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Instruments for measuring the areas of leathers

Instruments pour la mesure de la surface des cuirs

ORGANISATION INTERNATIONALE
DE MÉTROLOGIE LÉGALE

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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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Instruments for measuring the areas of leathers

TERMINOLOGY (Terms and definitions)

The terminology used in this Recommendation conforms to the *International Vocabulary of Basic and General Terms in Metrology* (VIM, 1993 edition) and to the *International Vocabulary of Legal Metrology* (VIML, 2000 edition). In addition, for the purposes of this Recommendation, the definitions below apply.

T.1 GENERAL DEFINITIONS

T.1.1 Measuring

Set of operations, performed manually, semi-automatically or automatically, having the object of determining a value of a quantity.

T.1.2 Measuring instrument

Instrument intended to be used to make measurements, alone or in conjunction with supplementary device(s). *[VIM 4.1]*

T.1.3 Automatic measuring instrument

Instrument that measures without the intervention of an operator and follows a pre-determined program of automatic processes characteristic of the instrument.

T.1.4 Electronic instrument

Instrument equipped with electronic devices.

T.1.5 Reference instrument

Measuring instrument having one or more metrological property qualities that are well established to be used for the verification of an apparatus or the verification of a measurement method.

T.1.6 Leather

Material prepared from the hides and skins of animals, by tanning and other ancillary processes, the result of which is a three dimensional, durable and hygroscopic material of varying thickness and softness.

T.1.7 Area of leather

Measurement of the extent of the surface of a leather material held or supported to ensure that the material is presented for measurement in a form that removes the three dimensional characteristics of the material.

T.1.8 Template

Wear-resistant and dimensionally stable flexible material (e.g. rubber or reinforced rubber) of at least 1 mm thickness and of circular or irregular form.

T.1.9 Conventional true value (of a quantity)

Value attributed to a particular quantity (e.g. area of leather) and accepted, by convention, as having an uncertainty appropriate for a given purpose. *[VIM 1.20]*

T.2 CONSTRUCTION

Note: In this Recommendation the term "device" is used for any means by which a specific function is performed irrespective of the physical realization, e.g. by a mechanism or a key initiating an operation; the device may be a small part or a major portion of a measuring instrument.

T.2.1 Mechanical device

Device employing mechanical sub-assemblies and performing a specific function (e.g. a mechanical pin-wheel comprising of a drive roller and embedded pins for detecting presence of leather and providing area measurement with analogue indication).

T.2.2 Electronic device

Device employing electronic sub-assemblies and performing a specific function. An electronic device is usually manufactured as a separate unit and is capable of being independently tested (e.g. an instrument comprising of photocells for detecting leather or a camera for image scanning and providing area measurement with digital indication).

T.2.3 Electronic component

Smallest physical entity that uses electron or hole conduction in semi-conductors, gases or in a vacuum.

T.2.4 Indicating device

Part of the measuring device that displays the value of a measuring result in units of area.

T.2.4.1 Analogue indication

The output or display is indicated by an index and graduated scale, one of which is fixed and the position of the other is a continuous function of the particular quantity being measured.

T.2.4.2 Digital indication

The output or display is indicated by a sequence of aligned digits that do not permit interpolation to a fraction of the scale interval.

T.2.5 Zero-setting device

Device for setting the indication to zero.

T.2.5.1 Automatic zero-setting device

Device for setting the indication to zero automatically without the intervention of an operator.

T.2.5.2 Semi-automatic zero-setting device

Device for setting the indication to zero automatically following a manual command.

T.2.5.3 Nonautomatic zero-setting device

Device for setting the indication to zero by an operator.

T.3 METROLOGICAL CHARACTERISTICS

T.3.1 Scale interval (d)

Value, expressed in units of area, of the difference between:

- the values corresponding to two consecutive scale marks for analogue indication, or
- two consecutive indicated values for digital indication.

T.3.2 Minimum area (A_{min})

Smallest value that can be measured below which the indicated result may be subject to excessive relative error.

T.3.3 Maximum area (A_{max})

Highest value of the marked range on the indicator for an analogue display.

Nominally the highest value that can be detected by the digital indicator plus one scale interval for electronic displays.

T.3.4 Total area of a parcel of leather (A_{total})

Sum of the areas of pieces of leather individually measured and bundled into a parcel.

T.3.5 Measuring range

Range in which the maximum and minimum areas are intended to lie.

T.4 ERRORS

T.4.1 Error (of indication)

Indication of a measuring instrument minus the (conventional) true value of the area. *[VIM 5.20]*

T.4.2 Intrinsic error

Error of a measuring instrument determined under reference conditions. *[VIM 5.24]*

T.4.3 Maximum permissible error (MPE)

Extreme value of an error permitted by specifications or regulations between the indication of a measuring instrument and the corresponding true value. *[VIM 5.21]*

T.4.4 Maximum permissible deviation (MPD)

Maximum deviation of the mean area of the leather from the true area of the leather.

T.4.5 Fault

Difference between the error of indication and the intrinsic error of a measuring instrument.

Principally, a fault is the result of an undesired change of data contained in or flowing through an electronic instrument. In this Recommendation a “fault” is a numerical value.

T.4.6 Significant fault

Fault greater than 1 d.

The following are not considered to be significant faults:

- faults that result from simultaneous and mutually independent causes in the instrument or in its checking facility;
- faults that make it impossible to perform any measuring;
- transitory faults that are momentary variations in the indications which cannot be interpreted,

memorized or transmitted as a measuring result;
- faults that are so serious that they will inevitably be noticed by those interested in the measuring.

T.4.7 Rounding error

Difference between a digital measuring result (indicated or printed) and the value of that measuring result with an analogue indication.

T.4.8 Mean area error ($\bar{\chi}_e$)

Deviation of the mean value for a number of consecutive area measurements made on one template material, from the conventional true value of the template area, expressed mathematically as:

$$\bar{\chi}_e = [\bar{\chi} - V_{true}]$$

where:

V_{true} is the conventional true value of the leather area, and

$\bar{\chi}$ is the mean of the measurements, i.e. $\dfrac{\sum_{i=1}^{n} I_i}{n}$

where:

I is the leather measurement indication; and
n is the number of measurements.

T.4.9 Repeatability error (R)

Closeness of the agreement between the results of the difference between the maximum (A_{max}) and minimum (A_{min}) successive area measurements carried out under the same conditions of measurement.

$$R = A_{max} - A_{min}$$

Note: Repeatability conditions include:

- the same measurement procedure;
- the same operator;
- the same measuring instrument, used under the same conditions;
- the same location; and
- repetition over a short period of time.

Repeatability may be expressed quantitatively in terms of the dispersion characteristics of the results. *[VIM 3.6]*

T.4.10 Reproducibility error

Closeness of the agreement between the results of successive leather area measurements carried out under changed conditions of measurement.

Note: The changed conditions may include:

- leather-measuring instrument (e.g. use of a mechanical or electronic pinwheel, etc.);
- leather material;
- operator;
- location; and
- time.

T.4.11 Uncertainty of measurements

Percentage value associated with the total area of a parcel of leather (A_{total}), that characterizes the best estimate of the value of the total area of the parcel.

T.5 INFLUENCES AND REFERENCE CONDITIONS

T.5.1 Influence quantity

Quantity that is not the subject of the measurement but which influences the value of the measurand or the indication of the measurement instrument. *[VIM 2.7]*

T.5.1.1 Influence factor

Influence quantity having a value within the specified rated operating conditions of the instrument.

T.5.1.2 Disturbance

Influence quantity having a value within the limits specified in this Recommendation but outside the rated operating conditions of the instrument.

T.5.2 Rated operating conditions

Conditions of use which give the ranges of the influence quantities for which the metrological characteristics are intended to lie within the specified maximum permissible errors.

T.5.3 Reference conditions

Set of specified values of influence factors fixed to ensure valid intercomparison of the results of measurements. *[VIM 5.7]*

T.5.4 Performance

Ability of the measuring instrument to accomplish its intended functions.

T.6 TESTS

T.6.1 Material test

Test carried out on a complete leather-measuring instrument using the type of leather material which it is intended to measure.

