

WELMEC

European cooperation in legal metrology

**Measuring systems for the continuous and
dynamic measurement of quantities of liquids
other than water**

**Cross Reference Table 2004/22/EC vs. OIML R
117-1 - 2007**



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WELMEC is a co-operation between the legal metrology authorities of the Member States of the European Union and EFTA. This document is one of a number of Guides published by WELMEC to provide guidance to manufacturers of measuring instruments and to Notified Bodies responsible for conformity assessment of their products. The Guides are purely advisory and do not themselves impose any restrictions or additional technical requirements beyond those contained in relevant EC Directives. Alternative approaches may be acceptable, but the guidance provided in this document represents the considered view of WELMEC as to the best practice to be followed.

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Notes:

1. The column “Comments” indicates when necessary the relevant text of OIML R 117-1 and related explanations concerning the compliance with relevant MID requirement.
2. The column “Conclusion” gives the conclusion on the compliance between OIML R 117-1 for the relevant requirement.

The indication “Covered” means that:

- the requirement of OIML R 117-1 is identical to the one of MID; or
- the requirement of OIML R 117-1 is more severe than the one of MID; or
- All the requirement of OIML R 117-1 fulfils MID requirements (even when MID allows other alternatives),
- In case the requirement is not fully covered, a short statement explains what is covered.

The indication “Not Covered” means that the MID requirement is either not compatible with the relevant OIML R 117-1 requirement or not included in OIML R 117-1.

The indication “Not relevant” means that the MID Annex I requirement is not relevant for Measuring systems for the continuous and dynamic measurement of quantities of liquids other than water

The text in *italic* is an extract from the relevant clause of the OIML Recommendation.

	Directive 2004/22/EC Essential requirements of Annex I and Annex M-005	OIML R 117-1 (2007)	Comments	Conclusion
ANNEX 1				
1.1	<p>Allowable Errors</p> <p>Under rated operation conditions and in absence of a disturbance, the error of measurement shall not exceed the maximum permissible error (MPE) value as laid down in the appropriate instrument-specific requirements.</p> <p>Unless stated otherwise in the instrument-specific annexes, MPE is expressed as a bilateral value of the deviation from the true measurement value.</p>	<p>T.c.3.3</p> <p>T.e.4.3</p> <p>2.5</p>		Covered
1.2	<p>Under rated operating conditions and in presence of a disturbance, the performance requirement shall be as laid down in the appropriate instrument-specific requirements. Where the instrument is intended to be used in a specified permanent continuous electromagnetic field the permitted performance during the radiated electromagnetic field-amplitude modulated test shall be within MPE.</p>	<p>T.d.3</p> <p>T.f.1</p> <p>4.1.1.1</p> <p>4.1.1.2</p>	<p>See correspondence between critical change value (MID) and significant fault (OIML) in WELMEC Guide 8.1.</p> <p>Considering the conditions of installation, this is not applicable in most cases.</p>	<p>Covered except in case radiated electro magnetic amplitude modulated test has to be considered as an influence factor.</p>

