

INTERNATIONAL  
RECOMMENDATION

**OIML R 86**

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Drum meters for alcohol and their  
supplementary devices

Compteurs à tambour pour alcool et leurs dispositifs complémentaires

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# Foreword

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

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## TERMINOLOGY

### **T.1. Liquid to be measured**

The term "alcohol" is used to mean ethanol (ethyl alcohol) and mixtures of ethanol and water.

### **T.2. Drum meter**

A volume meter comprising several movable measuring chambers connected to form a rotating drum. The measurement is made by successively filling and emptying the chambers, the indication of the indicating device advancing each time by an amount equal to the volume of one measuring chamber.

### **T.3. Volume of the measuring chamber**

The volume of the chamber filled to a specified height. The filling height results from the construction of the meter.

### **T.4. Volume of the drum**

The sum of the volumes of the measuring chambers which form the drum.

### **T.5. Alcohol content**

The ethanol content of the liquid to be measured, indicated as volume concentration or as mass content.

### **T.6. Volume concentration of a mixture of ethanol and water**

Ratio of the volume of pure ethanol contained in the mixture, at a temperature of 20 °C, to the total volume of the mixture at the same temperature <sup>(\*)</sup>.

### **T.7. Mass content of a mixture of ethanol and water**

Ratio of the mass of ethanol contained in the mixture to the total mass of the mixture <sup>(\*)</sup>.

### **T.8. Minimum delivery**

The smallest volume of liquid whose measurement is required to be metrologically acceptable.

### **T.9. First element of an indicating device**

In an indicating device comprising several elements, the element which carries the scale with the smallest scale interval.

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<sup>(\*)</sup> References: International Recommendation OIML R 22 "International alcoholometric tables".

# **DRUM METERS for ALCOHOL**

## **and their SUPPLEMENTARY DEVICES**

### **1. Scope**

This Recommendation applies to drum meters for the continuous measurement of volumes of alcohol, with supplementary devices for the determination of the ethanol content (automatically or by taking samples).

### **2. Principles of measurement**

#### 2.1. Drum meter with sampler

A drum meter with sampler is provided with a supplementary device which automatically takes and collects samples of the liquid to be measured in order to permit the separate determination of the average alcohol content of the liquid which has passed through the measuring device, according to the usual methods. The quantity of ethanol contained in the liquid which has passed through the device can be calculated from the alcohol content and the volume indicated by the meter.

When the temperature of the measured liquid varies during the measurement, the meter may be provided with a device for the determination of the mean temperature of the measured liquid.

#### 2.2. Drum meter provided with a corrector to determine the volume of ethanol.

A drum meter may be provided with a supplementary device which automatically determines the density and temperature of the liquid passing. From these quantities and from the volume determined by the measuring element of the drum the supplementary device calculates and indicates the volume of ethanol contained in the liquid which has passed through the measuring device.

### **3. Technical requirements**

#### 3.1. Indicating device 3.1.1.

##### General

3.1.1.1. The indicating device of the drum meter shall indicate the measured volume in cubic decimetres, litres or cubic metres.

The indicating device of the volume corrector shall indicate the quantity of ethanol either in litres or cubic metres at reference temperature or in kilogrammes or tonnes.

3.1.1.2. It shall be possible to read the indications precisely, easily and without ambiguity. If the device comprises several elements, the whole installation shall be arranged in such a way that the result of measurement may be read by simple juxtaposition of the indications of the different elements.

3.1.1.3. The scale interval of the first element on the indicating device of the drum meter shall be equal to the volume of one measuring chamber.

The scale interval of the first element on the indicating device of the corrector shall be  $1 \cdot 10^n$ ,  $2 \cdot 10^n$  or  $5 \cdot 10^n$  authorized units of volume, n being a positive or negative whole number or zero.

3.1.1.4. The maximum range of the indicator shall be  $1 \cdot 10^n$ ,  $2 \cdot 10^n$  or  $5 \cdot 10^n$  authorized units of volume <sup>(\*)</sup>.

3.1.1.5. Where the entire scale of an element is visible, the value of one revolution of that element shall be  $10^n$  authorized units of volume <sup>(\*)</sup>. However, this rule does not apply to the element which includes the maximum range of the indicator.