T.6.2 Simulation test

Test carried out on a complete measuring instrument or part of an instrument in which any part of the measurement operation is simulated.

T.6.3 Performance test

Test to verify whether the equipment under test (EUT) is able to accomplish its intended functions.

1 GENERAL

1.1 Scope

This Recommendation specifies the requirements and test methods for instruments that are used for determining the area of leathers, hereafter called "leather-measuring instruments".

It provides standardized requirements and test procedures to evaluate the metrological and technical characteristics of a leather-measuring instrument in a uniform and traceable way.

1.2 Application

This Recommendation applies only to leather-measuring instruments that are used for commerce and trade.

1.3 Terminology

The terminology given on pages 5 to 8 shall be considered as part of this Recommendation.

2 METROLOGICAL REQUIREMENTS

2.1 Accuracy class

The accuracy class, X(x) shall be specified in accordance with the maximum permissible errors given in 2.2 and marked on the leather-measuring instrument in accordance with the descriptive markings given in 3.9.

Accuracy classes for leather-measuring instruments shall be specified for intended usage, i.e. nature of the leather material to be measured, method of measurement and operating conditions.

Note: The use of accuracy classes for certain applications may be determined by national prescription.

2.2 Maximum permissible errors (MPE)

2.2.1 Maximum permissible deviation (MPD)

The instrument for measuring the area of leathers shall have a specified accuracy class X(x) determined at initial verification for which the maximum permissible deviation of the mean from the conventional true value shall not be more than the greater of the following two values:

a) the smallest scale interval of the instrument;

b) the value calculated according to Table 1 multiplied by the class designation factor (x).

The value of (x) shall be 1×10^k, 2×10^k, 5×10^k, k being a positive or negative whole number or zero.

Table 1

Maximum permissible deviation from the conventional true value (%)	
Initial verification	In-service inspection
± 1 %	± 2 %

2.2.2 Repeatability error (*R*)

The repeatability error of area measurements at any value within the measuring range shall not be more than the greater of the following two values:

a) the smallest scale interval of the leather-measuring instrument;

b) the value calculated according to Table 1.

2.2.3 Reproducibility error

The uncertainty of measurement of the total area of a parcel of leather shall be less than:

- ± 2 % for firm leathers;
- ± 3 % for soft leathers.

2.2.4 Maximum permissible error for influence factor tests

The maximum permissible error for any measurement during influence factor tests is ± 1 d.

2.3 Influence factors

Refer to Annex A for test conditions.

2.3.1 Temperature

2.3.1.1 Temperature limits

If no particular working temperature is stated in the descriptive markings of the leather-measuring instrument, then the instrument shall comply with the appropriate metrological and technical requirements at temperatures from:

– 5 °C to + 40 °C.

2.3.1.2 Special temperature limits

For special applications the limits of the temperature range may differ from those given above. The temperature limits shall be marked on the instrument in accordance with the descriptive markings stated in 3.9.

2.3.2 Power supply

An electronic instrument shall comply with the appropriate metrological and technical requirements, if the supply voltage varies between the lower, U_{min} and upper, U_{max} values of the nominal voltage marked on the instrument:

- AC mains voltage supply: $U_{min} = U_{nom} - 15\ \%$, $U_{max} = U_{nom} + 10\ \%$
- DC mains power or battery voltage supply: U_{min} = lower operating limit

Note: The minimum operating voltage (U_{min}) is defined as the lowest possible operating voltage before the instrument is automatically switched off.

Battery-operated electronic instruments or instruments with external or plug-in voltage supply (AC or DC) shall either continue to function correctly or not indicate any area values if the voltage is below the manufacturer's specified value, the latter being larger or equal to the minimum operating voltage.

2.4 Units of measurement

The unit to be used on the instrument for measuring the area of leathers is the square decimetre (dm^2). The square foot (ft^2) may be used under national prescription. In this case 1 ft^2 shall be considered to be 9.29 dm^2.

2.5 Optical measuring devices

Instruments with measuring devices that are based on light techniques (e.g. light emitting diodes and photocells) shall comply with the appropriate metrological and technical requirements in accordance with 4.3.5 and shall be tested for compliance with the ambient light test in A.6.3.5.

3 TECHNICAL REQUIREMENTS

3.1 Suitability for use

Leather-measuring instruments shall be designed to suit the method of operation and the products for which they are intended. They shall be of adequately robust construction so that they maintain their metrological characteristics when properly installed and used in an environment for which they are intended.

3.2 Security of operation

3.2.1 Fraudulent use

Leather-measuring instruments shall have no characteristics likely to facilitate their fraudulent use.

3.2.2 Accidental maladjustment

Leather-measuring instruments shall be so constructed that an accidental breakdown or a maladjustment of control elements likely to disturb their correct functioning cannot take place without its effect being evident.

3.2.3 Security

Means shall be provided for securing components, interfaces, software devices and pre-set controls of leather-measuring instruments, to which unauthorized access is prohibited or is detected and made evident by an audit trail. National prescription may specify the security or sealing that is required.

3.2.4 Modifications and identification

Any modifications to the instruments or devices or software parts shall be such that they do not affect their correct functioning and their metrological characteristics. Modifications shall be identifiable and capable of being confirmed at verification.

3.2.5 Controls

Controls shall be so designed that they cannot normally come to rest in positions other than those intended by design, unless during the manoeuvre all indication is made impossible. Keys shall be marked unambiguously.

3.3 Indication of measurement results

Indication devices may be digital or analogue.

3.3.1 General

3.3.1.1 Quality of reading

The indication devices shall permit reliable, simple and unambiguous reading of the results under conditions of normal use:

- the overall accuracy of reading of an analogue indicating device shall not exceed 0.2 *d*;
- the figures forming the results shall be of a size, shape and clarity for reading to be easy.

The scales, numbering and printing shall permit the figures forming the results to be read by simple juxtaposition.

3.3.1.2 Form of the indication

Measuring results shall be expressed with the name or symbol of the unit of area, dm^2, or in accordance with 2.4.

All indicating and printing devices of leather-measuring instruments shall, within any one measurement range, have the same scale interval for any given area.

Digital indication shall display at least one figure, beginning at the extreme right.

3.3.1.3 Scale interval (*d*)

The value of area scale intervals shall be in the form 1×10^k, 2×10^k or 5×10^k, where k is a positive or negative whole number, or zero.

3.3.2 Analogue indicator

3.3.2.1 Indication index

The index of an indicator shall be symmetrical about the scale marks with which it is associated. The index shall not obscure the shortest scale marks and the end of the scale marks shall be of a constant thickness.

3.3.2.2 Rotating index

For a leather-measuring instrument with an indicator consisting of a fixed circular scale and a rotating index the direction of rotation of this index shall be clockwise for increasing area.

3.3.2.3 Reading aperture

For analogue indicators that are viewed through an aperture, the width of the aperture measured in the direction of travel of the indicator shall allow the visibility of the numbers of at least two numbered scale marks at all times.

3.3.2.4 Form and size of scale marks

The scale marks on an analogue indicating device shall be straight lines, evenly spaced at a minimum of 2 mm and of uniform width.

3.3.2.5 Parallax

The distance between the dial and the index shall not exceed the width of the scale spacing.

3.4 Zero-setting devices

Leather-measuring instruments shall be provided with a device for resetting the indications to zero. The device may be:

- nonautomatic;
- semi-automatic;
- automatic.

3.4.1 Control of zero-setting devices

Zero-setting shall only be possible when there is no leather material in the measuring area. Either this condition shall be met automatically for each measurement, or the zero indication shall be prevented.

An automatic zero-setting device may operate at the start of automatic operation or as part of every automatic measurement cycle. A description of the operation of the automatic zero-setting device should be included in the type approval certificate.

Nonautomatic zero-setting devices shall not be operable during automatic operation.

3.4.2 Accuracy of zero-setting

Zero-setting devices shall be capable of setting to an accuracy of:

- zero for digital indicators;
- the greater of the following two values for analogue indicators:
  a) 1.0 dm^2;
  b) 0.25 *d*.

3.5 Totalizing indicator

Instruments for measuring the area of leathers may be equipped with a totalizing device for indicating the total value of the different areas measured successively provided that the totalized value is identified by a special word or symbol. All totals shall be the algebraic sums of all values indicated.

