

Directive 2014/32/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments (recast) (Text with EEA relevance)

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ANNEX VII

MEASURING SYSTEMS FOR THE CONTINUOUS AND DYNAMIC MEASUREMENT OF QUANTITIES OF LIQUIDS OTHER THAN WATER (MI-005)

The relevant essential requirements of Annex I, the specific requirements of this Annex and the conformity assessment procedures listed in this Annex, apply to measuring systems intended for the continuous and dynamic measurement of quantities (volumes or masses) of liquids other than water. If appropriate, the terms ‘volume, and L’ in this Annex can be read as: ‘mass and kg’.

DEFINITIONS

Meter	An instrument designed to measure continuously, memorise and display the quantity at metering conditions of liquid flowing through the measurement transducer in a closed, fully charged conduit.
Calculator	A part of a meter that receives the output signals from the measurement transducer(s) and possibly, from associated measuring instruments and displays the measurement results.
Associated measuring instrument	An instrument connected to the calculator for measuring certain quantities which are characteristic of the liquid, with a view to make a correction and/or conversion.
Conversion Device	<p>A part of the calculator which by taking account of the characteristics of the liquid (temperature, density, etc.) measured using associated measuring instruments, or stored in a memory, automatically converts:</p> <ul style="list-style-type: none"> — the volume of the liquid measured at metering conditions into a volume at base conditions and/or into mass, or — the mass of the liquid measured at metering conditions into a volume at metering conditions and/or into a volume at base conditions <p>Note: A conversion device includes the relevant associated measuring instruments.</p>
Base conditions	The specified conditions to which the measured quantity of liquid at metering conditions is converted.
Measuring System	A system that comprises the meter itself and all devices required to ensure correct measurement or intended to facilitate the measuring operations.

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Fuel dispenser	A measuring system intended for the refuelling of motor vehicles, small boats and small aircraft.
Self-service arrangement	An arrangement that allows the customer to use a measuring system for the purpose of obtaining liquid for his own use.
Self-service device	A specific device that is part of a self-service arrangement and which allows one of more measuring systems to perform in this self-service arrangement.
Minimum measured quantity (MMQ)	The smallest quantity of liquid for which the measurement is metrologically acceptable for the measuring system.
Direct indication	The indication, either volume or mass, corresponding to the measure and that the meter is physically capable of measuring. Note: The direct indication may be converted into another quantity using a conversion device.
Interruptible/non-interruptible	A measuring system is considered as interruptible/non-interruptible when the liquid flow can/cannot be stopped easily and rapidly.
Flowrate range	The range between the minimum flowrate (Q_{\min}) and maximum flowrate (Q_{\max}).

SPECIFIC REQUIREMENTS

1. Rated operating conditions

The manufacturer shall specify the rated operating conditions for the instrument, in particular;

1.1. The flowrate range

The flowrate range is subject to the following conditions:

- (i) the flowrate range of a measuring system shall be within the flowrate range of each of its elements, in particular the meter.
- (ii) meter and measuring system:

Table 1

Specific measuring system	Characteristic of liquid	Minimum ratio of Q_{\max} : Q_{\min}
Fuel dispensers	Not Liquefied gases	10: 1
	Liquefied gases	5: 1
Measuring system	Cryogenic liquids	5: 1

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Table 1

Measuring systems on pipeline and systems for loading ships	All liquids	Suitable for use
All other measuring systems	All liquids	4: 1

1.2. The properties of the liquid to be measured by the instrument by specifying the name or type of the liquid or its relevant characteristics, for example:

- Temperature range;
- Pressure range;
- Density range;
- Viscosity range.

1.3. The nominal value of the AC voltage supply and/or limits of the DC voltage supply.

1.4. The base conditions for converted values.

Note:

Point 1.4 is without prejudice to the Member States' obligations to require use of a temperature of either 15 °C in accordance with Article 12(2) of Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity⁽¹⁾.