1.3	The manufacturer shall specify the climatic, mechanical and electromagnetic environments in which the instrument is intended to be used, power supply and other influence quantities likely to affect its accuracy, taking into account of the requirements laid down in the appropriate instrument-specific annexes.	T.c.3.3 2.3.1 3.1.1.1 3.1.6.2 A.10.2 A.10.3 A.10.4 A.11.1.1		Covered
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1.3.1	<p>Climatic environments</p> <p>The manufacturer shall specify the upper temperature limit and the lower temperature limit from any of the values in Table 1 unless otherwise specified in the Annexes M-001 to M-010, and indicate whether the instrument is designed for condensing or non-condensing humidity as well as the intended location for the instrument, i.e. open or closed.</p> <p>Temperature limits:</p> <table><tr><td>Upper temperature limit</td><td>30 °C</td><td>40 °C</td><td>55 °C</td><td>70 °C</td><td></td></tr><tr><td>Lower temperature limit</td><td>5 °C</td><td>-10 °C</td><td>-25 °C</td><td>-40 °C</td><td></td></tr></table>	Upper temperature limit	30 °C	40 °C	55 °C	70 °C		Lower temperature limit	5 °C	-10 °C	-25 °C	-40 °C		<p>A.10.2</p> <p>A.10.3</p> <p>A.10.5</p> <p>A.10.6</p> <p>A.10.7</p>	<p>The upper limit may be chosen as follow:</p> <p>“.....</p> <table><tr><td rowspan="3">Test severities:</td><td colspan="6">One of the following severity levels shall be specified:</td></tr><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>unit</td></tr><tr><td>30</td><td>40</td><td>55</td><td>70</td><td>85</td><td>°C</td></tr></table> <p>....”</p> <p>The lower limit may be chosen as follow:</p> <p>“.....</p> <table><tr><td rowspan="3">Test severities:</td><td colspan="6">One of the following severity levels shall be specified:</td></tr><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>unit</td><td></td></tr><tr><td>5</td><td>-10</td><td>-25</td><td>-40</td><td>°C</td><td></td></tr></table> <p>....”</p> <p>A cyclic damp heat test is mandatory for class H2 and H3 instruments (see A.10.3). The relevant severity levels are defined in A.10.7.</p>	Test severities:	One of the following severity levels shall be specified:						1	2	3	4	5	unit	30	40	55	70	85	°C	Test severities:	One of the following severity levels shall be specified:						1	2	3	4	unit		5	-10	-25	-40	°C		<p>Covered</p>
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	5	-10	-25	-40	°C																																																	

1.3.2	(a) Mechanical environments are classified into classes M1 to M3 as described below	A.10.4	OIMR 117-1 has the same classification for mechanical environments as the one defined in the MD. No shock test is specified considering the conditions of installation and use of such measuring systems.	Covered for vibrations Not relevant for shocks
	M1: This class applies to instruments used in locations with vibration and shocks of low significance, e.g. for instruments fastened to light structures subject to negligible vibrations and shocks transmitted from local blasting or pile-driving activities, slamming doors, etc.		M1 is applicable to all measuring systems except those installed on trucks.	
	M2: This class applies to instruments used in locations with significant or high levels of vibration and shock, e.g. transmitted from machines and passing vehicles in the vicinity or adjacent to heavy machines, conveyer belts, etc.		M2 is applicable to all measuring systems on trucks and to other types of measuring systems for specific reasons.	
	M3: This class applies to instruments used in locations where the level of vibration and shock is high and very high, e.g. for instruments mounted directly on machines, conveyer belts, etc.		M3 may be applicable for specific applications.	
1.3.2 (b)	(b) The following influence quantities shall be considered in relation with mechanical environments: - Vibration - Mechanical shock	A.10.4 A.10.8	No shock test is specified considering the conditions of installation and use of such measuring systems.	Covered for vibrations Not relevant for shocks

1.3.3 (a)	(a) Electromagnetic environments are classified into E1, E2 or E3 as described below, unless otherwise laid down in the appropriate instrument-specific annexes.			
	<p>E1: This class applies to instruments used in locations with electromagnetic disturbances corresponding to those likely to be found in residential, commercial and light industrial buildings.</p> <p>E2: This class applies to instruments used in locations with electromagnetic disturbances corresponding to those likely to be found in other industrial buildings.</p>	A.11	The classification for electromagnetic environments E1 and E 2 is identical in the OIML R 117-1 and in the MID (see A.11.1.1).	Covered
	<p>E3: This class applies to instruments supplied by the battery of a vehicle. Such instruments shall comply with the requirements of E2 and the following additional requirements</p> <ul style="list-style-type: none"> - voltage reductions caused by energizing the starter-motor circuits of internal combustion engines, - load dump transients occurring in the event of a discharged battery being disconnected while the engine is running. 	A.12	Level E3 is applicable to instruments powered from road vehicle battery.	Covered except for load dump