3.6 Printing device

A printing device may be connected to an indicator.

Printing shall be clear and permanent for the intended use. Printed figures shall be at least 2 mm high.

If printing takes place, the name or the symbol of the unit of measurement shall be either to the right of the value or above a column of values.

3.7 Installation

In general, instruments for measuring the area of leathers shall be installed so as to keep the effects of the installation environment on the measurement results to a minimum.

Where particular details of installation may have an effect on the measurement operation (e.g. variations in moisture content of the atmosphere, conveyor speed) these details shall be recorded in the type approval certificate.

3.8 Sealing

3.8.1 General

Components that are not intended to be adjusted or removed by the user shall be fitted with a sealing device or shall be enclosed. When enclosed, it shall be possible to seal the enclosure. However, other types of sealing are permitted which provide sufficient integrity, e.g. electronic or mechanical seals.

The seals shall, in all cases, be easily accessible.

Sealing shall be provided on all parts of the measuring system which cannot be materially protected in any other way against operations liable to affect the measurement accuracy.

Any device for changing the parameters of measurement results, particularly for correction and conversion, shall be sealed.

3.8.2 Electronic sealing devices

When access to parameters that contribute to the determination of results of measurement is not protected by mechanical sealing devices, the protection shall fulfill the following provisions:

a) access shall only be allowed to authorized people, e.g. by means of a code (key-word) or of a special device (hard key, etc.); the code must be changeable;

b) it shall be possible for at least the last intervention to be memorized; the record shall include the date and a means of identifying the authorized person making the intervention (see (a) above).

3.8.3 Mechanical sealing devices

Mechanical seals shall be easily affixed without affecting the metrological properties of the leather-measuring instrument. Mechanical means include those where access to an electronic means of changing the parameters (for example via a keyboard) is prohibited by a mechanical seal.

3.9 Descriptive markings

Leather-measuring instruments shall bear the following mandatory markings at each location having an area indicating or printing device.

3.9.1 Markings shown in full

- name or identification mark of the manufacturer;
- name or identification mark of the importer (if applicable);
- date of manufacture of the leather-measuring instrument;
- serial number and type designation of the instrument;
- temperature range (if applicable, see 2.3.1) in the form: …. °C / …. °C;
- electrical supply voltage in the form: …. V;
- electrical supply frequency in the form: …. Hz.

3.9.2 Markings shown in code

- type approval sign;
- indication of the accuracy class in the form X(x) = ...;
- scale interval (if applicable) in the form: d = ... dm^2;
- maximum area in the form: A_{max} = ... dm^2;
- minimum area in the form: A_{min} = ... dm^2.

3.9.3 Supplementary markings

Depending upon the particular use of the leather-measuring instrument, supplementary markings may be required to specify certain operating conditions, for example:

- special temperature range;
- types of leather material that can be measured on the instrument;
- whether the leather material has to be located in a particular position;
- any limitations on the surface characteristics of the leather material being measured.

3.9.4 Presentation of descriptive markings

Descriptive markings shall be indelible and of a size, shape and clarity that permit legibility under normal conditions of use of the instrument.

Descriptive markings may be shown in an official language in accordance with national regulation.

Markings shall be grouped together in a clearly visible place on the instrument, either on a descriptive plate fixed near the indicating device or on the indicating device itself.

It shall be possible to seal the plate bearing the markings, unless it cannot be removed without being destroyed.

The descriptive markings may be shown on a programmable display which is controlled by software. In this case, means shall be provided for any access to reprogramming of the markings to be automatically and non-erasably recorded and made evident by an audit trail, e.g. by traceable access software such as an event logger providing an information record of the changes, or an event counter providing a non-resettable counter of changes.

3.10 Verification mark

A place shall be provided for the application of a verification mark. This place shall:

- allow easy application of the mark without changing the metrological properties of the instrument;
- be such that the part on which it is located cannot be removed from the instrument without damaging the marks; and
- be visible without the instrument or its protective covers having to be removed.

4 REQUIREMENTS FOR ELECTRONIC INSTRUMENTS

The type of an electronic instrument is presumed to comply with the following general requirements if it passes the examination and tests specified in Annex A, and all other applicable requirements of this Recommendation.

4.1 General requirements

4.1.1 Rated operating conditions

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

4.1.2 Disturbances

Electronic instruments shall be so designed and manufactured that when exposed to disturbances, either:

a) significant faults do not occur, i.e. the difference between the indication due to the disturbance and the indication without the disturbance (intrinsic error) does not exceed the value specified in T.4.6; or

b) significant faults are detected and acted upon.

Note: A fault equal to or less than the value specified in T.4.6 (1 d) is allowed irrespective of the value of the error of indication.

4.1.3 Durability

The requirements in 4.1.1 and 4.1.2 shall be met durably in accordance with the intended use of the instrument.

4.1.4 Evaluation for compliance

A type of an electronic weighing instrument is presumed to comply with the requirements in 4.1.1, 4.1.2 and 4.1.3 if it passes the examination and tests specified in Annex A.

4.2 Application

The requirements in 4.1.2 may be applied separately to:

a) each individual cause of significant fault; and/or

b) each part of the electronic instrument.

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

4.3 Functional requirements

4.3.1 Acting upon a significant fault

When a significant fault has been detected, the electronic instrument shall either be made inoperative automatically, or a visual or audible indication shall be provided and shall continue until the user takes action or the fault disappears. For automatic instruments the instrument shall be inoperative immediately.

4.3.2 Indicator display test

If the failure of an indicator display element can cause a false area indication then the instrument shall have a display test facility which is automatically initiated at

switch-on of indication, e.g. indication of all the relevant signs of the indicator in their active and non-active states for a sufficient time to be easily observed by the operator.

4.3.3 Influence factors

An electronic instrument shall comply with the requirements of 2.3 and shall also comply with appropriate metrological and technical requirements at a relative humidity of 85 % at the upper limit of the temperature range.

4.3.4 Warm-up time

During the warm-up time of an electronic instrument, there shall be no indication or transmission of the measurement result and automatic operation shall be inhibited.

4.3.5 Light effects

An electronic instrument that is based on light techniques shall continue to function correctly and its metrological functions shall not be influenced by light variations within the manufacturer's specified levels or disturbances acting on the light device.

4.3.6 Interfaces

An electronic instrument may be equipped with an interface permitting the coupling of the instrument to external equipment.

An interface comprises all mechanical, electrical and software devices at the communication point between instruments, peripheral and software devices.

When an interface is used, the instrument shall continue to function correctly and its metrological functions shall not be influenced by the attached external equipment or software devices or by disturbances acting on the interface.

Functions that are performed or initiated via an interface shall meet the relevant requirements and conditions of Clause 3.

It shall not be possible to introduce into an electronic instrument, through an interface, functions, program modules or data structures intended to:

- display unclear data;
- falsify displayed, processed or stored measurement results; or to
- permit unauthorized adjustment of the instrument.

Other interfaces shall be secured in accordance with 3.2.3.

4.3.7 DC mains voltage or battery power supply

An instrument with a DC mains voltage or battery power supply shall either continue to function correctly or show a significant error or is automatically put out of service for any under-voltages or over-voltages.

4.4 Examination and tests

Examination and testing of electronic instruments is intended to verify compliance with the applicable requirements of this Recommendation and with the requirements of Clause 4.

4.4.1 Examinations

An electronic instrument shall be examined to obtain a general appraisal of its design and construction.

4.4.2 Performance tests

An electronic instrument or electronic device, as appropriate, shall be tested as specified in Annex A to determine the correct functioning of the instrument.

Tests are to be carried out 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 electronic devices shall be tested, where possible as a simulated instrument including all electronic elements of a system which can affect the measurement result. In addition, an examination shall be carried out on the fully operational instrument.

Susceptibility that would result from the use of electronic interfaces to other equipment shall be simulated in the tests.

4.4.3 Span stability

When an electronic instrument is subjected to the span stability test specified in A.7, the absolute value of the difference between the errors obtained for any two measurements shall not exceed half the maximum permissible error for influence factor tests.

