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**Multi-dimensional measuring instruments**

**Part 1: Metrological and Technical Requirements**

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**Instruments de mesure multidimensionnels**

**Partie 1: Exigences métrologiques et techniques**

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## Foreword

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

The two main categories of OIML publications are:

- **International Recommendations (OIML R)**, which are model regulations that establish the metrological characteristics required of certain measuring instruments and which specify methods and equipment for checking their conformity; the OIML Member States shall implement these Recommendations to the greatest possible extent;
- **International Documents (OIML D)**, which are informative in nature and intended to improve the work of the metrological services.

OIML Draft Recommendations and Documents are developed by technical committees or subcommittees which are formed by the Member States. Certain international and regional institutions also participate on a consultation basis.

Cooperative agreements are established between OIML and certain institutions, such as ISO and IEC, with the objective of avoiding contradictory requirements; consequently, manufacturers and users of measuring instruments, test laboratories, etc. may apply simultaneously OIML publications and those of other institutions.

International Recommendations and International Documents are published in French (F) and English (E) and are subject to periodic revision.

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Bureau International de Métrologie Légale  
11, rue Turgot - 75009 Paris - France

Telephone: 33 (0)1 48 78 12 82

Fax: 33 (0)1 42 82 17 27

E-mail: [biml@oiml.org](mailto:biml@oiml.org)

Internet: [www.oiml.org](http://www.oiml.org)

## Multi-dimensional measuring instruments

### Part 1 - Metrological and Technical Requirements

#### 1 SCOPE

This Recommendation specifies the metrological and technical requirements for the type evaluation of multi-dimensional measuring instruments used to determine the dimensions and/or dimensional volume of an object for the purpose of calculating charges for postage, freight or storage.

The instruments may be used in conjunction with a weighing instrument also used in the determination of charges in which case the procedure is usually for the dimensional volume to be calculated, a conversion factor applied and the resulting dimensional weight of the object compared to its weight to establish which quantity (the largest of measured weight or dimensional weight) will be used to determine the charges. In some cases dimensions other than volume (for example length plus girth) are used for determining charges. The Recommendation also includes type evaluation procedures, verification procedures and test procedures.

The requirements of this Recommendation apply to automatic and semi-automatic instruments, but they do not apply (for example) to simple linear measures such as tape measures. The instruments measure the length, width and height of a rectangular box and in some cases determine the dimensional volume of that box. If the object is not in the form of a rectangular box, the volume of the smallest rectangular box which fully encloses the object is determined (see 2.2.1).

Instruments may include two different measurement devices, each using a different method to measure one or two separate dimensions of an object. The instrument may measure the object whilst there is relative motion between the instrument and the object.

If the dimensional measuring instrument is associated with a weighing instrument, which is also used for determining the charges, the requirements for the weighing instrument are included in other OIML Recommendations:

- (a) OIML R 76 *Nonautomatic weighing instruments* for nonautomatic weighing instruments; and
- (b) OIML R 51 *Automatic catchweighing instruments* for automatic weighing instruments.

The requirements of this Recommendation may also be used, where applicable, for type evaluation and verification of other instruments which measure the dimensions and/or the volume of objects for applications other than for determining postage, freight or storage charges.

#### 2 TERMINOLOGY

The following terminology includes terms applicable to those instruments covered by this Recommendation and some general terms included in the International Vocabulary of Basic and General Terms in Metrology (VIM, OIML V2-200 Edition 2012 (E/F), the International vocabulary of terms in legal metrology (VIML, OIML V1, Edition 2013 (E/F) and in some cases the Alphabetical list of terms defined in OIML Recommendations and Documents (OIML G 18:2010).

##### 2.1 GENERAL TERMS

###### 2.1.1 multi-dimensional measuring instrument

an instrument that measures the length (L), width (W) and height (H) dimensions of an object and determines the smallest rectangular parallelepiped (rectangular box) which fully encloses that object.

