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ELECTRONIC WEIGHING INSTRUMENTS

Instruments de pesage électroniques

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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.

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TERMINOLOGY
(terms and definitions)

The terminology used in this Recommendation conforms to the "International Vocabulary of Basic and General Terms in Metrology" (VIM - 1984 edition) and the "Vocabulary of Legal Metrology" (VML - 1978 edition). In addition, for the purposes of this Recommendation the following definitions apply:

T.1 Electronic weighing instrument

A weighing instrument equipped with electronic devices.

T.2 Electronic device

A device employing electronic subassemblies and performing a specific function. An electronic device is usually manufactured as a separate unit and is capable of being independently tested.

Note: An electronic device, as defined above, may be a complete weighing instrument (for example: counter scale) or part of a weighing instrument (for example: printer, indicator).

T.3 Electronic subassembly

A part of an electronic device, employing electronic components and having a recognizable function of its own.

T.4 Electronic component

The smallest physical entity that uses electron or hole conduction in semiconductors, gases, or in a vacuum.

T.5 Error (of indication)

The indication of a weighing instrument minus the (conventional) true value of the measurand [VIM 5.24].

T.6 Intrinsic error

The error of a weighing instrument used under reference conditions [VIM 5.27].

T.7 Initial intrinsic error

The intrinsic error of a weighing instrument as determined prior to performance and span stability tests.

T.8 Fault

The difference between the error of indication and the intrinsic error of a weighing instrument.

Note 1: Principally, a fault is the result of an undesired change of data contained in or flowing through an electronic weighing instrument.

Note 2: From the definition it follows that in this Recommendation, a "fault" is a numerical value.

T.9 Significant fault

A change in the indication of a measurement result greater than a certain value that is considered to be acceptable for a given category of weighing instrument or measurement application. This value shall be specified in the International Recommendation applicable to each category of weighing instrument.

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

- faults that result from simultaneous and mutually independent causes in the instrument itself or in its checking facility,
- faults that imply the impossibility of performing any measurement, except for instruments covered by the OIML International Recommendation R 50,
- transitory faults that are momentary variations in the indication which cannot be interpreted, memorized, or transmitted as a measurement result, except for instruments covered by R 50 and R 51,
- faults giving rise to variations in the measurement results so serious that they are bound to be noticed by all those interested in the measurement, except for instruments covered by R 50.

T.10 Indication of a significant fault

The means to make known the occurrence of such an event. For example, through an audio or visual signal or the blanking of the indication.

T.11 Influence quantity

A quantity that is not the subject of the measurement but which influences the value of the measurand or the indication of the weighing instrument [VIM 2.10].

T.11.1 Influence factor

An influence quantity having a value within the rated operating conditions of the weighing instrument specified in the appropriate International Recommendation.

T.11.2 Disturbance

An influence quantity having a value within the limits specified in this Recommendation, but outside the rated operating conditions of the weighing instrument specified in the appropriate International Recommendation.

T.12 Rated operating conditions

Conditions of use giving the ranges of the measurand and of the influence quantities, and other important requirements, for which the metrological characteristics are intended to be within the specified maximum permissible errors [adapted from VIM 5.05].

T.13 Reference conditions

A set of specified values of influence factors fixed to ensure valid intercomparison of the measurement results [adapted from VIM 5.07].

T.14 Span stability

The capability of a weighing instrument to maintain the difference between the indication of weight at capacity and the indication at zero within specified limits over a period of use.

T.15 Durability

The capability of a weighing instrument to maintain its performance characteristics over a period of use.

T.16 Durability error

The difference between the initial intrinsic error of a weighing instrument and the intrinsic error over a period of use.

T.17 Significant durability error

A durability error greater than:

a) for a nonautomatic weighing instrument (OIML R76), the value of "e",

Note 1: For a multi-interval instrument, the value of "e" according to the partial weighing range.

Note 2: A durability error may be due to mechanical wear or due to drift and ageing of electronic parts. The concept of significant durability error applies only to electronic parts.

b) for an automatic weighing instrument, the value fixed in the International Recommendation applicable to the particular type of automatic weighing instrument.