1.3.3 (b)	<p>(b) The following influence quantities shall be considered in relation with electromagnetic environments:</p> <ul style="list-style-type: none"> - voltage interruptions - short voltage reductions - voltage transients on supply lines and/or signal lines - electrostatic discharges - radio frequency electromagnetic fields - conducted radio frequency electromagnetic fields on supply lines and/or signal lines - surges on supply lines and/or signal lines 	<p>A.11.1.1 A.11.1.2 A.11.3 to A.11.11</p> <p>A.12.3</p>	<p>A.11 defines the influence quantities applicable and the associated severity level according to the environment class.</p> <p>A.12.3 is related to the electrical transient conduction along supply lines applicable for environment class E3.</p>	Covered
1.3.4	<p>Other influence quantities to be considered, where appropriate, are:</p> <ul style="list-style-type: none"> - voltage variation - mains frequency variation - power frequency magnetic fields - any other quantity likely to influence in a significant way the accuracy of the instrument. 	<p>A.11.2.1 A.11.2.2 A.12.2</p>	<p>These sections define the voltage variations applicable to:</p> <ul style="list-style-type: none"> • AC mains voltage • DC mains voltage • Instruments powered by road vehicle battery. <p>It may no longer be necessary to take mains frequency variation and power frequency magnetic fields into consideration in the European Union considering the present day characteristics of the mains power supply in this region.</p>	Covered except for AC mains frequency variations and power frequency magnetic fields

1.4	When carrying out the tests as envisaged in this Directive, the following paragraphs apply :			
1.4.1	<p><i>Basic rules for testing and the determination of errors</i></p> <p>Essential requirements specified in 1.1 and 1.2 shall be verified for each relevant influence quantity . Unless otherwise specified in the appropriate instrument-specific annex, these essential requirements apply when each influence quantity is applied and its effect evaluated separately , all other influence quantities being kept relatively constant at their reference value.</p> <p>Metrological tests shall be carried out during or after the application of the influence quantity , whichever condition corresponds to the normal operational status of the instrument when that influence quantity is likely to occur.</p>	<p>6.1.11.2</p> <p>Annex A</p>	<p><i>“Annex A (this Annex) defines the program of performance tests intended to verify that the measuring system or its constituent elements operate as intended in a specified environment and under specified conditions. Each test indicates, where appropriate, the reference conditions for determining the intrinsic error.</i></p> <p><i>Different kinds of tests are specified:</i></p> <ul style="list-style-type: none"> <i>• Accuracy tests (including repeatability and flow disturbances tests, if applicable),</i> <i>• Influence factor tests, and</i> <i>• Electronic disturbance tests.</i> <p>...</p> <p><i>When the effect of one influence quantity is being evaluated, all other influence quantities shall be held relatively constant, at values close to reference conditions.”</i></p>	Covered

1.4.2	<p><i>Ambient humidity</i></p> <p>- According to the climatic operating environment in which the instrument is intended to be used either the damp heat-steady state (non-condensing) or damp heat cyclic (condensing) test may be appropriate.</p> <p>- The damp heat cyclic test is appropriate where condensation is important or when penetration of vapour will be accelerated by the effect of breathing. In conditions where non-condensing humidity is a factor the damp-heat steady state is appropriate.</p>	A.10.7	<p>Considering the type of measuring instruments, the damp heat cyclic test only is relevant.</p> <p>Consequently, the damp heat cyclic test is mandatory for instruments of classes H2 and H3.</p>	Covered
2	<p>Reproducibility</p> <p>The application of the same measurand in a different location or by different user, all other conditions being the same, shall result in the close agreement of successive measurements. The difference between the measurement results shall be small when compared with the MPE.</p>	2.12 – 2.18	<p>This requirement is considered to be fulfilled by the requirements defined in sections 2.12 – 2.18 in OIML R 117-1.</p>	Covered
3	<p>Repeatability</p> <p>The application of the same measurand under the same conditions of measurement shall result in the close agreement of successive measurements. The difference between the measurement results shall be small when compared with the MPE.</p>	<p>T.e.4.4</p> <p>3.1.2.2</p> <p>A.6.1</p>	<p><i>“Repeatability error</i></p> <p><i>For the purposes of this Recommendation, the difference between the largest and the smallest results of successive measurements of the same quantity carried out under the same conditions.”</i></p> <p><i>“For any quantity equal to or greater than five times the minimum measured quantity, the repeatability error of the meter shall not be higher than two-fifths of the value specified in line A of Table 2.”</i></p>	Covered