###### 2.1.1.1 length (L)

a linear dimension that is measured horizontally relative to the instrument

###### 2.1.1.2 width (W)

a linear dimension that is measured horizontally relative to the instrument and at 90 degrees relative to the length

###### 2.1.1.3 height (H)

a linear dimension that is oriented 90 degrees vertically above the length and width dimensions

Question: Is the PG happy with these definitions for length (L), width (W) and height (H)? Should each term include "the maximum linear dimension . . ."?

### 2.1.2 device

identifiable instrument or part of an instrument or family of instruments that performs a specific function or functions.

*Note:* A device may be a stand-alone and complete measuring instrument (for example: counter scale, electricity meter) or part of a measuring instrument (for example: printer, indicator) (OIML D 11:2013 [3.3])

### 2.1.3 measuring instrument

device used for making measurements, alone or in conjunction with one or more supplementary devices

*Note:* A measuring instrument that can be used alone is a measuring system (OIML VIM 3.1)

### 2.1.4 processor

a device that contains all the necessary information and receives all the necessary signals from the measuring device to enable it to calculate the volume or other associated quantities.

*Note:* It may also store information, provide checking facilities for the information and communicate with auxiliary devices.

### 2.1.5 indicator

a device that displays the measured dimensions and the associated quantities calculated by the processor.

### 2.1.6 ancillary device

device intended to perform a particular function, directly involved in elaborating, transmitting or displaying measurement results (OIML VIM 5.06)

*Note 1* An ancillary device may or may not be subject to legal metrological control according to its function in the measuring system or to national regulations

*Note 2* Main ancillary devices are:

- zero setting device;
- repeating indicating device;
- printing device;
- memory device;
- price indicating device;
- totalizing indicating device;
- pre-setting device;
- self-service device

### 2.1.7 semi-automatic instrument

instrument requiring the intervention of an operator to carry out the measurements but automatically determines the results. (OIML G 18:2010 (E) [ID 01706].

### 2.1.8 automatic instrument

instrument that measures without the intervention of an operator and follows a pre-determined program of automatic processes characteristic of the instrument. (OIML G 18:2010 (E) [ID 01882]

### 2.1.9 multi-interval instrument

measuring instrument having one dimensional measuring range for each axis which is divided into partial measuring ranges each with different scale intervals, with the measuring range determined automatically according to the dimension being measured.

**2.1.10 electronic device**

device employing electronic sub-assemblies and performing a specific function, usually manufactured as a separate unit and is capable of being independently tested.

*Note:* An electronic device as defined above, may be a complete measuring instrument or part of a measuring instrument.

**2.1.11 electronic sub-assembly**

part of an electronic device employing electronic components and having a recognizable function of its own. (OIML G 18:2010 (E) [ID 01636])

**2.1.12 maximum measuring speed ( $V_{\max}$ )**

the maximum speed at which the instrument will measure correctly. *Note:* Only applicable to instruments where measurements are affected by means of relative movement between the object and the instrument

**2.1.13 minimum measuring speed ( $V_{\min}$ )**

the minimum speed at which the instrument will measure correctly. *Note:* Only applicable to instruments where measurements are affected by means of relative movement between the object and the instrument

**2.2 MEASUREMENT TERMS****2.2.1 rectangular box (rectangular parallelepiped)**

polyhedron having six faces that are parallel in pairs.

**2.2.2 irregular shaped object**

object other than a rectangular box.

**2.2.3 measured dimensions**

length (L), width (W) or height (H), measured by the instrument, of the smallest rectangular box which fully encloses the object.

**2.2.4 dimensional volume (Dim Vol or DV)**

volume of the smallest rectangular box which fully encloses the object, that is calculated using the measured dimensions of length (L), width (W) and height (H).

*Note this change from "volume" to "dimensional volume". Do members of the PG agree with this change?*

**2.2.5 maximum dimension (max)**

maximum measurable dimension for each axis as specified by the manufacturer for the measuring instrument.

**2.2.6 minimum dimension (min)**

value of the smallest measured dimension for each axis, determined as a function of the division size.

**2.2.7 dimensional weight (Dim Wt or DW)**

calculated value obtained by applying a conversion factor to the object's dimensional volume (see 2.2.4) or measured dimensions (see 2.2.3).