Note: The following are not considered to be significant durability errors within the meaning of this Recommendation, even when they exceed the values defined above:
An error that occurs after a period of use of the instrument and which is clearly the result of a device or component failure, or of a disturbance, or of a breakdown of the appropriate durability protection feature and for which the indication:
- cannot be interpreted, memorized, or transmitted as a measurement result, or
- implies the impossibility to perform any measurement, or
- is so obviously wrong that it is bound to be noticed by all those interested in the result of the measurement.

T.18 Checking facility

A facility that is incorporated in a weighing instrument and enables significant faults to be detected and acted upon.

T.18.1 Automatic checking facility

A checking facility operating without the intervention of an operator.

T.18.1.1 Permanent automatic checking facility (type P)

An automatic checking facility operating at each measurement cycle.

T.18.1.2 Intermittent automatic checking facility (type I)

An automatic checking facility operating at certain time intervals or per a fixed number of measurement cycles.

T.18.2 Nonautomatic checking facility (type N)

A checking facility that requires the intervention of an operator.

T.19 Warm-up time

The time between the moment that power is applied to the instrument and the moment at which the instrument is capable of complying with the requirements of the appropriate International Recommendation.

T.20 Performance test

A test to verify whether the equipment under test (EUT) is capable of accomplishing its intended functions.

ELECTRONIC WEIGHING INSTRUMENTS

1 General

1.1 Scope

This International Recommendation, prepared in close connection with the OIML International Document D 11 "General requirements for electronic measuring instruments", specifies the general metrological and technical characteristics that shall be exhibited by electronic weighing instruments, together with the relevant examinations and tests which shall be applied.

Future International Recommendations or revisions of existing International Recommendations relative to any category of weighing instrument shall incorporate requirements based upon this Recommendation.

1.2 Terminology

The terminology given in pages 1-6 shall be considered as a part of this Recommendation.

2 Application

This Recommendation applies to electronic weighing instruments. The examinations and tests specified in this Recommendation shall be performed as supplementary procedures for the completion of the pattern evaluation and, where appropriate, the initial verification processes as referenced in the appropriate International Recommendations relative to any category of weighing instrument (hereafter referred to as "appropriate Recommendation") whenever it contains an electronic device.

3 Requirements for electronic weighing instruments

Electronic weighing instruments shall comply with the following requirements, in addition to the requirements contained in the appropriate Recommendations.

3.1 General requirements

3.1.1 Electronic weighing instruments shall be designed and manufactured so that they do not exceed the maximum permissible errors under rated operating conditions.

3.1.2 Electronic weighing instruments shall be designed and manufactured so that when they are exposed to disturbances, either

a) significant faults do not occur, or

b) significant faults are detected and acted upon by means of a checking facility.

Note: A fault equal to or less than the value specified in T.9 is allowed irrespective of the value of the error of indication.

3.1.3 The requirements in 3.1.1 and 3.1.2 shall be met durably in accordance with the intended use of the instrument. Digital electronic devices shall be provided with the protection checking features specified in 3.4.1 to 3.4.3.

3.1.4 A pattern of a weighing instrument is presumed to comply with the requirements in 3.1.1, 3.1.2, and 3.1.3 if it passes the examinations and tests specified in 4.3.

3.2 Application

3.2.1 The requirements in 3.1.2 may be applied separately to each individual cause of significant fault and/or each part of the weighing instrument.

3.2.2 The choice as to whether to apply 3.1.2 (a) or (b) is left to the manufacturer.

3.3 Devices with checking facilities

3.3.1 When a significant fault has been detected, one of the following shall occur automatically.

a) For instruments intended to be used for direct trade with the public: a visible or audible indication shall be provided for the customer, and data transmission to any peripheral equipment shall be prevented. This indication shall continue until the user takes action or the fault disappears.

b) For other instruments: a visible or audible indication shall be provided and shall continue until the user takes action or the fault disappears

In the case of non-repeatable measurements, means shall be provided to retain any totalized load information contained in the instrument when the significant fault occurred.

3.3.2 It shall be possible during pattern evaluation to verify the presence and correct functioning of the checking facilities.

3.3.3 The requirements in 3.3.1 and 3.3.2 do not apply to weighing instruments or parts of weighing instruments for which the manufacturer claims compliance with the requirements in 3.1.2 (a) and which are nevertheless equipped with checking facilities.

