurements shall be made with the bursts applied.

Maximum Allowable Variations

All operational functions shall operate as designed (e.g. indicators).

The effect of the disturbance shall not exceed the significant fault or the instrument

shall detect and react to the fault (see clause 7.3).

B.3.7 Electrostatic Discharge

Test Method

Electrostatic discharge.

Object of the Test

To verify compliance with the general requirements for electronic measuring instruments under conditions of direct and indirect electrostatic discharges.

Reference

IEC 61000-4-2 (1995)

Test Procedure in Brief

An ESD generator shall be used with a performance as defined in the referred standard.
Before starting the tests, the performance of the generator shall be verified.
At least 10 discharges shall be applied. The time interval between successive disharges shall be at least 10 seconds.

For EUT not equipped with a ground terminal, the EUT shall be fully discharges between discharges.

If the EUT is an integrating instrument, the test pulses shall be continuously applied during the measuring time.

Contact discharge is the preferred test method. Air discharges shall be used where contact discharge cannot be applied.

Direct application:

If the contact discharge mode to be carried out on conductive surfaces, the electrode shall be in contact with the EUT.
In the air discharge mode on insulated surfaces, the electrode is approached to the EUT and the discharge occurs by spark.

Indirect application:

The discharges are applied in the contact mode to coupling planes mounted in the vicinity of the EUT.

Test Severities

8 kV for air discharges and 6 kV for contact discharges.

Number of Test Cycles

At least one direct discharge or one indirect discharge shall be applied during the one measurement. At least 10 deliveries shall be made with the discharges applied.

Maximum Allowable Variations

All operational functions shall operate as designed (e.g. indicators).

The effect of the disturbance shall not exceed the significant fault or the instrument shall detect and react to the fault (see clause 6.4).

B.3.8 Electromagnetic Susceptibility

Test Method

Radiated electromagnetic fields.

Object of the Test

To verify compliance with the provisions in clause 6.4 under conditions of electromagnetic fields.

Reference

IEC 61000-4-3 (2002)

Test Procedure in Brief

The EUT shall be exposed to electromagnetic field strength as specified by the severity level and a field uniformity as defined by the referred standard.

The EM field strength can be generated in different facilities, however the use of which is limited by the dimensions of the EUT and the frequency range of the facility.

The frequency ranges to be considered are swept with the modulated signal, pausing to adjust the RF signal level or to switch oscillators and antennas as necessary. Where the frequency range is swept incrementally, the step size shall not exceed 1% of the preceding frequency value.

The dwell time of the amplitude modulated carrier at each frequency shall not be less than the time necessary for the EUT to be exercised and to respond, but shall in no case be less than 0.5 seconds.

The sensitive frequencies (e.g. clock frequencies) shall be analysed separately.

Test Severities

Frequency range: 26 to 1 000 MHz, IEC 61000-4-3 (1995) only specifies test levels above 80 MHz. For frequencies in the lower range the test methods for conducted radio frequency disturbances are recommended. However for EUT having no mains or other input port available, the lower limit of the radiation test should be 26 MHz taking int account that the test specified in the conducted radio frequency disturbances cannot be applied. In all other cases, both radiated radio frequency fields and conducted radio frequency fields shall apply.
field strength 3 V/m

Modulation: 80% AM, 1 kHz sine wave

Number of Tests

Carry out deliveries throughout the application of the electromagnetic field. The tests will have to be initiated by remote control.

Maximum Allowable Variations

All operational functions shall operate as designed (e.g. indicators).
The effect of the disturbance shall not exceed the significant fault or the instrument shall detect and react to the fault (see clause 7.3).

B.3.9 Disturbances on d.c. Voltage Powered Instruments

Electronic measuring systems supplied with d.c. voltage shall fulfil the tests B.3.1 to B.3.8 with the exception of B.3.4 to B.3.6 which are replaced by the following provisions:

(a) for under-voltages or over-voltages all errors shall be within maximum permissible errors when the instrument is still working; and
(b) the under-voltage or over-voltage is applied for a complete measurement or part of a measurement.