3.1.1.6. On an indicating device comprising several elements, the value of one revolution of the movable part of an element whose entire scale is visible shall equal the scale interval of the element of next higher significance.

### 3.1.2. Methods of indication

An element of the indicating device may move continuously or discontinuously, but where elements other than the first have only part of their scales visible through the windows, these elements shall move discontinuously (the movement of the first element may be continuous or discontinuous).

3.1.2.1. An element with continuous movement shall comprise a scale and a datum mark to permit the determination of the value measured at any position of the element.

3.1.2.2. When such an element is formed by a fixed circular scale and a rotating pointer, the direction of rotation of the pointer shall be clockwise.

3.1.2.3. On an indicating device comprising several elements, the advance by one figure of any element with discontinuous movement, other than the first, shall be terminated when the element of next lower significance indicates zero.

This advance shall take place while the element of next lower significance moves through a fraction not exceeding one tenth of its revolution.

3.1.2.4. If the indication is given as a row of figures and if the movement of the first element is discontinuous, one or more fixed zeros may be inscribed to the right of this element.

### 3.1.3. Scales

3.1.3.1. All scale marks shall have the same width, constant along their length. This width shall not exceed one quarter of the scale spacing.

3.1.3.1.1. The distinction between scale marks corresponding to  $1 \cdot 10^n$ ,  $2 \cdot 10^n$  or  $5 \cdot 10^n$  authorized units of volume shall be indicated only by differences in their length <sup>(\*)</sup>.

3.1.3.1.2. The actual or optically magnified scale spacing shall not be less than 2 mm.

3.1.3.1.3. The actual or optically magnified height of the figures shall not be less than 4 mm.

3.1.3.2. When the first element has continuous movement and a moving scale, only part of which is visible through a window, the length of that window, measured in the direction parallel to that of movement of the scale, shall be at least equal to 1.5 times the distance between two consecutively numbered scale marks.

### 3.1.4. Drive of the indicating device

The drive of the indicating device by the measuring device shall be positive, durable, and by mechanical means.

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<sup>(\*)</sup> For the meaning of n, see point 3.1.1.3.

### 3.2. Measuring chambers of the drum

3.2.1. The volume of the individual measuring chambers shall be  $1 \cdot 10^n$ ,  $2 \cdot 10^n$  or  $5 \cdot 10^n$  litres<sup>(\*)</sup>.

The chambers of a drum shall be of equal size.

3.2.2. The drum axis shall be horizontal.

In order to be able to ensure that it is correctly installed, the meter shall be equipped with a level indicating device if, when the drum axis is inclined up to  $3^\circ$  to the horizontal, the indication of the meter varies by more than half the maximum permissible error on verification.

### 3.3. Sampler

The sampler shall separate and collect a representative sample of the liquid passing through the measuring device, for example, by separating an equal volume each time the measuring chambers are filled.

If the test volume withdrawn is subject to special or separate treatment, the measuring drum shall be so adjusted that the volume withdrawn is not included in the indication of the meter.

### 3.4. Corrector to determine the ethanol volume

The corrector shall function in accordance with the “International alcoholometric tables” (OIML R 22). The correction shall be applied mechanically; this Recommendation does not apply to electronic correctors ; if necessary, additional requirements will be developed later.

### 3.5. Adjusting mechanism

3.5.1. The volumes of the individual measuring chambers at a drum meter may be adjusted by means of displacement bodies.

3.5.2. The corrector which measures the density and temperature of the liquid measured shall be adjustable.

### 3.6. Inadmissible operating condition and failure

The following inadmissible operating conditions or failures shall either be prevented by special devices incorporated in the meter, or their occurrence shall be indicated by warning devices :

- excessive flowrate,
- obstruction of free flow,
- overfilling of the drum due to obstruction of the rotating movement,
- temperature outside the permissible range,
- inadmissible heating of the separated sample.

### 3.7. Device for the determination of the mean temperature of the liquid measured

The device shall determine the mean value of the temperature of the measured liquid, valid for the measured volume, to within  $\pm 0.5$  °C.