**2.2.8 conversion factor (F)**

factor applied to the volume or dimensions of an object to determine its dimensional weight.



### 2.2.9 scale interval (d)

a value, expressed in units of the measured quantity, of the difference between the values corresponding to two consecutive scale marks for analog indication, or two consecutive indicated values for digital indication.

## 2.3 PERFORMANCE TERMS

### 2.3.1 error of indication

indicated value minus a reference quantity value [VIML 0.04].

### 2.3.2 intrinsic error

error of a measuring instrument determined under reference conditions [VIML 0.06].

### 2.3.3 initial intrinsic error

intrinsic error of a measuring instrument as determined prior to performance tests [VIML 5.11]

### 2.3.4 maximum permissible error (mpe)

extreme value (positive and negative) of the error of indication permitted by specifications, Recommendations, regulations etc.

*Note:* The absolute value of the mpe is the same value without sign [VIM 4.26].

### 2.3.5 fault

difference between the error of indication and the intrinsic error of a measuring instrument [VIML 5.12].

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

*Note 2:* From the definition it follows that a "fault" is a numerical value which is expressed either in a unit of measurement or as a relative value, for instance as a percentage.

### 2.3.6 significant fault

fault greater than one scale interval (d). [VIML 5.14]

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

- (a) faults arising from simultaneous and mutually independent causes in the measuring instrument itself;
- (b) faults implying the impossibility to perform any measurement;
- (c) transitory faults being momentary variations in the indication, which cannot be interpreted, memorized or transmitted as a measurement result; and
- (d) faults giving rise to variations in the measurement result so serious that they are bound to be noticed by all those interested in the result of the measurement.

### 2.3.7 influence quantity

quantity that, in a direct measurement, does not affect the quantity that is actually measured, but affects the relation between the indication and the measurement result.[VIM 2.52].

#### 2.3.7.1 influence factor

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

**2.3.7.2 disturbance**

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

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

**2.3.8 rated operating conditions**

operating condition that must be fulfilled during measurement in order that a measuring instrument or measuring system perform as designed [VIM 4.9]

**2.3.9 reference conditions**

set of specified values of influence factors fixed to ensure valid intercomparison of results of measurements [VIM 4.11].

**2.3.10 performance**

ability of the measuring instrument to accomplish its intended functions.

**2.4 TESTING TERMS****2.4.1 test**

series of operations intended to verify the compliance of the EUT with certain requirements.

**2.4.2 test procedure**

detailed description of the tests.

**2.4.2 test program**

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

**2.4.3 performance test**

test intended to verify whether the EUT is able to accomplish its intended functions.

**2.4.4 test object**

object whose dimensions are verified by appropriate reference standards and intended to verify the compliance of the EUT with certain metrological requirements.

**3 UNITS OF MEASUREMENT**

The following units of measurement and their symbols shall be used:

	<b>Unit</b>	<b>Symbol</b>
<b>Length:</b>	metre	m
	centimetre	cm
	millimetre	mm
<b>Volume:</b>	cubic metre	m <sup>3</sup>
	cubic decimetre	dm <sup>3</sup>
	cubic centimetre	cm <sup>3</sup>

## 4 METROLOGICAL REQUIREMENTS

### 4.1 MAXIMUM PERMISSIBLE ERRORS AND MINIMUM DIMENSIONS

#### 4.1.1 Scale intervals, minimum dimension

The lower limit of the minimum dimension for all values of the scale interval is given in Table 1.

Table 1 Scale intervals and minimum dimension

Scale interval (d)	Minimum dimension (min) (lower limit)
$d \leq 2 \text{ cm}$	10 d
$2 \text{ cm} < d \leq 10 \text{ cm}$	20 d
$10 \text{ cm} < d$	50 d

*Note:* Where an instrument can meet a lower minimum dimension limit, it can be specified by the national authority according to 5.3.1.

#### 4.1.2 Value of mpe

The mpe applicable to the measurement by the instrument of any of the three dimensions for initial and subsequent verification is  $\pm 1 \text{ d}$ .

#### 4.1.3 Maximum permissible variation between indicators

There shall be no difference between the indications of the same quantity on different digital indicators.