3.4 Checking facilities

3.4.1 Upon switch-on (in the case of instruments permanently connected to the mains at switch-on of indication), a special procedure shall be performed that shows all relevant signs of the indicator in their active and non-active states for a sufficient time to be checked by the operator.

3.4.2 Upon switch-on (in the case of instruments permanently connected to the mains at switch-on of indication), all data storage components shall be checked automatically to verify that the values of all permanently memorized instructions and data are correct, by such means as:

- summing up of all instruction and data codes and comparing the sum with a fixed value,

- line and column parity bits (LRC and VRC following ISO 1155, October 1973),

- cyclic redundancy check (CRC 16, ISO 2111, June 1971),
- double storage of data, both in same code,
- double storage of data, second in inverse or shifted coding,
- storage of data in "safe coding," for example protected by check sum, line and column parity bits.

3.4.3 All relevant measurement data shall be checked for correct value whenever they are transferred or stored internally or transmitted to peripherals by interface, by such means as parity bit, check sum, independent double storage, or handshake-routine with retransmission.

Note: The use of parity bit alone is not sufficient in the case of storing or reading data which are relevant for the metrological characteristics of the instrument.

3.5 Functional requirements

3.5.1 Electronic weighing instruments shall comply with the requirements of the appropriate Recommendation as regards influence factors specified in Annex A of this Recommendation.

3.5.2 When an electronic weighing instrument is subjected to a disturbance referenced in Annex A, the difference between the indication due to the disturbance and the indication without the disturbance (intrinsic error) shall not exceed the values specified in the appropriate Recommendation, or the instrument shall detect and act upon a significant fault.

3.5.3 During the warm-up time of an electronic instrument, there shall be no indication or transmission of the weighing result.

3.6 Interface and power supply requirements

3.6.1 An instrument may be equipped with an interface permitting the coupling of the instrument to external equipment. When an interface is used, the instrument shall continue to function correctly and its metrological functions shall not be influenced.

3.6.2 Instruments intended for non-repeatable measurements that operate from the mains shall, in the event of a power failure, retain the metrological information contained in the instrument at the time of failure for a least 24 hours. A switch-over to an emergency power supply shall not cause a significant fault.

3.6.3 Instruments intended to operate from a battery power supply shall indicate whenever the voltage drops below the manufacturer's specified minimum value and shall either continue to function correctly or automatically be put out of service.

4 Pattern evaluation

4.1 Documentation

4.1.1 In addition to the required documentation specified in the appropriate Recommendation, the application for pattern approval shall include a description of the electronic devices with drawings, diagrams, and general software information explaining their construction and operation.

4.1.2 The application shall be accompanied by any document or other evidence demonstrating that the design and construction of the electronic weighing instrument comply with the requirements of this Recommendation.

4.2 General requirements

Pattern evaluation shall be carried out on at least one and normally, not more than three instruments that represent the definitive pattern. The evaluation shall consist of the tests specified in 4.3.

These tests should be applied uniformly by the legal metrology services and should form a uniform program adapted to the electronic weighing instrument concerned. Guidance for the conduct of pattern evaluation is provided in the OIML International Documents D 19.

When laboratory testing of the complete instrument or all of its devices is impracticable, evaluation may be by in-situ tests on a limited number of individual instruments sufficient to assess the pattern quality through evaluation of these results.

4.3 Examination and tests

The examination and tests of an electronic weighing instrument is intended to verify compliance with the appropriate Recommendations, and compliance with the requirements in clause 3 of this Recommendation.

4.3.1 Electronic weighing instruments shall be examined to obtain a general appraisal of the design and construction.

4.3.2 Electronic weighing instruments or electronic devices, as appropriate, shall be tested as specified in Annex A to determine their correct functioning.

Tests are to be conducted on the whole instrument except when the size and/or configuration of the instrument does not lend itself to testing as a unit. In such cases, the separate electronic devices shall be subjected to testing. It is not intended that electronic devices be further dismantled for separate testing of components. In addition, an examination shall be carried out on the fully operational weighing instrument or, if necessary for practical reasons, on the electronic devices in a simulated set-up that sufficiently represents the weighing instrument. The equipment shall continue to function correctly as specified in Annex A.