## 4. Metrological requirements

4.1. Limiting values for :

- the alcohol content,
- the temperature of liquid to be measured, and
- the maximum permissible flowrate,

shall be fixed during pattern evaluation in accordance with the results of the pattern-evaluation tests.

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<sup>(\*)</sup> For the meaning of n, see point 3.1.1.3.

4.2. The reference temperature is 20 °C (see OIML R 22).

4.3. For drum meters without correctors the minimum delivery shall be the drum volume. For drum meters with correctors it is specifically fixed during pattern evaluation if, for example, the time behaviour of the corrector gives rise to additional errors of measurement when a sudden change in the condition of the liquid measured arises in service.

## 5. Markings

5.1. Each meter shall bear the following information assembled either on the dial of the indicating device or on a special data plate :

- the name and address of the manufacturer or his trade mark, and if appropriate, the model number (or name), serial number and year of manufacture of the meter,
- the approval sign,
- the name of the liquid to be measured ("for alcohol"),
- the metrological data fixed during pattern evaluation according to point 4,
- the volume of the measuring chamber,
- the volume of the drum,
- the unit in which the indication is expressed on the indicating device.

5.2. The above information shall be incised in such a way that it is clearly legible and indelible under the rated operating conditions of the meter.

5.3. Any measuring devices which can be dismantled shall be marked with a serial number if its replacement can affect the results of measurement.

## 6. Maximum permissible errors

6.1. In the approved flow range the maximum permissible errors, positive or negative, on verification of the drum meter are 0.5 % of the measured volume, or 1 % of the minimum delivery, whichever is greater.

6.2. In the approved flow range, the maximum permissible errors, positive or negative, on verification of the corrector to determine the volume of ethanol are 0.5 % of the nominal value of the amount of ethanol, calculated from the indicated volume, density and temperature.

## 7. Marks

7.1. On all meters a place shall be provided on an essential part of the measuring device or the indicating device, or on the casing of these devices, visible without dismantling, on which the main control mark can be applied.

7.2. On all meters devices shall be provided which can be sealed and which prevent access to the parts which allow adjustment of the results of measurement, as well as even partial dismantling of the meter, without the protective marks applied to the seal being damaged.

7.3. The notice of approval may require a place for the application of a control mark on the interchangeable parts of meters which can be dismantled, beside the identification number referred to in point 5.3.

## 8. Mandatory metrological controls

### 8.1. Pattern approval

8.1.1. In any country where meters are subject to state metrological controls, the first stage of such controls is pattern approval.

8.1.2. Each type of meter made by each manufacturer shall be subject to the pattern approval procedure.

8.1.3. Any modifications or additions to an approved pattern shall be authorized by the service which gave the approval, where they influence or may influence the results of measurement or the prescribed conditions for use of the meter; otherwise, the manufacturer is simply required to inform the authority concerned.

### 8.2. Verification

#### 8.2.1. Determination of the volumes of the measuring chambers

The individual volumes of the drum chambers shall be determined using water at a temperature of about 20 °C. The insides of the chambers and of the meter casing shall be wetted beforehand. The flowrate during filling shall be of the order of 0.01 to 0.02 times the maximum flowrate. The draining time before the chamber is filled and after it is emptied into a suitable measuring vessel shall be 1 minute.

#### 8.2.2. Verification of the drum meter

The metrological test during the verification of the drum meter shall be done with alcohol, at about 20 °C, with a volume concentration which is characteristic of the installation. In doing so, the meter shall be tested at the following flowrates :

- at 0.01 to 0.02 times the maximum flowrate,
- at 0.1 to 0.2 times the maximum flowrate,
- at 0.9 to 1 time the maximum flowrate.

The test volume shall be equal to at least that measured by 5 rotations of the drum.

If, at all the above mentioned flowrates, the errors are all of the same sign, one at least of these errors shall not exceed 0.3 % of the specified volume.

The test may be performed with the aid of approved non-interacting devices which facilitate the test, for example by observation of the movement of the drum.

#### 8.2.3. Verification of supplementary devices

The tests to be performed on supplementary devices at verification shall be specified for the pattern at the time of pattern evaluation in accordance with the requirements.



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