B.3.10 Accuracy, Precision and Reproducibility Requirements

Grain analyzers will be tested for accuracy, repeatability (precision), and reproducibility over the applicable constituent concentration ranges shown in Table B1. Instrument and calibration performance will be individually tested for each grain type and constituent.

Table B1. Constituent Ranges for Type Evaluation

Grain Type	Constituent	Constituent Range (%) at Moisture Basis (M.B.) Shown	Low Moisture Range	High Moisture Range
Durum Wheat	Protein	10 - 18 at 12% M.B.	9% - 12%	13% - 15%
Hard Red Spring Wheat	Protein	10 - 19 at 12% M.B.		
Hard Red Winter Wheat	Protein	8 - 18 at 12% M.B.		
Hard White Wheat	Protein	9 - 16 at 12% M.B.		
Soft Red Winter Wheat	Protein	9 - 12 at 12% M.B.		
Soft White Wheat	Protein	8 - 15 at 12% M.B.		
"All Class" Wheat Calibration	Protein	8 - 19 at 12% M.B.		
Two-rowed Barley	Protein	8 - 17 at 0% M.B.	10% - 12%	13% - 15%
Six-rowed Barley	Protein	8 - 17 at 0% M.B.		
"All Class" Barley Calibration	Protein	8 - 17 at 0% M.B.		
Corn	Protein	8 - 12 at 0% M.B.	11% - 13%	14% - 16%

	Oil	3 - 9 at 0% M.B.		
	Starch	67 - 73 at 0% M.B		
Soybeans	Protein	30 - 40 at 13% M.B.	10% - 12%	13% - 15%
	Oil	16 – 21 at 13% M.B.		

B.3.11 Sample temperature sensitivity

Testing is required to verify that accurate results are provided when the sample and instrument are at different temperatures. This will be referred to as the sample temperature sensitivity test. Tests will be conducted with the instrument at room temperature and the sample temperature varying from room temperature plus ΔT_H to room temperature minus ΔT_C, where ΔT_H is the magnitude of the manufacturer-specified maximum difference for grain above room temperature, and ΔT_C is the magnitude or the manufacturer-specified maximum difference for grain below room temperature. In no case will room temperature plus ΔT_H be allowed to exceed 45 °C, but ΔT_H need not equal ΔT_C. For purposes of these tests, room temperature will be defined as 22 ºC ± 2 ºC

Testing will be conducted using two sample sets from each grain type representing low and high moisture ranges shown in Table B1. Each moisture set will consist of three samples, one from each of three constituent concentration ranges (the upper third, the middle third, and the lower third of the constituent concentration range for the grain type). Separate bias analyses will be made for the low and high moisture sets. When high moisture samples are not available for any constituent concentration range in any grain type, testing may be conducted using tempered (artificially moistened) samples. Three analyses will be made for each sample at room temperature, the hot temperature extreme, and the cold temperature extreme. The average constituent concentration for the 9 observations in each moisture set (1 moisture level x 3 constituent concentration levels x 3 replicates) run at each temperature extreme must agree with the average constituent concentration obtained for the room temperature runs within the applicable tolerances shown in Table 2.

Sample Temperature Sensitivity tests will not be conducted for ground-grain NIR instruments. For whole-grain instruments, sample presentation must be the same as that which will be used in the field. Sealed cells cannot be used for the Sample Temperature Sensitivity tests.

B.3.12 Dust ingress

Table B2

Applicable standards	IEC 60512-11-8 [16], IEC 60529 [18], IEC 60721-2-5 [20]	
Test method	Sand and dust	
Object of the test	To verify compliance with the general requirements for electronic measuring instruments under dust-laden atmosphere	
Test procedure in brief	The test consists of exposure to cyclic temperature variation between 30 °C and 65 °C, maintaining the following conditions: • relative humidity: less than 25% • air speed: 3 m/s • particles concentration: 5 g/m^3 • composition of the particles: as specified in clause 3.2.1 of IEC 60512-11-8 [16]	
Severity levels	**1**[(1)]	**2**
Number of cycles	**1**	**2**
Note	[(1)] Preferred severity level for OIML Recommendations: Level 1	
Information to be given in the Recommendation	a) severity: number of cycles b) state of the EUD during conditioning c) intermediate measurements d) recovery conditions e) electrical and mechanical measurements to be made at the end of the test, the parameters to be measured first, and the maximum period allowed for the measurement of these parameters.	