5 Initial verification

Initial verification of electronic weighing instruments may include a procedure as defined in the OIML International Document D 20, to determine conformance of individual electronic weighing instruments with the approved pattern.

ANNEX A

PERFORMANCE AND SPAN STABILITY TESTS

A.1 General

Included in this Annex are performance and span stability tests intended to ensure that electronic weighing instruments can perform as intended in the environment and under the conditions specified. In appropriate cases, tests indicate the reference condition under which the intrinsic error is determined.

A.2 Test considerations

A.2.1 All electronic weighing instruments of the same category shall be subjected to the same performance test program whether or not equipped with checking facilities.

A.2.2 Tests shall be conducted on fully operational equipment in its normal operational state. When the equipment is connected in other than a normal configuration, the procedure shall be mutually agreed upon by the approving authority and the applicant.

A.2.3 When the effect of one factor is being evaluated, all other factors are to be held relatively constant, at a value close to normal.

A.3 Performance tests

Test	Characteristics under test	Conditions applied
A.3.1 Static temperatures	Influence factor	mpe(*)
A.3.2 Damp heat, steady state	Influence factor	mpe
A.3.3 Power voltage variation	Influence factor	mpe
A.3.4 Short time power reduction	Disturbance	sf(**)
A.3.5 Burst	Disturbance	sf
A.3.6 Electrostatic discharge	Disturbance	sf
A.3.7 Electromagnetic susceptibility	Disturbance	sf

(*) mpe: maximum permissible error on initial verification.
Note: the maximum permissible error for the zero point shall also be taken into consideration, in accordance with the appropriate Recommendation.

(**) sf: value of the significant fault (see T.9).

A.3 Performance tests

A.3.1 Static temperatures

Test method:	Dry heat (non condensing) and cold
Object of the test:	To verify compliance with the provisions in 3.1.1 under conditions of high and low temperature.
Reference to standard:	See Bibliography /1/
Test procedure in brief:	The test consists of exposure of the EUT to the high and low temperatures specified in the appropriate Recommendation under "free air" conditions for a two-hour period after the EUT has reached temperature stability. The EUT shall be tested with at least five different test loads (or simulated loads) under the following conditions: - at a reference temperature of 20 °C following conditioning, - at the specified high temperature, two hours after achieving temperature stabilization, - at the specified low temperature, two hours after achieving temperature stabilization, - at a temperature of 5 °C, two hours after achieving temperature stabilization, - after recovery of the EUT at the reference temperature of 20 °C.
Test severity:	1) Temperature: as specified in the appropriate Recommendation 2) Duration: two hours.
Number of test cycles:	At least one cycle.
Maximum allowable variations:	All functions shall operate as designed. Zero drift shall not exceed the requirements specified in the appropriate Recommendation. All indications shall satisfy the requirements concerning the maximum permissible errors specified in the appropriate Recommendation.
Conduct of test:	Refer to the IEC Publications mentioned in /1/ for detailed test procedures.

Supplementary information to the IEC test procedures

Preconditioning:	16 hours.
Test equipment:	Load cell simulator, if applicable.
Condition of EUT:	Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Power is to be "on" for the duration of the test.

Adjust the EUT as close to a zero indication as practicable prior to the test (if an automatic zero tracking is connected, adjust to a value near zero). Not to be adjusted or readjusted at any time during the test.

Test sequence: Stabilize the EUT in the chamber at a reference temperature of 20 °C. Apply at least five different test loads or simulated loads and record the following data:

a) date and time

b) temperature

c) relative humidity

d) test load

e) indication

f) errors

g) functions performance

Increase the temperature in the chamber to the high temperature specified in the appropriate Recommendation. Check by measurement that the EUT has reached temperature stability and maintain the temperature for two hours. Following the two hours, apply at least five different test loads or simulated loads and record the test data indicated above.

Reduce the temperature in the chamber to the low temperature specified in the appropriate International Recommendation. After temperature stabilization, allow the EUT to soak for two hours. Following the two hours, apply at least five different test loads or simulated test loads and record the test data indicated above.

Raise the temperature in the chamber to 5 °C. After temperature stabilization, allow the EUT to soak for two hours. Following the two hours, apply at least five different test loads or simulated test loads and record the test data indicated above.