5 METROLOGICAL CONTROLS

5.1 General

The metrological controls of leather-measuring instruments shall consist of:

- type approval;
- initial verification; and
- in-service inspection.

Tests should be applied uniformly by the metrology services and should form a uniform program. Guidance for the conduct of type approval and initial verification is provided in OIML International Documents D 19 [1] and D 20 [2] respectively.

5.2 Type approval

5.2.1 Documentation

The application for type approval shall include documentation comprising:

- metrological characteristics of the instrument;
- a set of specifications for the instrument;
- a functional description of the components and devices;
- drawings, diagrams and general software information (if applicable), explaining the construction and operation, including interlocks; and
- any document or other evidence that the design and construction of the instrument comply with the requirements of this Recommendation.

Note: Adherence to requirements for which no test is available, such as software-based operations, may be demonstrated by a specific declaration of the manufacturer (e.g. for interfaces as specified in 4.3.6, and for password protected access to prevent unauthorized access in accordance with 3.2.3).

5.2.2 General requirements

Type evaluation shall be carried out on one or more measuring instruments that represent the definitive type. The instrument to be subjected to performance testing shall be as specified in 4.4.2. In addition, the constituent parts of a measuring system, mainly, but not limited to, those listed below, and sub-systems that may include more than one of these elements, may be subject to separate type approval:

- electronic calculator (including the indicating device);
- conversion and correlation devices (i.e. digital recorders, gain switch, etc.);
- devices providing or memorizing measurement results (i.e. measuring wheels, photocells, etc.);
- printer.

The evaluation shall consist of the tests specified in 5.2.3.

5.2.3 Type evaluation

The submitted documents shall be examined and tests carried out to verify that the leather-measuring instrument complies with:

- the metrological requirements in Clause 2;
- the appropriate parts of the technical requirements in Clause 3; and
- the requirements in Clause 4 for electronic measuring instruments, where applicable.

The metrological authority shall:

- conduct the tests in a manner which prevents an unnecessary commitment of resources; and
- permit the results of these tests to be assessed for initial verification.

Note: The metrological authority is advised to accept, with the consent of the applicant, equivalent test data obtained from other metrological authorities without repeating the tests.

5.2.3.1 Type evaluation with template

The template used for type evaluation shall be representative of a product for which the leather-measuring instrument is designed. Templates (T.1.8) of a specified area shall be used to determine the maximum permissible errors of the instrument. The tests shall be conducted in accordance with the test method in Clause 6.

5.2.3.2 Tests for influence factors

Influence factors shall be applied to the measuring instrument (or simulator during simulation tests) in a manner that will reveal a corruption of the measurement result of any measuring process to which the instrument may be subjected to, in accordance with:

- 2.3 for all instruments; and
- 4 for electronic instruments.

Maximum permissible errors for influence factor tests shall be apportioned in accordance with 5.2.3.3 to parts of the measuring instrument that are tested separately.

5.2.3.3 Apportioning of errors

Where parts of a measuring instrument are examined separately in the process of type approval, the following requirements apply:

The error limits applicable to a part which is examined separately are equal to a fraction P_i of the maximum permissible errors or the allowed variations of the indication of the complete instrument. The fractions for any part have to be taken for the same accuracy class as for the complete instrument incorporating the part.

The fractions P_i shall satisfy the following equation:

$$(P_1^2 + P_2^2 + P_3^2 + ...) \leq 1$$

The fraction P_i shall be chosen by the manufacturer of the part and shall be verified by an appropriate test. However, the fraction shall not exceed 0.8 and shall not be less than 0.3, when more than one part contributes to the effect in question.

If the metrological characteristics of any major component have been evaluated in accordance with the requirements of any OIML Recommendation, that approval shall be used to aid in the type approval if so requested by the applicant.

Note: As the requirements of this subclause only apply to the instrument submitted for type approval and not to those subsequently submitted for verification, the means by which it will be possible to determine whether the appropriate maximum permissible error or maximum allowable variation has been exceeded will be decided mutually between the metrological authority and the applicant. The means may be for example:

- the provision or adaptation of the indicating device to give the required resolution or appropriate increment or scale interval; or
- any other means mutually agreed.

5.2.4 Provision of means for testing

For the purposes of testing, the metrological authority may require from the applicant the product (i.e. the leather material to be measured), the leather-measuring measurement instrument and the personnel to perform the tests.

5.2.5 Place of testing

Measuring instruments submitted for type approval may be tested either:

- on the premises of the metrological authority to which the application has been submitted; or
- in any other suitable place mutually agreed between the metrological authority concerned and the applicant.

5.2.6 Type approval certificate

The following information shall appear on the type approval certificate:

- name and address of the recipient of the approval certificate;
- name and address of the manufacturer, if it is not the recipient;
- type designation (i.e. electronic conveyor or electronic pinwheel);
- metrological and technical characteristics;
- type approval mark;
- information on the location of marks for type approval, initial verification and sealing (for example, pictures and drawings); and
- a list of documents which accompany the type approval certificate.

The type approval certificate shall state the accuracy class as determined for the influence factor tests.

5.3 Initial verification

5.3.1 General

Leather-measuring instruments shall be examined for conformity with the approved type where applicable and shall be tested for compliance with Clause 2 (excluding 2.2.4) and Clause 3 for the intended products and corresponding accuracy classes as stated in the type approval certificate and when operated under normal conditions of use.

Tests shall be carried out by the metrological authority, in-situ, with the leather-measuring instrument fully assembled and fixed in the position in which it is intended to be used.

The installation of the leather-measuring instrument shall be so designed that an automatic measuring operation will be the same whether for the purposes of testing or for use for a transaction.

5.3.2 Initial verification

In-situ verification tests shall be done:

- in accordance with the descriptive markings given in 3.9;
- under the normal conditions and with the products for which the instrument is intended; and
- in accordance with the test method in Clause 6.

5.3.3 Conduct of the tests

The metrological authority:

- shall conduct the tests in a manner which prevents an unnecessary commitment of resources; and
- may, where appropriate and to avoid duplicating tests previously done on the instrument for type approval under 5.2.3, use the test results from type approval for initial verification.

5.3.4 Determination of accuracy class

The metrological authority shall:

- apply the accuracy class requirements for the tests in accordance with the appropriate parts of 2.2 for initial verification; and
- verify that the accuracy classes marked in accordance with 3.9 are equal to the accuracy class determined as above.

Note: The accuracy class that was achieved at type approval stage may not be achieved at initial verification if the leather used is significantly less stable or of different dimensions. In this case a lower accuracy class shall be marked in accordance with 2.2 and 3.9.2. Marking of a higher accuracy class than was achieved at the type approval stage is not permitted.

5.4 Subsequent verification

Subsequent verification shall be carried out in accordance with the same provisions as in 5.3 for initial verification, with the exception of the second bullet of 5.3.3.

5.5 In-service inspection

In-service inspection shall be as specified in 5.3 for initial verification.

The maximum permissible errors shall be as specified in 2.2 for in-service inspection.

6 TEST METHOD

6.1 Verification of leather-measuring instruments with templates

6.1.1 Templates

Templates subjected to an independent verification method; i.e. quality-tested certificate of the templates by a metrologically competent organization (e.g. weights and measures department) shall be used for the verification tests.

6.1.2 Material and shape of templates

Shall be as specified in T.1.8.

6.2 Test

The test shall be carried out using templates of a specified area (or of the same order of magnitude as the leather materials to be measured at, or near to, the maximum limit and also at, or near to, the minimum limit of the measuring range of the instrument.

For large pieces of leather the template shall be at least 15 % of the area of the leather material to be measured.

6.2.1 Test conditions

All tests shall be conducted with any adjustable parameter critical to metrological integrity, e.g. conveyor speed, set to the standard operating conditions.

Before a test is conducted and without a template on the instrument, the instrument shall be in a zero or ready condition. The template shall be placed in accordance with the manufacturer's instructions or as specified in 6.2.2.1.

6.2.2 Test procedure

6.2.2.1 Presentation of template to the instrument

The template shall be presented to the active measuring zone of the instrument laid out as flat as can be achieved and without creases and folds at the point of area measuring. The template shall be fed at different points across the face of the conveyor of the instrument to ensure that all the active face of the leather-measuring instrument is verified.