#### 4.1.4 Multi-interval instruments

For multi-interval instruments with scale intervals of  $d_1, d_2 \dots d_r$ , the mpes are  $\pm 1 d_1, \pm 1 d_2 \dots \pm 1 d_r$  for the applicable range and axis.

#### 4.1.5 Calculated quantities

For all calculated quantities included in the transaction, the indicated quantity shall equal the quantity obtained by using the indicated values included in the calculation together with any rounding applied. If the indicated, calculated quantity, is rounded it shall be rounded to  $\pm 0.5$  scale intervals.

#### 4.1.6 Rules for the determination of errors

The rules for the determination of errors are as follows:

- When a test is conducted, the expanded uncertainty (coverage factor  $k = 2$ ) of the determination of the errors on indications of dimensions shall not be greater than one-fifth of the mpe specified (see GUM).
- The mpes apply to all instruments irrespective of their principles of operation. Limitations of use as marked on the instrument may apply, for example with respect to the position, shape and material of the object.
- The mpe specification in 4.1.2 to 4.1.5 is applicable to all indications included in the transaction as appropriate.
- The initial intrinsic error is found at reference conditions of  $20 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$ , ambient atmospheric pressure, nominal voltage and  $50 \% \pm 15 \%$  relative humidity.

### 4.2 Influence factors

#### 4.2.1 Influence factors under rated operating conditions

Instruments shall be designed and manufactured such that they do not exceed the mpes when exposed to following ranges of environmental conditions:

- (a) mains power voltage variations: – 15 % to + 10 % of nominal voltage;
- (b) air temperature variations if no temperature limits are stated in the descriptive markings: – 10 °C to + 40 °C

An electronic instrument powered by direct current shall either continue to function correctly or not indicate any quantity when the voltage is below the manufacturer's specified nominal voltage.

The indication for the same input shall remain within the mpes when applied to reference conditions before and after the test (see 4.1.6(d)) and when applied to the test conditions specified in (a) A.2.4 and (b) A.2.2.

If special temperature limits are stated in the descriptive markings, the range shall be at least 30 degrees Celsius.

#### 4.2.2 Humidity

All measuring instruments shall be subjected to the damp heat steady state test described in A.2.2.

The indication for the same input shall remain within the mpes when applied at reference conditions before and after the test (see 4.1.6(d)) and when applied at the test conditions specified in A.2.2 after 48 h at these conditions.

Question: Does the PG agree with the proposal to add:

"(c) relative humidity of 85% at high temperature limit"

as an additional condition in 4.2.1 and to delete the requirement for this test as suggested in comment #47 of the combined comments?

### 4.3 DISTURBANCES

#### 4.3.1 Disturbance applied to measuring instrument

An instrument shall be designed and manufactured such that, when exposed to disturbances, either:

- (a) significant faults do not occur; or
- (b) significant faults are detected and acted upon.

*Note:* A fault equal to, or smaller than,  $d$  is allowed during the disturbance irrespective of the value of the error of indication prior to the disturbance.

#### 4.3.2 Disturbance applied to devices

The requirement in 4.3.1 may be applied separately:

- (a) to each individual cause of significant fault; and/or
- (b) to each part of the electronic instrument.

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

#### 4.3.3 Tests for disturbances; severity levels

Instruments shall be tested so as to determine if they will withstand the appropriate disturbances as listed in Table A.1 when subject to the applicable severity levels given in A.3.

#### 4.3.4 Light and acoustic effects

Instruments based on light or acoustic measuring techniques shall remain within the mpe when subjected to the applicable light or acoustic disturbances described in A.4.

## 5 OPERATIONAL REQUIREMENTS

### 5.1 GENERAL

#### 5.1.1 Fraudulent use

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

#### 5.1.2 Suitability of construction

Instruments shall be constructed so that all controls, indicators, etc. are suitable for operation under normal conditions of use.

#### 5.1.3 Suitability for verification

Instruments shall be constructed so that the performance requirements of this Recommendation can be applied.

If in normal operation the instrument indicates the volume and not the dimensions, a test mode shall be provided to display or print out the dimensions.