Note: This test point relates to a -10 °C to + 40 °C range. For special ranges, it may not be necessary.

Raise the temperature in the chamber to the 20 °C reference temperature. After recovery, apply five test loads and record the test data indicated above.

A.3.2 Damp heat, steady state

Not applicable to Class I nonautomatic instruments, or to Class II nonautomatic instruments when "e" value is less than 1 g.

Test method: Damp heat, steady state

Object of the test: To verify compliance with the provisions in 3.1.1 under conditions of high humidity and constant temperature.

Reference to standard:	See Bibliography /2/
Test procedure in brief:	The test consists of exposure of the EUT to a constant temperature at the upper limit of the temperature range specified for the instrument and a constant relative humidity of 85 % for a two day period. The EUT shall be tested with at least five different test loads (or simulated loads) under the following conditions: - at a reference temperature of 20 °C and a relative humidity of 50 % following conditioning, - at the upper limit of the temperature range specified in the appropriate Recommendation and a relative humidity of 85 %, two days following temperature and humidity stabilization.
Test severity:	1) Temperature: upper limit of the temperature range specified in the appropriate Recommendation 2) Humidity: 85 % (non-condensing) 3) Duration: two days.
Number of test cycles:	At least one test
Maximum allowable variations:	All functions shall operate as designed. All indications shall satisfy the requirements concerning the maximum permissible errors specified in the appropriate Recommendation.
Conduct of the test:	Refer to the IEC Publications mentioned in /2/ for detailed test procedures.

Supplementary information to the IEC test procedures

Preconditioning:	None required
Test equipment:	Load cell simulator, if applicable
Condition of EUT:	Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Power is to be "on" for the duration of the test. The handling of the EUT shall be such that no condensation of water occurs on the EUT. Adjust the EUT as close to a zero indication as practicable prior to the test (if an automatic zero tracking is connected, adjust to a value near zero). Not to be adjusted or readjusted at any time during the test.
Test sequence:	Allow three hours for stabilization of the EUT at a reference temperature of 20 °C and a relative humidity of 50 %. Following stabilization, apply at least five different test loads (or simulated loads) and record the following data: a) date and time b) temperature

c) relative humidity

d) test load

e) indication

f) errors

g) functions performance

Increase the temperature in the chamber to the upper limit of the temperature range specified for the instrument and a relative humidity of 85 %. Maintain the EUT at no load for a period of two days. Following the two days, apply at least five test loads (or simulated loads) and record the data as indicated above.

Allow full recovery of the EUT before any other tests are performed.

A.3.3 Power voltage variation

A.3.3.1 AC power supply

Test method:	Variation in AC mains power supply (single phase)
Object of the test:	To verify compliance with the provisions in 3.1.1 under conditions of varying AC mains power supply.
Reference to standard:	No reference to international standard can be given at the present time.
Test procedure in brief:	The test consists of subjecting the EUT to AC mains power variations while the EUT is operating under normal atmospheric conditions.
Test severity:	Mains voltage: upper limit U_{nom} + 10 % lower limit U_{nom} – 15 %
Number of test cycles:	At least one cycle
Maximum allowable variations:	All functions shall operate correctly. All indications shall satisfy the requirements concerning the maximum permissible errors specified in the appropriate Recommendation.

Conduct of the test

Preconditioning:	None required
Test equipment:	Variable power source Calibrated voltmeter Load cell simulator, if applicable.
Condition of EUT:	Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer.

Adjust the EUT as close to a zero indication as practicable prior to the test (if an automatic zero tracking is connected, adjust to a value near zero). Not to be adjusted or readjusted at any time during the test.

Test sequence: Stabilize the power supply at nominal voltage ± 2 % and record the following data at no load and at one load (or simulated load) between 50 % and maximum capacity of the EUT:

a) date and time

b) temperature

c) relative humidity

d) power supply voltage

e) test load

f) indications

g) errors

h) functions performance

Reduce the power supply to - 15 % nominal.

Record the data indicated above at no load and at one load (or simulated load) between 50 % and maximum capacity of the EUT.

Increase the power supply to + 10 % nominal.