4	<p>Discrimination and sensitivity</p> <p>A measuring instrument shall be sufficiently sensitive and the discrimination threshold shall be sufficiently low for the intended measurement task.</p>	<p>T.q.1.3</p> <p>2.3.2</p>	<p><i>“Minimum measured quantity (MMQ)</i> <i>Smallest quantity of liquid for which the measurement is metrologically acceptable for that system or element....”</i></p> <p><i>“The minimum measured quantity shall satisfy the conditions of use of the measuring system; except in exceptional cases, the measuring systems shall not be used for measuring quantities less than this minimum measured quantity.”</i></p>	Covered
5	<p>Durability</p> <p>A measuring instrument shall be designed to maintain an adequate stability of its metrological characteristics over a period of time estimated by the manufacturer's instruction when in the environmental conditions for which it is intended.</p>	<p>T.e.2</p> <p>T.e.3</p> <p>3.1.2.3</p> <p>A.7</p> <p>T.d.4</p> <p>4.1.3</p>	<p>Two different aspects have been considered: mechanical durability and electronic durability.</p> <p><i>“Endurance</i> <i>Capability of the measuring system to keep its performance characteristics over a period of use.”</i></p> <p><i>“Durability for electronic devices</i> <i>Capability of the electronic devices of a measuring system to keep their performance characteristics over a period of use.”</i></p> <p><i>“The requirements in 4.1.1 shall be met durably. For this purpose, electronic measuring systems shall be provided with the checking facilities specified in 4.3.”</i></p>	Covered
6	<p>Reliability</p> <p>A measuring instrument shall be designed to reduce as far as possible the effect of a defect that would lead to an inaccurate measurement result, unless the presence of such a defect is obvious.</p>	4	<p><i>“Electronic measuring systems shall be designed and manufactured such that their metrological functions are safeguarded and their errors do not exceed the maximum permissible errors as defined in 2.5 under rated operating conditions.” (4.1.1)</i></p>	Covered
7	Suitability			

7.1	A measuring instrument shall have no feature likely to facilitate fraudulent use, whereas possibilities for unintentional misuse shall be minimal.	2.9 to 2.18 2.20		Covered
7.2	A measuring instrument shall be suitable for its intended use taking account of the practical working conditions and shall not require unreasonable demands of the user in order to obtain a correct measurement result.	2 3 5	It is an objective of all OIML Recommendations. Section 5 gives additional requirements for certain types of measuring systems and therefore takes into account relevant practical working conditions.	Covered
7.3	The errors of a utility measuring instrument at flows or currents outside the controlled range shall not be unduly biased.		These measuring systems are not utility measuring instruments.	Not relevant
7.4	Where a measuring instrument is designed for the measurement of values of the measurand that are constant over time, the measuring instrument shall be insensitive to small fluctuations of the value of the measurand, or shall take appropriate action.			Not relevant
7.5	A measuring instrument shall be robust and its materials of construction shall be suitable for the conditions in which it is intended to be used.	2 5 6.1.11.1	Section 2 defines all the elements to be included in a measuring system to guarantee an appropriate operation (e.g. gas elimination device, transfer point). Section 5 defines additional requirements for particular type of measuring systems (e.g. 5.6 for measuring systems for milk, beer and other foaming potable liquids). “Design examination ...It includes: a) <i>an examination of the mode of construction and of the electronic sub-systems and components used, to verify their appropriateness for their intended use; ...”</i>	Covered

7.6	A measuring instrument shall be designed so as to allow the control of the measuring tasks after the instrument has been placed on the market and put into use. If necessary, special equipment or software for this control shall be part of the instrument. The test procedure shall be described in the operation manual.	3.1.4 3.7.6 4.3.4.3 4.3.5 5.4.3 5.4.4 5.5.3	R 117-1 does not require that test procedures be included in the operating manual. In addition, such requirement is not part of International Recommendation for any category of measuring instruments. Test conditions and requirements are defined in the relevant OIML Recommendation.	Covered except for test procedures to be included in the operation manual.
	When a measuring instrument has associated software which provides other functions besides the measuring function, the software that is critical for the metrological characteristics shall be identifiable and shall not be inadmissibly influenced by the associated software.	6.1.2.1 6.1.3	<p><i>"The application for type approval of a measuring system or of a constituent element of a measuring system shall include the following documents:</i></p> <p>...</p> <ul style="list-style-type: none"> <i>instructions on how to access metrological software [and revision number of software]."</i> <p><i>"The following information shall appear on the type approval certificate:</i></p> <p>...</p> <p><i>the version of the metrological part of the evaluated software,..."</i></p>	