6.2.2.2 Number of measurement tests

Each template shall undergo at least ten measurement tests.

6.2.2.3 Range of measurement tests

The measurement tests shall be carried out over the measuring range that the instrument is required to be approved for.

6.3 Mean area error (T.4.8)

For each measured template, calculate the deviation of the mean value for a number of consecutive area measurements from the conventional true value of the template area.

6.4 Maximum permissible deviation of the mean

For each measured template, calculate the difference between the mean of the indicated areas and the conventional true value of the template area, which shall not exceed the maximum permissible deviation specified in 2.2.1.

6.5 Reproducibility

The reproducibility error of the total area of a parcel of leather shall be as specified in 2.2.3.

7 MEASURING THE AREA OF LEATHERS

Clause 6 identifies the method of verification for all instruments for measuring the area of leathers and can be considered universally applicable. A wide range of instruments in commerce and trade can be manufactured and verified to meet the requirements in this Recommendation using Clauses 1 to 6.

However, these instruments are not automatically verified for measurement for every different type of leather because of their leather characteristics of softness, flexibility and the inability to be presented flat for measurement. The manner of presentation of the leather to the instrument will affect the recorded area. Some leathers are not materially similar to the template.

Where a high quality certified mechanical pinwheel is available this can be used as a reference instrument for the calibration and operation of leather-measuring instruments provided that the conditions for the correct operation of the mechanical pinwheel as specified in the "Code of Practice for the area measurement of leather by the mechanical pinwheel", [16], and the requirements for measurement of area, given in ISO 11646 (1993) [17], are adhered to.

ANNEX A

TEST PROCEDURES

(Mandatory)

Meaning of symbols:

I	=	Indication
R	=	Repeatability error
d	=	Scale interval
MPE	=	Maximum permissible error
MPD	=	Maximum permissible deviation
EUT	=	Equipment under test
A_{max}	=	Maximum area
A_{min}	=	Minimum area
A_{total}	=	Total area of a parcel of two or more leather pieces

A.1 EXAMINATION FOR TYPE APPROVAL

A.1.1 Documentation (5.2.1)

Review the documentation that is submitted, including necessary photographs, drawings, diagrams, general software information, relevant technical and functional description of main components, devices, etc. to determine if it is adequate and correct. Consider the operational manual.

A.1.2 Comparing construction with documentation

Examine the various devices of the measuring instrument to ensure compliance with the documentation.

A.1.3 Technical requirements

Examine the instrument for conformity with the technical requirements according to the checklist in the Test Report Format (see OIML R 136-2).

A.2 EXAMINATION FOR INITIAL VERIFICATION

A.2.1 Compare construction with documentation (5.2.1)

Examine the instrument for conformity with the approved type.

A.2.2 Descriptive markings (3.9)

Check the descriptive markings according to the checklist in the Test Report Format.

A.2.3 Verification marks (3.10) and sealing devices (3.8)

Check the arrangement for verification marks and sealing according to the checklist given in the Test Report Format.

A.3 GENERAL TEST REQUIREMENTS

A.3.1 Power supply

Power-up the equipment under test (EUT) for a time period equal to or greater than the warm-up time specified by the manufacturer and maintain the EUT energized for the duration of each test.

A.3.2 Zero-setting

Adjust the EUT as closely as practicable to zero prior to each test, and do not readjust it at any time during the test, except to reset it if a significant fault has been indicated.

Certain tests require the automatic zero-setting devices to be in operation (or not in operation). Where there is no specific requirement to this effect, the automatic zero-setting devices shall be switched off. When this is done it should be mentioned in the test report.

A.3.3 Reference conditions

The tests shall be performed at a steady ambient temperature, usually normal room temperature unless otherwise specified. The temperature is deemed to be steady when the differences between the extreme temperatures noted during the test do not exceed one-fifth of the temperature range of the instrument without being greater than 5 °C, and the rate of change does not exceed 5 °C per hour.

The handling of the instrument shall be such that no condensation of water occurs on the instrument.

A.4 TEST PROGRAM

A.4.1 Type approval (5.2)

Clauses A.1 and A.5 to A.8 shall normally be applied for type approval.

A.4.2 Initial verification (5.3)

Clauses A.2 and A.8 shall be applied for initial verification.

A.5 TEST FOR ZERO-SETTING (3.4)

A.5.1 General

Zero-setting may be by more than one mode, for example, nonautomatic, semi-automatic and or automatic.

It is normally only necessary to test the accuracy of zero-setting in one mode if it is clear that the same process is used for each mode. To test automatic zero-setting it is necessary to allow the instrument to operate through the appropriate part of the automatic cycle and then to halt the instrument before testing.

A.5.2 Accuracy of zero-setting (3.4.2)

1) Check that there is no leather material in the measurement area.

2) Initiate the zero-setting mode of the instrument, e.g. switching the instrument on and off.

3) For electronic indicators verify that the indication on the instrument is showing zero.

4) For analogue indicators verify that the indication does not exceed the value specified in 3.4.2.

A.6 INFLUENCE FACTOR AND DISTURBANCE TESTS

A.6.1 Test conditions

A.6.1.1 General requirements

Influence factor and disturbance tests specified in 4.3.3 and 4.1.2 are intended to verify that electronic instruments can perform and function as intended in the environment and under the conditions specified. Each test indicates, where appropriate, the reference condition under which the intrinsic error is determined.

When the effect of one influence factor is being evaluated, all other factors are to be held relatively constant, at a value close to normal. After each test the instrument shall be allowed to recover sufficiently before the following test.

Where parts of the measuring instrument are examined separately, errors shall be apportioned in accordance with details given in 5.2.3.3.

The operational status of the measuring instrument or simulator shall be recorded for each test.

The applicant for type approval may define specific environmental conditions for the intended use of the instrument in the documentation supplied to the metrological authority. In this case the metrological authority carries out the tests at severity levels corresponding to these specific environmental conditions. If type approval is granted the data plate shall indicate the corresponding limits of uses. Conditions of use for which the instrument is to be approved shall be provided by the manufacturer. The metrological authority shall verify that the conditions of use are met.

When the measuring instrument is connected in other than a normal configuration, the procedure shall be mutually agreed on by the approving authority and the applicant.

A.6.1.2 Simulated tests

A.6.1.2.1 General

The tests may be conducted by simulating any part of the measurement to determine the effect of influence factors and disturbance.

The simulator for influence factor and disturbance tests should include all electronic devices of the measuring system.

A.6.1.2.2 Interfaces (4.3.6)

Susceptibility that would result from the use of electronic interfaces to other equipment shall be simulated in the tests. For this purpose it is sufficient to connect 3 m of interface cable terminated to simulate the interface impedance of the other equipment.

A.6.1.2.3 Documentation

Simulators shall be defined in terms of hardware and functionality by reference to the instrument under test, and by any other documentation necessary to ensure reproducible test conditions.

This information shall be attached to, or be traceable from the test report.

A.6.2 Influence factor tests (2.3)

Table 2 – Summary of influence factor tests

§	Test	Instrument characteristics			Condition applied
		Mechanical measuring device	Optical measuring device	DC or battery power supply	
A.6.2.1	Static temperatures	✓	✓	✓	MPE*
A.6.2.2	Damp heat, steady state	✓	✓	✓	MPE
A.6.2.3	AC mains voltage variation	✓	✓		MPE
A.6.2.4	DC mains or battery power supply voltage variation	✓	✓	✓	MPE

*as specified in 2.2.4

A.6.2.1 Static temperatures (2.3.1)

Static temperature tests are carried out according to basic standard IEC Publication 60068-2-1 [3], IEC Publication 60068-2-2 [4] and IEC 60068-3-1 [5] and according to Table 3.

Table 3 – Temperature tests

Environmental phenomena	Test specification	Test set-up
Temperature	Reference of 20 °C	IEC 60068-2-1 IEC 60068-2-2 IEC 60068-3-1
	Specified high for 2 hours	
	Specified low for 2 hours	
	Temperature of – 5 °C	
	Reference of 20 °C	
Note: Use IEC 60068-3-1 for background information.		