Record the data indicated above at no load and at one load (or simulated load) between 50 % and maximum capacity of the EUT.

Unload the EUT and decrease the power supply to nominal power ± 2 %.

Record the data indicated above at no load and at one load (or simulated load) between 50 % and maximum capacity of the EUT.

Note: In case of three phase power supply, the voltage variation shall apply for each phase successively.

A.3.3.2 DC power supply

Under consideration

A.3.4 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 3.1.2 under conditions of short time mains voltage interruptions and reductions.

Reference to standard: No reference to international standards can be given at the present time.

Test procedure in brief:	The test consists of subjecting the EUT to voltage interruptions from nominal voltage to zero voltage for a period equal to 8-10 ms, and to voltage reductions from nominal voltage to 50 % of nominal voltage for a period equal to 16-20 ms. The mains voltage interruptions and reductions shall be repeated ten times with a time interval of at least ten seconds.
Test severity:	100 % voltage interruption for a period equal to 8-10 ms 50 % voltage reduction for a period equal to 16-20 ms.
Number of test cycles:	Ten tests with a minimum of ten seconds between tests.
Maximum allowable variations:	The difference between the weight indication due to the disturbance and the indication without the disturbance either shall not exceed the values given in T.9, or the EUT shall detect and act upon a significant fault.
Conduct of the test	
Preconditioning:	None required
Test equipment:	A test generator suitable to reduce the amplitude of the AC voltage from the mains. The test generator shall be adjusted before connecting the EUT. Load cell simulator, if applicable.
Condition of EUT:	Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Adjust the EUT as close to zero indication as practicable prior to the test (if an automatic zero tracking is connected, adjust to a value near zero). Not to be adjusted or readjusted at any time during the test except to reset if a significant fault has been indicated.
Test sequence:	Stabilize all factors at nominal reference conditions. Apply one test load (or simulated load) and record the following data: a) date and time b) temperature c) relative humidity d) power supply voltage e) test load f) indications g) errors h) functions performance Interrupt the power supply for a period equal to 8-10 ms. During interruption observe the effect on the EUT and record as appropriate.

Repeat the above procedure four additional times making sure that there is a ten-second interval between repetitions. Observe the effect on the EUT.

Reduce the power supply to 50 % of nominal voltage for a period equal to 16-20 ms. During reduction observe the effect on the EUT and record as appropriate.

Repeat the above procedure four additional times making sure that there is a ten-second interval between repetitions. Observe the effect on the EUT.

A.3.5 Bursts

Test method:	Electrical bursts
Object of the test:	To verify compliance with the provisions in 3.1.2 under conditions where electrical bursts are superimposed on the mains voltage.
Reference to standard:	See Bibliography /3/
Test procedure in brief:	The test consists of subjecting the EUT to specified bursts of voltage spikes.
Test severity:	Power supply: 1kV ± 0.1 kV I/O signals, data and control lines: 0.5 kV ± 0.05 kV.
Number of test cycles:	At least ten positive and ten negative randomly phased bursts shall be applied at 1000 V.
Maximum allowable variations:	The difference between the weight indication due to the disturbance and the indication without the disturbance either shall not exceed the values given in T.9, or the EUT shall detect and act upon a significant fault.
Conduct of the test:	Refer to the IEC Publication mentioned in /3/ for detailed test procedures.

Supplementary information to the IEC test procedures

Test equipment:	A burst generator having an output impedance of 50 ohms. Representative load cell.
Test conditions:	Refer to IEC Publications
Condition of EUT:	Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Adjust the EUT as close to a zero indication as practicable prior to the test (if an automatic zero tracking is connected, adjust to a value near zero). Not to be adjusted or readjusted except to reset if a significant fault has been indicated.

Test sequence:	Stabilize all factors at nominal reference conditions. Apply one test load and record the following data: a) date and time b) temperature c) relative humidity d) test load e) indication f) errors g) functions performance Subject the EUT to the tests as specified. Observe the effect on the EUT and record as appropriate. Stabilize all factors at nominal reference conditions. Apply one test load and record the data indicated above.