2. Accuracy classification and maximum permissible errors (MPEs)

2.1. For quantities equal to or greater than 2 litres the MPE on indications is:

TABLE 2

	Accuracy Class				
	0,3	0,5	1,0	1,5	2,5
Measuring systems (A)	0,3 %	0,5 %	1,0 %	1,5 %	2,5 %
Meters (B)	0,2 %	0,3 %	0,6 %	1,0 %	1,5 %

2.2. For quantities less than two litres the MPE on indications is:

TABLE 3

Measured volume V	MPE
$V < 0,1 \text{ l}$	$4 \times$ value in Table 2, applied to 0,1 L
$0,1 \text{ l} \leq V < 0,2 \text{ l}$	$4 \times$ value in Table 2
$0,2 \text{ l} \leq V < 0,4 \text{ l}$	$2 \times$ value in Table 2, applied to 0,4 L
$0,4 \text{ l} \leq V < 1 \text{ l}$	$2 \times$ value in Table 2
$1 \text{ l} \leq V < 2 \text{ l}$	Value in Table 2, applied to 2 L

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2.3. However, no matter what the measured quantity may be, the magnitude of the MPE is given by the greater of the following two values:

- the absolute value of the MPE given in Table 2 or Table 3,
- the absolute value of the MPE for the minimum measured quantity (E_{\min}).

2.4.1. For minimum measured quantities greater than or equal to 2 litres the following conditions apply:

Condition 1

E_{\min} shall fulfil the condition: $E_{\min} \geq 2 R$, where R is the smallest scale interval of the indication device.

Condition 2

E_{\min} is given by the formula:

$$E_{\min} = (2MMQ) \times (A / 100)$$

, where:

- MMQ is the minimum measured quantity,
- A is the numerical value specified in line A of Table 2.

2.4.2. For minimum measured quantities of less than two litres, the above mentioned condition 1 applies and E_{\min} is twice the value specified in Table 3, and related to line A of Table 2.

2.5. *Converted indication*

In the case of a converted indication the MPEs are as in line A of Table 2.

2.6. *Conversion devices*

MPEs on converted indications due to a conversion device are equal to $\pm (A - B)$, A and B being the values specified in Table 2.

Parts of conversion devices that can be tested separately

(a) *Calculator*

MPEs on quantities of liquid indications applicable to calculation, positive or negative, are equal to one-tenth of the MPEs as defined in line A of Table 2.

(b) *Associated measuring instruments*

Associated measuring instruments shall have an accuracy at least as good as the values in Table 4:

TABLE 4

MPE on Measurements	Accuracy classes of the measuring system				
	0,3	0,5	1,0	1,5	2,5
Temperature	$\pm 0,3 \text{ }^\circ\text{C}$	$\pm 0,5 \text{ }^\circ\text{C}$			$\pm 1,0 \text{ }^\circ\text{C}$
Pressure	Less than 1 MPa: $\pm 50 \text{ kPa}$ From 1 to 4 MPa: $\pm 5 \%$ Over 4 MPa: $\pm 200 \text{ kPa}$				
Density	$\pm 1 \text{ kg/m}^3$		$\pm 2 \text{ kg/m}^3$		$\pm 5 \text{ kg/m}^3$

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These values apply to the indication of the characteristic quantities of the liquid displayed by the conversion device.

(c) *Accuracy for calculating function*

The MPE for the calculation of each characteristic quantity of the liquid, positive or negative, is equal to two fifths of the value fixed in (b).

2.7. The requirement (a) in point 2.6 applies to any calculation, not only conversion.

2.8. The measuring system shall not exploit the MPEs or systematically favour any party.

3. **Maximum permissible effect of disturbances**

3.1. The effect of an electromagnetic disturbance on a measuring system shall be one of the following:

- the change in the measurement result is not greater than the critical change value as defined in point 3.2, or
- the indication of the measurement result shows a momentary variation that cannot be interpreted, memorised or transmitted as a measuring result. Furthermore, in the case of an interruptible system, this can also mean the impossibility to perform any measurement, or
- the change in the measurement result is greater than the critical change value, in which case the measuring system shall permit the retrieval of the measuring result just before the critical change value occurred and cut off the flow.

3.2. The critical change value is the greater of $MPE/5$ for a particular measured quantity or E_{min} .

4. **Durability**

After an appropriate test, taking into account the period of time estimated by the manufacturer, has been performed, the following criterion shall be satisfied:

The variation of the measurement result after the durability test, when compared with the initial measurement result, shall not exceed the value for meters specified in line B of table 2.