#### 5.1.4 Zero or ready adjustment

Instruments shall be provided with facilities to set the instrument to, and maintain it at, zero or ready condition. This shall only be possible without an object in the measurement area and shall be indicated by a zero indication, a ready light or a similar display. Either this condition is met automatically for each measurement or the instrument is automatically inhibited.

#### 5.1.5 Tare device

- (a) The tare function shall only operate subtractively .
- (a) The value of the tare scale interval shall be the same as the scale interval of the respective axis and range.
- (b) Operation of tare shall be indicated.

#### 5.1.6 Warm-up

As soon as the instrument indicates or transmits the measurement results after the warm-up period following switch-on, the indications shall be within mpes.

### 5.2 Indicators and printing devices

#### 5.2.1 General

- (a) An instrument shall have either:
  - an indicator which displays the measurement results
  - a printer which prints the measurement results
  - a device to transmit, store and preserve measurement results so that they can durably be reconstructed from the stored data
- (b) In the case of an instrument used for direct sales to the public, all indications shall be available to the customer.
- (c) The indication shall be automatically displayed or printed out following each step in the process or be readily available by a simple action of the operator, for example by pressing a key.
- (d) Other indications such as dimensional weight, weight conversion factors etc. may be displayed or printed out. Indications may either be automatically displayed or printed out following an appropriate step in the process, or be readily available by a simple action of the operator.
- (e) The indications for an object shall remain until the next new object is detected. The previous displayed indications shall not persist for longer than 1 s after a new object is detected in the measurement area.

- (f) When an instrument is fitted with an extended indication device, displaying the indication with a scale interval smaller than  $d$  shall be possible only:
- while pressing a key; or
  - for a period not exceeding 5 s after a manual command by the operator.

In any case printing out of extended indication shall not be possible.

Instruments used for direct sales to the public shall not have any extended indicating device.

- (g) All indications shall be identified either by the full name or abbreviations (see 5.2.9).

### 5.2.2 Clarity of indications

Printed and displayed indications shall be reliable, clear and unambiguous and printing shall be indelible. Figures forming the results shall be of a size, shape and clarity for reading to be easy.

Digital indications shall be stable around the changeover point. All digits on displays and tickets shall be oriented in the normal viewing position and shall permit reading by simple juxtaposition.

### 5.2.3 Units of measurement

All printed and displayed indications shall include the name or symbol of the unit of measurement. On tickets, the name or symbol may be printed out by the printer or pre-printed on the ticket.

For each indication of a quantity only one unit of measurement for that quantity shall be used, for example cm only, not m and cm, and the unit of measurement shall be the same for each axis.

### 5.2.4 Value of the scale interval

The value of all scale intervals shall be in the form  $1, 2$  or  $5 \times 10^n$  where  $n$  is a positive or negative whole number or zero.

The value of the scale interval shall be:

- (a) the same for each axis; or
- (b) different for one axis from the other two provided that instructions are marked on the instrument specifying any limitations of use; alternatively indication of incorrect use shall be given; or
- (c) variable (for example multi-interval) on one or more axes provided that:
  - if all three axes are multi-interval, then  $d_{x1} = d_{y1} = d_{z1}$ ,  $d_{x2} = d_{y2} = d_{z2}$ , ... ,  $d_{xr} = d_{yr} = d_{zr}$ ;
  - if two axes are multi-interval, for example  $x$  and  $y$ , and  $z$  is fixed, then  $d_{x1} = d_{y1}$ ,  $d_{x2} = d_{y2}$ , ... ,  $d_{xr} = d_{yr}$ , and instrument limitations such as object size, placement, etc. are clearly marked to define how to operate the instrument; and
  - if only one axis is multi-interval, for example  $x$ , and  $y$  and  $z$  are fixed, then  $d_y = d_z$  and instrument limitations such as object size, placement, etc. are clearly marked to define how to operate the instrument.

### 5.2.5 Decimal numbers

If the indication is expressed in a decimal form, there shall be at least one zero preceding the decimal mark for values less than one.

The decimal mark on tickets shall be printed out with the measured value by the printer, with at least one zero preceding the decimal mark for values less than one.