A.3.6 Electrostatic discharge

Test method:	Electrostatic discharge (ESD)
Object of the test:	To verify compliance with the provisions in 3.1.2 under conditions of electrostatic discharges.
Reference to standard:	See Bibliography /4/
Test procedure in brief:	See IEC 801-2 (1991) N°8
Test severity:	Air discharge: up to and including 8 kV Contact discharge: up to and including 6 kV
Number of test cycles:	At least ten direct and ten indirect discharges shall be applied at intervals of at least ten seconds between discharges.
Maximum allowable variations:	The difference between the weight indication due to the disturbance and the indication without the disturbance either shall not exceed the values indicated in T.9 or the EUT shall detect and act upon a significant fault.
Conduct of the test:	Refer to the IEC Publication mentioned in /4/ for detailed test procedures.

Supplementary information to the IEC test procedures

Preconditioning:	None required
Test equipment:	Representative load cell.
Condition of EUT:	Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Power is to be "on" for the duration of the test. The EUT shall be operating under standard atmospheric conditions for testing.

Adjust the EUT as close to a zero indication as practicable prior to the test (if an automatic zero tracking is connected, adjust to a value near zero). Not to be adjusted or readjusted at any time during the test except to reset the EUT if a significant fault has been indicated.

Test sequence: Stabilize all factors at nominal reference conditions.

Apply one test load and record the following data:

a) date and time

b) temperature

c) relative humidity

d) power supply voltage

e) test load

f) indication

g) errors

h) functions performance

Approach the EUT with the discharge electrode until discharge occurs and then remove it before the next discharge. Observe the effect of the discharge on the EUT and record as appropriate.

Repeat the above procedure at least nine more times, making sure to wait at least ten seconds between successive discharges. Observe the effect on the EUT and record as appropriate.

Stabilize all factors at nominal reference conditions.

Apply one test load and record the following data:

a) date and time

b) temperature

c) relative humidity

d) power supply voltage

e) test load

f) indication

g) errors

h) functions performance

A.3.7 Electromagnetic susceptibility

Test method: Electromagnetic fields (radiated)

Object of the test: To verify compliance with the provisions in 3.1.2 under conditions of electromagnetic fields.

Reference to standard: See Bibliography /5/ and note

Test procedure in brief: The EUT is placed in an EMC chamber and tested under normal atmospheric conditions at one load. It is then exposed to electromagnetic field strengths as specified in the "Test severity" paragraph below.

	The field strength can be generated in various ways: see IEC 801-3. Under exposure to electromagnetic fields the EUT is again tested at one load.
Test severity:	Frequency range: 26 - 1000 MHz Field strength: 3 V/m Modulation: 80% AM, 1 kHz sine wave.
Number of test cycles:	Conduct test by continuously scanning the specified frequency range while maintaining the field strength.
Maximum allowable variations:	The difference between the weight indication due to the disturbance and the indication without the disturbance either shall not exceed the values given in T.9, or the EUT shall detect and act upon a significant fault.
Conduct of the test:	Refer to the IEC Publication mentioned in /5/ for detailed information on test procedures.

Supplementary information to the IEC test procedures

Test conditions:	The specified field strength shall be established prior to the actual testing (without the EUT in the field). At least 1 m of all external cables shall be included in the exposure by stretching them horizontally from the EUT. The field strength shall be generated in two orthogonal polarizations and the frequency range scanned slowly. If antennas with circular polarization (i.e. log-spiral or helical antennas) are used to generate the electromagnetic field, a change in the position of the antennas is not required. When the test is carried out in a shielded enclosure to comply with international laws prohibiting interference to radio communications, care must be taken to handle reflections from the walls. Anechoic shielding might be necessary.
Condition of EUT:	Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Power is to be "on" for the duration of the test. The EUT shall be operated under standard atmospheric conditions for testing. Adjust the EUT as close to a zero indication as practicable prior to the test (if an automatic zero tracking is connected, adjust to a value near zero). Not to be adjusted or readjusted at any time during the test except to reset the EUT if a significant fault has been indicated.
Test sequence:	Stabilize all factors at nominal reference conditions.

Apply one test load and record the following data:

a) date and time

b) temperature

c) relative humidity

d) test load

e) indication

f) errors

g) functions performance

Expose the unloaded EUT to the specified field strengths while slowly scanning the three indicated frequency ranges.