8	Protection against corruption			
8.1	The metrological characteristics of a measuring instrument shall not be influenced in any inadmissible way by the connection to it of another device, by any feature of the connected device itself or by any remote device that communicates with the measuring instrument.	<p>2.2.3</p> <p>2.20.2.2</p> <p>2.20.2.3</p>	<p><i>"When ancillary devices are not subject to control, it shall be verified that these devices do not affect the correct operation of the measuring system. In particular, the system shall continue to operate correctly and its metrological functions shall not be affected whether the ancillary device is connected or disconnected."</i></p> <p><i>"For measuring systems with parts which may be disconnected one from another by the user and which are interchangeable, the following provisions shall be fulfilled:</i></p> <ul style="list-style-type: none"> <i>• it shall not be possible to access parameters that participate in the determination of results of measurements through disconnected points unless the provisions in 2.20.2.1 are fulfilled;</i> <i>• interposing any device which may influence the accuracy shall be prevented by means of electronic and data processing securities or, if not possible, by mechanical means."</i> <p><i>"For measuring systems with parts which may be disconnected one from another by the user and which are not interchangeable, the provisions in 2.20.2.2 apply. Moreover, these measuring systems shall be provided with devices which do not allow them to operate if the various parts are not associated according to the manufacturer's configuration.</i></p> <p><i>Note: Disconnections by the user which are not allowed may be prevented, for example by means of a device that prevents any measurement after disconnecting and reconnecting."</i></p>	Covered

8.2	A hardware component that is critical for metrological characteristics shall be designed so that it can be secured. Security measures foreseen shall provide for evidence of an intervention.	2.20.1 3.1.3	<i>"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."</i> <i>"A meter may have a sealable means of adjustment which permits modification of the ratio between the indicated quantity and the actual quantity..."</i>	Covered
8.3 (a)	Software that is critical for metrological characteristics shall be identified as such and shall be secured.	6.1.3		Covered
8.3 (b)	Software identification shall be easily provided by the measuring instrument.			Not covered
8.3 (c)	Evidence of an intervention shall be available for a reasonable period of time.	220.2.1.5	<i>"For identification, data concerning the latest intervention(s) shall be automatically recorded into an event logger. The record shall include at least:</i> <ul style="list-style-type: none"> <i>• an event counter,</i> <i>• the date the parameter was changed (this is allowed to be entered manually),</i> <i>• the new value of the parameter, and</i> <i>• an identification of the person that implemented the intervention.</i> <i>The traceability of the last intervention shall be assured for at least two years, if it is not over-written on the occasion of a further intervention."</i>	Covered

8.4	Measurement data, software that is critical for measurement characteristics and metrologically important parameters stored or transmitted shall be adequately protected against accidental or intentional corruption.	2.20.1 2.20.2	<p><i>“Without prejudice to the provisions in 3.1.4 and 3.7.5, it must be prohibited to change parameters which participate in the determination of the results of measurement (parameters for correction and conversion in particular) by means of sealing devices.”</i></p> <p><i>“When access to parameters that participate in the determination of results of measurement is not protected by mechanical sealing devices, the protection shall fulfil the provisions of 2.20.2.1.1 through 2.20.2.1.5.” (2.20.2.1)</i></p>	Covered
8.5	For utility measuring instruments the display of the total quantity supplied or the displays from which the total quantity supplied can be derived, whole or partial reference to which is the basis for payment, shall not be able to be reset during use.			Not relevant