One or more fixed zeros may be used to the right of the variable numbers for values greater than one. Please note that all the decades to the right of the decimal point or comma must be active and the least significant digit should correspond to the scale interval.

Printed numbers and symbols shall be at least 2 mm high.

### 5.2.6 Limits of indication

Indications or printing of any dimension must be inhibited, or indicate an error message with its measurement indication, if the axis being measured:

- (a) is smaller than the minimum dimension marked on the device; or
- (b) is larger than the maximum dimension marked on the device plus  $9d$ ; or
- (c) has dimensions that exceed the measurement capability of the instrument.

### 5.2.7 Multi-interval instruments

For each partial measuring range, the following apply:

- (a) scale intervals  $d_1 < d_2 < d_3 \dots < d_r$ ; and
- (b)  $\min = \min_1$ ,  $\max = \max_r$ ,  $\max_1 = \min_2$ , etc.

### 5.2.8 Multi-instrument system

A number of measuring devices may be connected to one indicating device to form a multi-instrument system. The following requirements apply.

If the indicator is not within adequate proximity to each measuring device to allow easy testing, a test indicator shall be provided. It shall be possible for the test indicator to be readily connected to each measuring device without affecting the performance of that device. The test indicator shall agree exactly with the common indicator in regard to the indications being tested.

The indication from each measuring device shall be clearly identified with the device on the common indicator.

### 5.2.9 Printed and display information

5.2.9.1 Any printed ticket or displayed indication shall include sufficient information to identify the transaction, for example:

- (a) dimensions: length ( $L$ ), width ( $W$ ) and height ( $H$ );
- (b) dimensional volume (Dim Vol ... L of DV ... L);
- (c) weight ( $Wt$ ) if the instrument includes a weighing instrument;
- (d) dimensional weight (Dim Wt ... kg or DW ... kg);
- (e) dimensional tare (DT ... kg) or linear tare (LT .....cm);
- (f) conversion factor ( $F$ );
- (g) quantity for charging, for example dimensions, vol or DW ... kg;
- (h) price rate and price; and
- (i) date, transaction number or other identification of the object.

*Note 1:* Icons may be used to identify indications.

*Note 2:* When the customer is not present during the measurement process the above information need not be displayed or printed out at the time but shall be available on request, e.g. retrievable from a data storage device (which shall have sufficient storage capacity for the intended purpose).

*Note 3:* The price interval and the price rate shall comply with the national regulations applicable for trade.

5.2.9.2 A printed ticket shall also contain the following printed or pre-printed information:

- (a) that the dimensions and/or volume shown are those of the smallest rectangular box that fully encloses the object; and
- (b) that the dimensional weight is a calculated value obtained by applying a conversion factor to the object's volume or dimensions.

### 5.2.10 Stability

Printing or storage of indications for subsequent indication, data transfer, totalizing, etc., shall be inhibited when the equilibrium is not stable. Stable equilibrium is considered to be achieved when, over a period of 5 s before printout, calculation of dimensional volume or data storage, no more than two adjacent values are indicated, one of which is the printed or stored value.

## 5.3 Markings

### 5.3.1 Nameplate

Instruments shall be clearly and permanently marked on a permanently attached nameplate in the vicinity of the indicating device with the following information:

- (a) manufacturer's name or mark;
- (b) model designation;
- (c) serial number of instrument and year of manufacture;
- (d) type evaluation mark;
- (e) the maximum and minimum dimensions for each axis in the form  $\max = \dots$   $\min = \dots$  ;
- (f) if measurements are affected by means of relative movement between the object and the instrument the maximum and minimum measuring speeds for which the instrument will measure correctly in the form  $V_{\max} = \dots$  m/s,  $V_{\min} = \dots$  m/s;
- (g) scale interval(s) for each axis and range (multi-interval) in the form  $d = \dots$  ;and
- (h) temperature limits (if other than  $-10\text{ }^{\circ}\text{C}$  to  $+40\text{ }^{\circ}\text{C}$ );

### 5.3.2 Notices

Any special notice or limitation of use relating to the instrument or the objects being measured shall be clearly marked on a notice visible to the operator or in an operator's manual, for example:

- (a) special application if used for a purpose other than determining postage, freight or storage charges;
- (b) minimum spacing between successive objects;
- (c) if the instrument can measure only rectangular boxes;
- (d) if the box has to be located in a particular position;
- (e) any limitation of the surface characteristics of the objects being measured;
- (f) that the dimensions and/or volume shown are those of the smallest rectangular box that fully encloses the object; and
- (g) that the dimensional weight is a calculated value obtained by applying a conversion factor to the object's volume or dimensions.