Supplementary information to the IEC test procedures:

Object of the test:	To verify compliance with the provisions given in 2.3.1 under conditions of high temperature.
Test procedures in brief	
Precondition:	None required.
Area measurement test:	At least two different measurements including A_{max} and A_{min}.
Condition of the 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 zero-setting functions shall be enabled as for normal operation. The EUT shall not be readjusted at any time during the test.
Temperature sequence:	Reference temperature of + 20 °C Specified high of + 40 °C Specified low of – 5 °C Reference temperature of + 20 °C
Stabilization:	2 hours at each temperature under "free air" conditions after the EUT is stabilized.
Number of test cycles:	One cycle.
Measuring test:	After stabilization at the reference temperature and again at each specified temperature conduct the following: Adjust the EUT as close to zero indication as practicable. It is important to ensure that the test result is unaffected by the automatic zero-setting function which should therefore be disabled. The EUT shall be tested for at least two different measurements including A_{max} and A_{min}. Record the following data: a) date and time; b) temperature; c) relative humidity; d) measurement indications; e) errors; f) functional performance.
Maximum allowable variations:	All functions shall operate as designed. All errors shall be within the maximum permissible errors specified in 2.2.4.

A.6.2.2 Damp heat, steady state (4.3.3)

Damp heat, steady state tests are carried out according to basic standard IEC Publication 60068-2-78 [6] and IEC Publication 60068-3-4 [7] and according to Table 4.

Table 4 – Damp heat, steady state

Environmental phenomena	Test specification	Test set-up
Damp heat, steady state	Reference of 20 °C Upper limit temperature and relative humidity of 85 % for 48 hours	IEC 60068-2-78 IEC 60068-3-4
Note: Use IEC 60068-3-4 for background information.		

Supplementary information to the IEC test procedures:

Object of the test:	To verify compliance with the provisions given in 4.3.3 under conditions of high humidity and constant temperature.
Test procedures in brief	
Precondition:	None required.
Area measurement test:	A complete measurement as specified in 6.2.2.3.
Condition of the 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 zero-setting functions shall be enabled as for normal operation. The EUT shall not be readjusted at any time during the test. The handling of the EUT shall be such that no condensation of water occurs on the EUT.
Temperature/ humidity sequence:	Reference temperature at 50 % relative humidity. Upper limit temperature at 85 % humidity. Reference temperature at 50 % relative humidity.
Stabilization:	3 hours at reference temperature and 50 % humidity. 48 hours at the upper limit temperature.
Number of test cycles:	At least one cycle.
Measuring test:	After stabilization of the EUT at reference temperature and 50 % humidity apply the measurement. Record the following data: a) date and time; b) temperature; c) relative humidity; d) measurement indications; e) errors. Increase the temperature in the chamber to the specified upper limit and increase the relative humidity to 85 %. Repeat the test measurement. Allow full recovery of the EUT before any other tests are performed.
Maximum allowable variations:	All functions shall operate as designed. All errors shall be within the maximum permissible errors specified in 2.2.4.

A.6.2.3 AC mains voltage variation (2.3.2)

AC mains voltage variation tests are carried out according to basic standard IEC Publication 61000-2-1 [8] and IEC Publication 61000-4-1 [9] and according to Table 5.

Table 5 – AC mains voltage variation tests

Environmental phenomena	Test specification	Test set-up
Voltage variation	Nominal voltage $U_{max} = U_{nom} + 10\ \%$ $U_{min} = U_{nom} - 15\ \%$ Nominal voltage	IEC 61000-2-1 IEC 61000-4-1
Note: The nominal voltage is the value marked on the measuring instrument.		

Supplementary information to the IEC test procedures:

Object of the test:	To verify compliance with the provisions given in 2.3.2 under conditions of AC mains voltage variations.
Test procedures in brief	
Precondition:	None required.
Area measurement test:	A complete or part measurement as specified in 6.2.2.3.
Condition of the EUT:	Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. The zero-setting functions shall be enabled as for normal operation. Adjust the EUT as close to zero indication as practicable, prior to the test and after applying each level of voltage.
Number of test cycles:	At least one cycle.
Measuring test:	The EUT shall be subjected to the required measuring test at the upper and lower voltage limits. Zero-setting function shall be in operation.
Measuring test:	Stabilize the power supply at the reference voltage within the defined limits and apply the measurement test. Record the following data: a) date and time; b) temperature; c) power supply voltage; d) measurement indications (as applicable); e) errors; f) functional performance. Repeat the measurement test for each of the voltages defined in IEC 61000-4-11 in section 5 and record the indications.
Maximum allowable variations:	All functions shall operate as designed. All errors shall be within the maximum permissible errors specified in 2.2.4.

A.6.2.4 DC mains or battery power (internal) supply voltage variation (2.3.2 and 4.3.7)

Electronic instruments with DC mains or battery power supply shall fulfill the tests in A.6.2, with the exception of A.6.2.3 which is to be replaced by the test according to basic IEC Publication 60654-2 [10] and according to Table 6.

Table 6 – DC mains voltage or battery power supply voltage variations

Environmental phenomena	Test specification	Test set-up
DC mains or battery voltage variation	Nominal voltage	IEC 60654-2
	U_{max}	
	U_{min}	
Note: U_{min} and U_{max} are the DC levels at which the instrument has been manufactured to automatically detect low and high level conditions respectively.		

Supplementary information to the IEC test procedures:

Object of the test:	To verify compliance with the provisions in 2.3.2 under conditions of DC mains or battery power voltage supply variations.
Test procedure in brief:	The test consists of exposure to the specified power supply condition for a period sufficient for achieving stability and for performing the required measurements.
Test severity:	Tests performed at voltage levels between the minimum and maximum operating voltages of the nominal voltage marked on the instrument.
Preconditioning:	None.
Condition of the EUT:	Normal power supplied and “on” for a time period equal to or greater than the warm-up time specified by the manufacturer. The zero-setting functions shall be enabled as for normal operation. Adjust the EUT as close to zero indication as practicable, prior to the test and after applying each level of voltage.
Number of test cycles:	At least one cycle.
Measuring test:	After stabilization of the EUT perform one small measurement test and record the following: a) date and time; b) temperature; c) supply voltage; d) indications (as applicable); e) errors; f) functional performance at defined voltages. Reduce the power voltage to the EUT until the instrument ceases to function properly according to the specifications and metrological requirements, and record the indications.
Maximum allowable variations:	All functions shall operate as designed. All errors shall be within the maximum permissible errors specified in 2.2.4.

A.6.3 Disturbance tests (4.1.2)

Table 7 – Summary of disturbance tests

§	Test	Instrument characteristics			Condition applied
		Mechanical measuring device	Optical measuring device	DC or battery power supply	
A.6.3.1	Short time power reduction	✓	✓		Significant fault(*)
A.6.3.2	Electrical bursts	✓	✓		Significant fault
A.6.3.3	Electrostatic discharge	✓	✓	✓	Significant fault
A.6.3.4	Electromagnetic susceptibility	✓	✓	✓	Significant fault
A.6.3.5	Ambient light test		✓		Significant fault

(*) as specified in T.4.6

A.6.3.1 Short time power reduction

Short time power reduction (voltage dips and short interruptions) tests are carried out according to basic standard IEC Publication 61000-4-11 [11] and according to Table 8.

Table 8 – Short time power reduction tests

Environmental phenomena	Test specification	Test set-up
Voltage dips and short interruptions	Interruption from reference voltage to zero voltage for one half cycle. Interruption from reference voltage to 0 % of reference voltage for two half cycles. These mains voltage interruptions shall be repeated ten times with a time interval of at least 10 seconds.	IEC 61000-4-11
The reference voltage (rated voltage) shall be as defined in section 5. Refer to [11] for specific parts of the IEC test.		