9.3	<p>The instrument shall be accompanied by information on its operation, unless the simplicity of the measuring instrument makes this unnecessary. Information shall be easily understandable and shall include where relevant:</p> <ul style="list-style-type: none"> - rated operating conditions - mechanical and electromagnetic environment classes - the upper and lower temperature limit, whether condensation is possible or not, open or closed location - instructions for installation, maintenance, repairs, permissible adjustments - instructions for correct operation and any special conditions use - conditions for compatibility with interfaces, sub-assemblies or measuring instruments. 	<p>2.19.1</p> <p>6.1.3</p>	<p>Most of the information is indicated on the identification plate.</p>	<p>Covered, except for information on its operation, installation, maintenance, repairs, permissible adjustments, correct operation and conditions for compatibility.</p>
9.4	<p>Groups of identical measuring instruments used in the same location or used for utility measurements do not necessarily require individual instruction manuals.</p>		<p>Providing an operating manual is not required in OIML R 117-1. According to 9.3 of Annex 1 it could be understood that such manual is not necessary.</p>	<p>Not relevant</p>
9.5	<p>Unless specified otherwise in an instrument-specific annex, the scale interval for a measured value shall be in the form 1×10^n, 2×10^n, or 5×10^n, where n is any integer or zero. The unit of measurement or its symbol shall be shown close to the numerical value.</p>	<p>3.2.1.2</p> <p>3.2.2.1</p> <p>3.3.3</p> <p>2.9.1</p>	<p><i>"The scale interval shall be in the form 1×10^n, 2×10^n or 5×10^n authorized units of quantity, where n is a positive or negative whole number, or zero."</i></p> <p><i>"The name of the unit or its symbol shall appear in the immediate vicinity of the indication. For mass, according to the case, the name of the unit or its symbol shall be accompanied by the term "mass" (actual mass) or "conventional mass" (comparison to weights)."</i></p>	<p>Covered</p>

9.6	A material measure shall be marked with a nominal value or a scale, accompanied by the unit of measurement used.		Measuring systems are not material measure.	Not relevant
9.7	The units of measurement used and their symbols shall be in accordance with the provisions of Community legislation on units of measurement and their symbols.	2.9.1		Covered
9.8	All marks and inscriptions required under any requirement shall be clear, non-erasable, unambiguous and non-transferable.	2.19.1		Covered

10	Indication of result			
10.1	Indication of the result shall be by means of a display or a hard copy.	<p>T.m.2</p> <p>T.m.3</p> <p>T.a.6</p> <p>T.q.1.2</p> <p>2.9.2</p> <p>3.2</p> <p>3.4</p> <p>3.5</p> <p>5.1.9</p> <p>5.2.7</p> <p>5.4.8</p> <p>5.6.4</p>	<p>Indication by means of a display is mandatory in OIML R 117-1.</p> <p><i>“Instrument intended to measure continuously and display the quantity of liquid passing through the measuring device at metering conditions. A meter includes at least a measuring device, a calculator (including adjustment or correction devices if present) and an indicating device.”</i></p> <p><i>“Measuring systems shall be provided with an indicating device giving the quantity of liquid measured at metering conditions.”</i></p> <p>3.2 is related to the indicating device.</p> <p>3.4 is related to the printing device.</p> <p>3.5 is related to the memory device.</p> <p>These four sections define requirements applicable when the measuring system is fitted with a printing device.</p>	Covered

10.2	The indication of any result shall be clear and unambiguous and accompanied by such marks and inscriptions necessary to inform the user of the significance of the result. Easy reading of the present result shall be permitted under normal conditions of use. Additional indications may be shown provided they cannot be confused with the metrologically controlled indications.	2.9.1 2.9.2 2.9.3 2.9.4 2.9.5 3.2.1.1 3.2.1.3 3.3	<p><i>"The name of the unit or its symbol shall appear in the immediate vicinity of the indication. For mass, according to the case, the name of the unit or its symbol shall be accompanied by the term "mass" (actual mass) or "conventional mass" (comparison to weights)."</i></p> <p><i>"...The use of the same display for the indications of quantities at metering conditions and converted indications is permitted provided that the nature of the displayed quantity is clear..."</i></p> <p>General requirement for price indications.</p>	Covered
10.3	In the case of hard copy the print or records shall also be easily legible and non-erasable.	2.2 2.2.2 3.4.2 3.4.3	<p>Printing and memory devices are considered in OIML R 117-1 as ancillary devices.</p> <p><i>"When these ancillary devices are mandatory in application of this Recommendation or of a national or international regulation, they are considered as integral parts of the measuring system they are subject to control, and they shall meet the requirements of this Recommendation."</i></p> <p><i>"Stored data may be deleted if either:</i></p>	Covered