## 5.4 VERIFICATION MARK AND SEALING

### 5.4.1 Verification mark

Provision shall be made for the application of a verification mark either on a nameplate, a stamping plug or on an adhesive label. The following requirements apply:

- (a) the mark shall be easily affixed without affecting the metrological properties of the instrument;
- (b) the mark shall be visible without moving or dismantling the instrument when in use;
- (c) the part on which the mark is located shall not be removable from the instrument without damaging the mark; and
- (d) the size of the space shall be sufficient to contain the marks applied by the verifying authority: for example an area of at least  $200\text{ mm}^2$ .

**Note:** If technical reasons restrict or limit the verification mark(s) to be fixed only in a "hidden" place (e.g. when an instrument – in combination with another device – is integrated in other equipment) this can be accepted if these marks are easily accessible, and if there is a legible notice provided on the instrument in a clearly visible place that points to these marks or if its location is defined in the operation manual, the OIML Certificate and OIML Test Report.



### 5.4.2 Sealing

Provision shall be made for sealing those devices and parameters that have a metrologically significant effect and that determine the measurement result. This may include devices and parameters which affect the configuration of the instrument as well as those which affect the calibration.

Sealing may be by mechanical or electronic means. 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.

The requirements for applying a mark to a mechanical seal are the same as those for 5.4.1.

The requirements for electronic seals are as follows:

- (a) Access by authorized persons shall be protected by some form of physical key or a password or access code (for example a four digit code).
- (b) Any access to alter protected parameters shall be automatically recorded (for example by means of a counter which automatically increments when access is initiated).
- (c) The record shall be readily accessible by a simple action (for example by display of the counter when a button identified as being for this purpose is pressed, or during the indication check).
- (d) The record shall be readily identifiable as such and shall not be easily confused with other indications of the instrument.
- (e) A reference record in the same form as the incremental record shall be permanently marked on the instrument to indicate that the parameters have been accessed since the last verification (for example the reference record could be associated with the verification mark).
- (f) The record shall not repeat in a sequence of less than 999 alterations. It shall also persist reliably for a period of at least two years (unless it is overwritten by a further alteration).
- (g) The record shall persist through tests for influence factors and disturbances specified in this Recommendation.

## 5.5 INSTRUMENT CONSTRUCTION

### 5.5.1 General

Measuring instruments shall be constructed so that they comply with the following metrological and technical requirements and will thus be suitable for use.

#### 5.5.2 Ancillary devices interface

An instrument may be equipped with interfaces permitting the coupling of any ancillary devices or other instruments.

An interface shall not allow the metrological functions of the instrument and its measurement data to be affected by the operation of the ancillary devices or connected instruments or by disturbances acting on the interface.

If instructions or data can be introduced through the interface into the measuring instrument which alters the parameters that determine the measurement result, the interface shall be sealed as described in 5.4.2.

## 5.6 CHECKING FACILITIES

### 5.6.1 Acting upon significant faults

When a significant fault has been detected, the instrument shall either be made inoperative automatically or a visual or audible indication shall be provided automatically and shall continue until

such time as the user takes action or the fault disappears. For automatic instruments the instrument shall be made inoperative automatically.

### **5.6.2 Indication check**

If the failure of an indicator display element can cause a false indication, then the instrument shall have a display test facility which when turning on the power and on demand, shows all relevant elements of the indication display in both active and non-active states, for sufficient time to allow the operator to check them.

This is not applicable for displays on which failure becomes evident, e.g. non-segmented displays, screen-displays, matrix-displays, etc.