Supplementary information to the IEC test procedures:

Object of the test:	To verify compliance with the provisions given in 4.1.2 under conditions of short mains voltage interruptions and reductions while observing the indication of one measurement.
Test procedures in brief	
Precondition:	None required.
Condition of the EUT:	The test consists of exposure to the specified power supply condition for a period sufficient for achieving temperature stability and for performing measurements (i.e. 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. Zero-setting functions shall not be in operation. Not to be adjusted or readjusted at any time during the test except the reset if a significant fault has been indicated.
Number of test cycles:	At least one cycle.
Measuring test:	One measurement within the measuring range. Stabilize all factors at nominal reference conditions. Conduct the measurement and record the following data: a) date and time; b) temperature; c) power supply voltage; d) measurement indications; e) errors; f) functional performance. Interrupt the power supply to zero voltage for a period equal to one half cycle and conduct the test as detailed in IEC 61000-4-11 section 8.2.1. During interruption observe the effect on the EUT and record as appropriate. Reduce the power supply to 0 % of nominal voltage for a period equal to two half cycles and conduct the test as detailed in IEC 61000-4-11 section 8.2.1 during reductions observe the effect on the EUT and record, as appropriate.
Maximum allowable variations:	The difference between the indication due to the disturbance and the indication without the disturbance either shall not exceed the significant fault value as specified in T.4.6, or the EUT shall detect and act upon a significant fault.

A.6.3.2 Electrical bursts (fast transient tests)

Electrical bursts tests (fast transient tests) are carried out according to basic standard IEC 61000-4-4 [12] for 2 minutes with a positive polarity and for 2 minutes with a negative polarity and according to Tables 8.1 and 8.2.

Table 8.1 – Ports for signal lines and control lines

Environmental phenomena	Test specification	Test set-up
Fast transient common mode	0.5 kV (peak) 5/50 ns T_1 / T_h 5 kHz repetition frequency	IEC 61000-4-4
Note: Applicable only to ports or interfacing with cables whose total length may exceed 3 m according to the manufacturer's functional specification.		

Table 8.2 – Input and output AC and DC power ports

Environmental phenomena	Test specification	Test set-up
Fast transient common mode	1 kV (peak) 5/50 ns T_1 / T_h 5 kHz repetition frequency	IEC 61000-4-4
Note: DC power ports, not applicable to battery-operated instrument that cannot be connected to the mains while in use.		

A coupling/decoupling network shall be applied for testing AC power ports.

Supplementary information to the IEC test procedures:

Object of the test:	To verify compliance with the provisions given in 4.1.2 under conditions where electrical bursts (fast transients) are superimposed on the mains voltage while observing the indication of the measurement.
Test procedures in brief Precondition:	None required.
Condition of the 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. Reset the EUT if a significant fault has been indicated.
Stabilization:	Before any test stabilize the EUT under constant environmental conditions.
Measuring test:	Conduct one measurement and record the following with and without the transients: a) date and time; b) temperature; c) power supply voltage; d) measurement indications; e) errors; f) functional performance.
Maximum allowable variations:	The difference between the indication due to the disturbance and the indication without the disturbance either shall not exceed the significant fault value as specified in T.4.6, or the instrument shall detect and act upon a significant fault.

A.6.3.3 Electrostatic discharge

Electrostatic discharge tests are carried out according to basic standard IEC 61000-4-2 [13], with test signals and conditions as given in Table 9.

Table 9 – Electrostatic discharge tests

Environmental phenomena	Test specification	Test set-up
Electrostatic discharge	8 kV air discharge 6 kV contact discharge	IEC 61000-4-2
Note: The 6 kV contact discharge shall be applied to conductive accessible parts. Metallic contacts e.g. in battery compartments or in socket outlets are excluded from this requirement.		

Contact discharge is the preferred test method. 20 discharges (10 with positive and 10 with negative polarity) shall be applied on each accessible metal part of the enclosure. The time interval between successive discharges shall be at least 10 seconds. In the case of a non conductive enclosure, discharges shall be applied on the horizontal or vertical coupling planes as specified in IEC 61000-4-2. Air discharges shall be used where contact discharges cannot be applied. Tests with other (lower) voltages than those given in Table 9 are not required.

Supplementary information to the IEC test procedures:

Object of the test:	To verify compliance with the provisions given in 4.1.2 under conditions where electrostatic discharges are applied while observing the indication of the measurement.
Test procedures in brief	
Precondition:	None required.
Condition of the 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. Reset the EUT if a significant fault has been indicated.
Stabilization:	Before any test stabilize the EUT under constant environmental conditions.
Measuring test:	Conduct one measurement and record the following with and without electrostatic discharge: a) date and time; b) temperature; c) power supply voltage; d) measurement indications; e) errors; f) functional performance.
Maximum allowable variations:	The difference between the indication due to the disturbance and the indication without the disturbance either shall not exceed the significant fault specified in T.4.6, or the instrument shall detect and act upon a significant fault.

A.6.3.4 Electromagnetic susceptibility

A.6.3.4.1 Radiated

Radiated, radio frequency electromagnetic susceptibility tests are carried out to IEC 61000-4-3 [14] and according to Table 10.

The modulated carrier of the test signal is adjusted to the indicated test value. To perform the test, the carrier is in addition modulated as specified.

Table 10 – Radiated electromagnetic susceptibility

Environmental phenomena	Test specification			
	Frequency ranges MHz	Severity levels (V/m)		Test set-up
		Residential, commercial and light industrial environment	Industrial environment	
Electromagnetic field of general origin	80 to 800 (1) 26 to 800 (2) 960 to 1400	3 V/m	10 V/m	IEC 61000-4-3
Electromagnetic field caused by digital radio telephones	800 to 960 1400 to 2000	10 V/m		IEC 61000-4-3
Modulation	80 % AM, 1 kHz sine wave			

Notes: (1) IEC 61000-4-3 only specifies test levels above 80 MHz. For frequencies in the lower range the test methods for conducted radio frequency disturbances are recommended (A.6.3.4.2).

(2) However, for EUT having no mains or other input port available the lower limit of the radiation test should be 26 MHz.

Supplementary information to the IEC test procedures:

Object of the test:	To verify compliance with the provisions given in 4.1.2 under conditions of specified electromagnetic fields applied while observing the indication of a measurement.
Test procedures in brief	
Precondition:	None required.
Condition of the 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. Reset the EUT if a significant fault has been indicated.

Stabilization:	Before any test stabilize the EUT under constant environmental conditions.
Measuring test:	Conduct the measurement and record the following with and without electromagnetic fields: a) date and time; b) temperature; c) power supply voltage; d) measurement indications; e) errors; f) functional performance.
Maximum allowable variations:	The difference between the indication due to the disturbance and the indication without the disturbance either shall not exceed the significant fault value in T.4.6, or the instrument shall detect and act upon a significant fault.

A.6.3.4.2 Conducted, radio frequency, electromagnetic fields

Conducted, radio frequency, electromagnetic field immunity tests are carried out according to IEC 61000-4-6 [15] and according to Table 11.

The modulated carrier of the test signal is adjusted to the indicated test value. To perform the test the carrier is in addition modulated as specified.

Table 11 – Conducted electromagnetic susceptibility

Environmental phenomena	Test specification			
	Frequency range MHz	Severity levels (e.m.f.)		Test set-up
		Residential, commercial and light industrial environment	Industrial environment	
Conducted electromagnetic field	0.15 to 80	3 V	10 V	IEC 61000-4-6
Modulation	80 % AM, 1 kHz sine wave			
This test is not applicable when the EUT has no mains or other input port.				

Coupling and decoupling devices shall be used for appropriate coupling of the disturbing signal (over the entire frequency range, with defined common-mode impedance at the EUT port) to the various conducting cables connected to the EUT.

Supplementary information to the IEC test procedures:

Object of the test:	To verify compliance with the provisions given in 4.1.2 under conditions of specified conducted electromagnetic fields while observing the indication of a measurement.
Test procedures in brief Precondition:	None required.
Condition of the 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. Reset the EUT if a significant fault has been indicated.
Stabilization:	Before any test stabilize the EUT under constant environmental conditions.
Measuring test:	Conduct the measurement and record the following with and without electromagnetic fields: a) date and time; b) temperature; c) power supply voltage; d) measurement indications; e) errors; f) functional performance.
Maximum allowable variations:	The difference between the indication due to the disturbance and the indication without the disturbance either shall not exceed the significant fault value specified in T.4.6, or the instrument shall detect and act upon a significant fault.

A.6.3.5 Ambient light test

Ambient light variation tests are carried out according to Table 12. There is no reference to standards for this test.