		3.5.3	<ul style="list-style-type: none"> <i>the transaction is settled; or</i> <i>these data are printed by a printing device subject to legal control."</i> 	
		3.5.4	<i>"Memorization shall be such that it is impossible in normal use to modify stored values."</i>	
		3.5.5		
10.4	<p>A measuring instrument for direct sales trading transactions shall be designed to present the measurement result to both parties in the transaction when installed as intended.</p> <p>When critical in case of direct sales, any ticket provided to the consumer by an ancillary device not complying with the appropriate requirements of this Directive shall bear an appropriate restrictive information.</p>	<p>T.d.2</p> <p>B. T.d.2</p> <p>5.1</p> <p>5.2</p> <p>5.5</p> <p>5.10</p> <p>2.2.3</p> <p>5.9</p>	<p>Measuring systems are equipped with an indicating device. As far as fuel dispensers and measuring systems on road tankers are concerned by direct sales, the indicating device is readable by both parties.</p> <p><i>"...Printing devices may only be excluded from control if such a legend is present on each print-out intended for the customer. However, such a legend needs only be present on printouts truly intended for the customer (and not in all cases where the customer can have access to these printouts)."</i></p>	Covered
10.5	Whether or not a measuring instrument intended for utility measurement purposes can be remotely read it shall in any case be fitted with a metrologically controlled display accessible without tools to the customer. The reading of this display is the measurement result that serves as the basis for the price to pay.			Not relevant

11	Further processing of data to conclude the trading transaction			
11.1	A measuring instrument other than a utility measuring instrument shall record by a durable means the measurement result accompanied by information to identify the particular transaction, when: - the measurement is non-repeatable - the measuring instrument is normally intended for use in the absence of one of the trading parties.	T.a.6 T.s.4.2 T.s.5 3.5 5.10.1.7 5.10.3.1 5.11 5.12		Covered
11.2	Additionally, a durable proof of the measurement result and the information to identify the transaction shall be available on request at the time the measurement is concluded.	3.5 5.10.2 5.10.3 5.11 5.12		Covered
12	Conformity evaluation A measuring instrument shall be designed so as to allow ready evaluation of its conformity with the appropriate requirements of this Directive.		No equivalent specific requirement but an instrument in conformity with the OIML Recommendation allows its ready evaluation.	Covered

ANNEX MI-005

	<p>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".</p>	<p>1.1</p> <p>2.9.1</p>		<p>Covered</p>
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Definitions	Meter	T.m. 1 T.m. 3		Covered, except for direct indication
	Calculator	T.c. 1 T.m. 3		
	Associated measuring instrument	T.a. 7 T.a. 8 T.a. 9		
	Conversion device	T.c. 4		
	Base conditions	T.c. 3. 1		
	Measuring system	T.m. 2 T.a. 2 T.a. 6		
	Fuel dispenser	T.f. 4		
	Self-service arrangement	T.s. 1		
	Self-service device	T.s. 2		
	Minimum measured quantity (MMQ)	T.q. 1.3		
	Direct indication		No definition in OIML R 117-1	
	Interruptible/non-interruptible	T.i. 4		
	Flowrate range	T.c. 3. 3 2.3.1 2.3.3. 2		

1	Rated operating conditions The manufacturer shall specify the rated operating conditions for the instrument, in particular;	2.3.1 6.1.2.2 B.2.3.1		Covered
1.1	The flowrate range The flowrate range is subject to the following conditions:			

1.2	<p>The properties of the liquid to be measured by the instrument specifying the name or type of the liquid or its relevant characteristics, for example:</p> <ul style="list-style-type: none"> ▪ Temperature range; ▪ Pressure range; ▪ Density range; ▪ Viscosity range. 	<p>1.2</p> <p>2.3.1</p> <p>3.1.1.1</p>		Covered
1.3	The nominal value of the AC voltage supply and/ or limits of the DC voltage supply.	2.3.1		Covered
1.4	<p>The base conditions for converted values.</p> <p>Note: Paragraph 1.4 is without prejudice to the Member States' obligations to require use of a temperature of either 15°C in accordance with Article 3(1) of Council Directive 92/81/EEC of 19 October 1992 on the harmonisation of the structures of excise duties on mineral oils 1 or, for heavy fuel oils, LPG and methane, another temperature pursuant to Article 3(2) of that Directive.</p>	<p>T.c.3.1</p> <p>2.19.4</p>		Covered