B.3.13 Vibration and mechanical shock

Table B3

Applicable standard	IEC 60068-2-47 [11], IEC 60068-2-64 [12]			
Test method	Random vibration			
Object of the test	To verify compliance with the general requirements for electronic measuring instruments under conditions of random vibration			
Test procedure in brief	The test consists of exposure to the vibration level for a time sufficient for testing the various functions of the EUT during the exposure. The EUT shall, in turn, be tested in three mutually perpendicular axes mounted on a rigid fixture by its normal mounting means. The EUT shall normally be mounted so that the gravitational force acts in the same direction as it would in normal use. Where the effect of gravitational force is not important the EUT may be mounted in any position.			
Severity levels	1 (1)	2 (1)	3	Unit
Total frequency range	10 ÷ 150	10 ÷ 150	10 ÷ 150	
Total RMS level	1.6	7	16	ms^{-2}
ASD (2) level 10-20 Hz	0.05	1	5	m^2s^{-3}
ASD level 20-150 Hz	-3	-3	-3	dB/octave
Duration per axis	2 minutes in each functional mode as defined in the Recommendation or a longer period if necessary for carrying out the measurement.			
Note	(1) Preferred severity levels for OIML Recommendations: Level 1 and Level 2 (2) ASD: Acceleration spectral density			

Annex C

SAMPLING PROCEDURES - TRUCKS

C.1. Scope

This annex applies to both manual and mechanical sampling. It should be noted that the Australian Wheat Board has stated in its *AWB Limited Wheat Receival Standards 2001–02 Season* that manual sampling will be progressively phased out by 2006–07. The procedures contained in this annex are based on ISO 13690:1999.

C.2 Sampling System

C.2.1 Manual Sampling

Research carried out indicates that vacuum sampling has better repeatability than other manual sampling methods. Accordingly, of the manual sampling systems, vacuum systems are preferred. However, where vacuum systems are unavailable conventional manual spears may be used.

C.2.1.1 Design of Vacuum Sampling Spear

The sampling spear comprises a 2 m long, 32 mm diameter stainless steel tube connected by a flexible hose to a sample container with a 0.5 mm mesh to ensure that fine material is retained in the sample container. The spear has a vacuum bypass that allows the operator to control the sampling.

C.2.1.2 Quantity of Grain Sampled

Table C1

Size of rail or road wagon	Minimum composite sample quantity
10 t or less	3 L
Over 10 t to 20 t	4 L
Over 20 t to 30 t	5 L
Over 30 t to 40 t	6 L
Over 40 t to 50 t	7 L
Over 50 t to 60 t	8 L
Over 60 t to 70 t	9 L
Over 70 t to 80 t	10 L

C.2.1.3 Sampling Plans

For each bulk unit tendered for delivery, the following number of sampling points are to be used, evenly spaced throughout the load. Approximately equal sub-samples are to be taken from each sampling point in the road or rail vehicle.

Table C2

Size of rail or road wagon	Number of sampling points
10 t or less	3
Over 10 t to 20 t	4
Over 20 t to 30 t	5
Over 30 t	7

C.2.2 Mechanical Sampling

Mechanical sampling devices, such as pneumatic systems, shall use the same sampling plans and produce the same sampled quantities of grain but the method of sampling is not manual.

C.3 Collection and Packaging of Samples for Daily Monitoring

Each composite sample shall be thoroughly mixed prior to analysis. Samples to be returned to the laboratory for analysis shall be sealed in moisture-tight containers, labelled and stored appropriately