Observe and record the effect on the EUT.

Repeat the test with the EUT under one test load; observe and record the effect.

Stabilize all factors at nominal reference conditions.

Apply one test load and record the following data:

a) date and time

b) temperature

c) relative humidity

d) test load

e) indication

f) errors

g) functions performance

A.4 Span stability test

Test	Characteristics under test	Conditions applied
Span stability	Stability	1/2 absolute mpe(*) but not less than 1/2 e

Test method: Span stability

Object of the test: To verify compliance with the provisions in 3.1.3 after the EUT has been subjected to the performance tests.

Reference to standard: No reference to international standards can be given at the present time.

Test procedure in brief: The test consists of observing the variations of the error of the EUT under sufficiently constant ambient conditions (reasonably constant conditions in a normal laboratory environment) at various intervals: before, during, and after the EUT has been subjected to performance tests.

(*) mpe: maximum permissible error on initial verification.

Note: the maximum permissible error for the zero point shall also be taken into consideration, in accordance with the appropriate Recommendation.

	The EUT shall also be disconnected from the power supply for at least eight hours at least two times during the test duration and reconnected and stabilized at rated operating conditions before any further tests are conducted.
Test severity:	Test duration: not to exceed 28 days. Time (t) between tests (days): $0.5 \leq t \leq 10$. Test load: A load as specified in the appropriate Recommendation.
Maximum allowable variations:	All functions shall operate correctly. The variation in the indication of the test load shall not exceed 1/2 the absolute value of the mpe on initial verification for the test load applied on any of the (n) tests conducted, or a value specified in the appropriate Recommendation.
Number of tests (n):	$n \geq 10$. If the test results indicate a trend, i.e. the errors continue to vary in the same direction, conduct additional tests until the trend comes to a rest or reverses itself.
Preconditioning:	None required.
Test Equipment:	Verified mass standards.
Condition of EUT:	Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Adjust the EUT as close to zero indication as practicable before each test. The automatic zero tracking should be made inoperative (if the EUT is so equipped) during the test, unless otherwise specified in the appropriate Recommendation.
Test sequence:	Stabilize all factors at nominal reference conditions. Apply the test load (or simulated load) and record the following data, as appropriate: a) date and time b) temperature c) barometric pressure d) relative humidity e) test load f) indication g) errors h) functions performance i) changes in test location Repeat this test at periodic intervals during and after the conduct of the various performance tests. Allow full recovery of the EUT before any other tests are performed

BIBLIOGRAPHY

Below are references to Publications of the International Electrotechnical Commission (IEC), where mention is made in some of the tests in Annex A.

/1/ IEC Publication 68-2-1 (1974) : Basic environmental testing procedures. Part 2: Tests, Test Ad: Cold, for heat dissipating equipment under test (EUT), with gradual change of temperature.

IEC Publication 68-2-2 (1974) : Basic environmental testing procedures, Part 2: Tests, Test Bd: Dry heat, for heat dissipating equipment under test (EUT) with gradual change of temperature.

IEC Publication 68-3-1 (1974) : Background information, Section 1: Cold and dry heat tests.

/2/ IEC Publication 68-2-56 (1988) : Environmental testing , Part 2: Tests, Test Cb: Damp heat, steady state. primarily for equipment

IEC Publication 68-2-28 (1980) : Guidance for damp heat tests.

/3/ IEC Publication 801-4 (1988) : Electromagnetic compatibility for industrial-process measurement and control equipment, Part 4: Electrical fast transients requirements.

/4/ IEC Publication 801-2 (1991) : Electromagnetic compatibility for industrial-process measurement and control equipment, Part 2: Electrostatic discharge requirements.

/5/ IEC Publication 801-3:
IEC draft 65A/77B
(secretariat) 135/100 Electromagnetic compatibility for industrial-process measurement and control equipment, Part 3: Radiated electromagnetic field requirements.

Note: At the time of printing this Recommendation the IEC Publication 801-3 is still being revised (latest draft: IEC 65A/77B(secretariat) 135/100, December 1992). When performing this test, metrology authorities shall refer to the final text of IEC 801-3 when available, and before to the most recent draft. A corrigendum to this Recommendation will be issued as soon as the final text of IEC 801-3 is available.