5. **Suitability**

5.1. For any measured quantity relating to the same measurement, the indications provided by various devices shall not deviate one from another by more than one scale interval where devices have the same scale interval. In the case where the devices have different scale intervals, the deviation shall not be more than that of the greatest scale interval.

However, in the case of a self-service arrangement the scale intervals of the main indicating device on the measuring system and the scale intervals of the self-service device shall be the same and results of measurement shall not deviate one from another.

5.2. It shall not be possible to divert the measured quantity in normal conditions of use unless it is readily apparent.

5.3. Any percentage of air or gas not easily detectable in the liquid shall not lead to a variation of error greater than:

- 0,5 % for liquids other than potable liquids and for liquids of a viscosity not exceeding 1 mPa.s, or
- 1 % for potable liquids and for liquids of a viscosity exceeding 1 mPa.s.

However, the allowed variation shall never be smaller than 1 % of MMQ. This value applies in the case of air or gas pockets.

5.4. *Instruments for direct sales*

5.4.1. A measuring system for direct sales shall be provided with means for resetting the display to zero.

It shall not be possible to divert the measured quantity.

5.4.2. The display of the quantity on which the transaction is based shall be permanent until all parties in the transaction have accepted the measurement result.

5.4.3. Measuring systems for direct sales shall be interruptible.

5.4.4. Any percentage of air or gas in the liquid shall not lead to a variation of error greater than the values specified in point 5.3.

5.5. *Fuel Dispensers*

5.5.1. Displays on fuel dispensers shall not be capable of being reset to zero during a measurement.

5.5.2. The start of a new measurement shall be inhibited until the display has been reset to zero.

5.5.3. Where a measuring system is fitted with a price display, the difference between the indicated price and the price calculated from the unit price and the indicated quantity shall not exceed the price corresponding to E_{\min} . However this difference need not be less than the smallest monetary value.

6. **Power supply failure**

A measuring system shall either be provided with an emergency power supply device that will safeguard all measuring functions during the failure of the main power supply device or be equipped with means to save and display the data present in order to permit the conclusion of the transaction in progress and with means to stop the flow at the moment of the failure of the main power supply device.

7. **Putting into use**

TABLE 5

Accuracy Class	Types of Measuring system
0,3	Measuring systems on pipeline
0,5	All measuring systems if not differently stated elsewhere in this Table, in particular: <ul style="list-style-type: none"> — fuel dispensers (not for liquefied gases), — measuring systems on road tankers for liquids of low viscosity (< 20 mPa.s)

a However, Member States may require measuring systems of accuracy class 0,3 or 0,5 when used for the levying of duties on mineral oils when (un)loading ships and rail and road tankers.

Note: However, the manufacturer may specify a better accuracy for a certain type of measuring system.

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	<ul style="list-style-type: none"> — measuring systems for (un)loading ships and rail and road tankers^a — measuring systems for milk — measuring systems for refuelling aircraft
1,0	<p>Measuring systems for liquefied gases under pressure measured at a temperature equal to or above – 10 °C</p> <hr/> <p>Measuring systems normally in class 0,3 or 0,5 but used for liquids</p> <ul style="list-style-type: none"> — whose temperature is less than – 10 °C or greater than 50 °C — whose dynamic viscosity is higher than 1 000 mPa.s — whose maximum volumetric flowrate is not higher than 20 L/h
1,5	<p>Measuring systems for liquefied carbon dioxide</p> <hr/> <p>Measuring systems for liquefied gases under pressure measured at a temperature below – 10 °C (other than cryogenic liquids)</p>
2,5	<p>measuring systems for cryogenic liquids (temperature below – 153 °C)</p>

a However, Member States may require measuring systems of accuracy class 0,3 or 0,5 when used for the levying of duties on mineral oils when (un)loading ships and rail and road tankers.

Note: However, the manufacturer may specify a better accuracy for a certain type of measuring system.

8. Units of measurement

The metered quantity shall be displayed in millilitres, cubic centimetres, litres, cubic metres, grams, kilograms or tonnes.

CONFORMITY ASSESSMENT

The conformity assessment procedures referred to in Article 17 that the manufacturer can choose between are:

B + F or B + D or H1 or G.

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(1) OJ L 283, 31.10.2003, p. 51.