Table 12 – Light variations test

Environmental phenomena	Test severity level
Light variations	200 lx to 500 lx (reference) 100 lx 1000 lx to 1500 lx

Object of the test:	To verify compliance with the provisions given in 4.3.5.
Test procedures in brief	
Precondition:	None required.
Area measurement test	A complete measurement test as specified in 6.2.2.3.
Condition of the EUT:	Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. The zero-setting functions shall be enabled as for normal operation. If it has an automatic zero-setting function then the instrument should be set to zero after applying each level of illumination.
Number of test cycles:	At least one cycle.
Measuring test:	The EUT shall be tested at the severity levels of illumination specified in Table 12. The severity levels apply where the object to be measured is normally placed. The illumination can be measured with a photographic light meter (photometer) with the light detecting surface pointing towards the light source. The light source for the reference illumination can be the normal room lighting suitably dimmed. The light source for the other illumination can be a photographic slide projector with a halogen projection lamp. The angle of projection should be at approximately 45° to the axis of the light measurement transducer of the instrument. The specified levels of illumination can be achieved by placing the projector at different distances from the instrument. Other light sources can be used. Conduct the measurement and record the following: a) date and time; b) temperature; c) severity levels; d) indications; e) errors; f) functional performance.
Maximum allowable variations:	All functions shall operate as designed. The difference between the indication due to the disturbance and the indication without the disturbance either shall not exceed the significant fault value specified in T.4.6, or the instrument shall detect and act upon a significant fault.

A.7 SPAN STABILITY TEST (4.4.3)

Object of the test:	To verify compliance with the provisions given in 4.4.3 after the EUT has been subjected to the performance tests.
Reference to standard:	No reference to international standards are given.
Test procedure in brief:	The test consists of observing the variations of 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. The performance tests shall include the temperature test and, if applicable, the damp heat test. Other performance tests listed in this Annex may be performed. The EUT shall be disconnected from the mains power supply, or battery supply where fitted, two times for at least 8 hours during the period of the test. The number of disconnections may be increased if the manufacturer of the instrument specifies so or at the discretion of the approved authority in the absence of any such specification. In the conduct of this test, the operating instructions for the instrument as supplied by the manufacturer shall be considered. The EUT shall be stabilized at sufficiently constant ambient conditions after switch-on for at least 5 hours, and at least 16 hours after the temperature and damp heat tests have been performed.
Test severities:	Test duration: 28 days or over the period necessary for the conduct of the performance tests, whichever is less.
Time, t, (days) between tests:	$0.5 \leq t \leq 10$
Area measurement test:	A measurement in the measuring range; the same test templates shall be used throughout the test.
Maximum allowable variations:	The variation in the indication of the measurement shall not exceed half of the absolute value of the MPE for influence factor tests (2.2.4) for the measurement applied on any of the (n) tests conducted.
Number of tests (n):	$n \geq 8$. If the test results indicate a trend more than half the permissible variation specified above, conduct additional tests until the trend comes to rest or reverses itself, or until the error exceeds the maximum permissible variation. Precondition: None required.
Test equipment:	Verified mass standards.
Condition of the EUT:	Adjust the EUT as close to zero indication as practicable before each test.
Measuring test:	Stabilize all factors at nominal reference conditions. If the instrument is provided with automatic zero-setting it shall not be in operation. Conduct the measurement and record the following data: a) date and time; b) temperature; c) barometric pressure; d) relative humidity; e) test template area; f) indication; g) errors; h) changes in test location. And apply all necessary corrections resulting from variations of temperature, pressure, etc. between the various measurements.

At the first test immediately repeat zeroing and measurement four times to determine the average value of error. For the next tests perform only one, unless either the result is outside the specified tolerance or the range of the five readings of the initial test was more than 1/10 of the maximum permissible variation.

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.

A.8 VERIFICATION TESTS

A.8.1 General

Ensure that the measuring range for the instrument verification complies with T.3.5.

For type approval, tests shall be carried out corresponding to the mutual agreement between the metrological authority and the applicant. For initial verification, tests shall be carried out corresponding to the normal site operation of the instrument.

A.8.2 Determination of accuracy class, X(x) (5.3.4)

1) For each template area test:

Calculate the mean area error ($\bar{\chi}_e$) (in units of area) in accordance with 6.3:

$\bar{\chi}_e = [\bar{\chi} - V_{true}]$

where: V_{true} is the conventional true value of the leather area, and

$\bar{\chi}$ is the mean of the measurements, i.e. $\frac{\sum x}{n}$

with: x being the leather measurement indication; and

n being the number of measurements.

2) The MPD for each template test (2.2.1) shall be the greater of the following values:

$\bar{\chi}_e \leq$ the smallest scale interval of the leather-measuring instrument;

$\bar{\chi}_e \leq 1$ %, for initial verification; or

$\bar{\chi}_e \leq 2$ %, for in-service verification.

3) Determine the accuracy class (x) such that:

$(x) \geq (\text{MPD})_{max}$

and $(x) = 1 \times 10^k$, 2×10^k, or 5×10^k,

the index k being a positive or negative whole number or zero.

$(\text{MPD})_{max}$ is the maximum of the MPD values determined in 2) above.

BIBLIOGRAPHY

Below are references to Publications of the IEC and the ISO, and where mention is made in some of the tests in Annex A. Use these or refer to the most recent and applicable issue of the publication valid at the time of testing the instrument.

[1]	OIML D 19 (1988)	Pattern evaluation and pattern approval
[2]	OIML D 20 (1988)	Initial and subsequent verification of measuring instruments and processes
[3]	IEC Publication 60068-2-1 (1990-05) with amendments 1 (1993-02) and 2 (1994-06):	Basic environmental testing procedures. Part 2: Tests, Test Ad: Cold, for heat dissipating equipment under test (EUT), with gradual change of temperature.
[4]	IEC Publication 60068-2-2 (1974-01) with amendments 1 (1993-02) and 2 (1994-05):	Basic environmental testing procedures, Part 2: Tests, Test Bd: Dry heat, for heat dissipating equipment under test (EUT) with gradual change of temperature.
[5]	IEC Publication 60068-3-1 (1974-01) + Supplement A (1978-01):	Background information, Section 1: Cold and dry heat tests.
[6]	IEC Publication 60068-2-78 (2001-08):	Environmental testing, Part 2-78: Tests, Test Cb: Damp heat, steady state. Primarily for equipment.
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[8]	IEC Publication 61000-2-1 (1990-05):	Electromagnetic Compatibility (EMC), Part 2: Environment. Section 1: Description of the environment – Electromagnetic environment for low-frequency conducted disturbances and signalling in public power supply systems
[9]	IEC Publication 61000-4-1 (2000-4):	Basic EMC Publication Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques Section 1: Overview of IEC 61000-4 series
[10]	IEC Publication 60654-2 (1979-01), with amendment 1 (1992-09)	Operating conditions for industrial-process measurement and control equipment - Part 2: Power
[11]	IEC Publication 61000-4-11 (2004-03):	Electromagnetic compatibility (EMC), Part 4: Testing and measurement techniques - Section 11: Voltage dips, short interruptions and voltage variations immunity tests. Section 5.2 (Test levels - Voltage variation). Section 8.2.2 (Execution of the test-voltage variation).
[12]	IEC Publication 61000-4-4 (2001-04):	Electromagnetic Compatibility (EMC), Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test.
[13]	IEC Publication 61000-4-2 (1995-01) with amendment 1 (1998-01) and amendment 2 (2000-11)	Basic EMC Publication. Electromagnetic Compatibility (EMC), Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test.

[14] IEC Publication 61000-4-3 consolidated Edition 2.1 (2002-09) with amendment 1 (2002-08): Electromagnetic Compatibility (EMC), Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test.

[15] IEC Publication 61000-4-6 (2003-05) with amendment 1 (2004-10) Electromagnetic Compatibility (EMC) Part 4: Testing and measurement techniques - Section 6: Immunity to conducted disturbances, induced by radio-frequency fields.

[16] International Council of Tanners (1998) Code of Practice for the area measurement of leather by the pinwheel measuring machine

[17] ISO 11646: 1993 (E) Leather – Measurement of area.