2	Accuracy classification and maximum permissible error (MPEs)																											
2.1	<p>For quantities equal to or greater than 2 litres the MPE on indication is:</p> <p>Table 2</p> <table><tr><th colspan="6">Accuracy class</th></tr><tr><th></th><th>0,3</th><th>0,5</th><th>1</th><th>1,5</th><th>2,5</th></tr><tr><td>Measuring systems (A)</td><td>0,3 %</td><td>0,5 %</td><td>1,0 %</td><td>1,5 %</td><td>2,5 %</td></tr><tr><td>Meters (B)</td><td>0,2 %</td><td>0,3 %</td><td>0,6 %</td><td>1,0 %</td><td>1,5 %</td></tr></table>	Accuracy class							0,3	0,5	1	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 %	2.5.1	<p>OIML R 117-1 does not specify any accuracy class 2,5.</p> <p>OIML R 117-1 does not require that the meter is evaluated separately in the case of a global type examination of a measuring system.</p>	<p>Covered provided the meter is also evaluated separately from the rest of the measuring instrument.</p>
Accuracy class																												
	0,3	0,5	1	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	<p>For quantities less than two litres the MPE on indications is:</p> <table><tr><th colspan="2">Table 3</th></tr><tr><th>Measured volume V</th><th>MPE</th></tr><tr><td>V < 0,1 L</td><td>4 x value in Table 2, applied to 0,1 L</td></tr><tr><td>0,1 L ≤ V < 0,2 L</td><td>4 x value in Table 2</td></tr><tr><td>0,2 L ≤ V < 0,4 L</td><td>2 x value in Table 2, applied to 0,4 L</td></tr><tr><td>0,4 L ≤ V < 1 L</td><td>2 x value in Table 2</td></tr><tr><td>1 L ≤ V < 2 L</td><td>Value in Table 2, applied to 2 L</td></tr></table>	Table 3		Measured volume V	MPE	V < 0,1 L	4 x value in Table 2, applied to 0,1 L	0,1 L ≤ V < 0,2 L	4 x value in Table 2	0,2 L ≤ V < 0,4 L	2 x value in Table 2, applied to 0,4 L	0,4 L ≤ V < 1 L	2 x value in Table 2	1 L ≤ V < 2 L	Value in Table 2, applied to 2 L	2.5.2		Covered
Table 3																		
Measured volume V	MPE																	
V < 0,1 L	4 x value in Table 2, applied to 0,1 L																	
0,1 L ≤ V < 0,2 L	4 x value in Table 2																	
0,2 L ≤ V < 0,4 L	2 x value in Table 2, applied to 0,4 L																	
0,4 L ≤ V < 1 L	2 x value in Table 2																	
1 L ≤ V < 2 L	Value in Table 2, applied to 2 L																	
2.3	<p>However, no matter what the measured quantity may be, the magnitude of the MPE is given by the greater of the following two values:</p> <ul style="list-style-type: none">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}).	2.5.3		Covered														

2.4.1	<p>For minimum measured quantities greater than or equal to 2 litres the following conditions apply :</p> <p>Condition 1 E_{min} shall fulfil the condition: $E_{min} \geq 2R$, where R is the smallest scale interval of the indication device.</p> <p>Condition 2 E_{min} is given by the formula: $E_{min} = (2 \text{ MMQ}) \times (A/100)$, where:</p> <ul style="list-style-type: none"> ▪ MMQ is the minimum measured quantity , ▪ A is the numerical value specified in line A of Table 2. 	2.5.3		Covered
2.4.2	<p>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.</p>	2.5.3		Covered
2.5	<p>Converted indication In the case of a converted indication the MPEs are as in line A of Table 2.</p>	2.5.1		Covered

2.6 (a) and 2.6 (b)	<p>Conversion devices</p> <p>MPEs on converted indications due to a conversion device are equal to + (A - B), A and B being the values specified in Table 2.</p> <p>Parts of conversion devices that can be tested separately</p> <p>(a) Calculator</p> <p>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.</p> <p>(b) Associated measuring instruments Associated measuring instruments shall have an accuracy at least as good as the values in Table 4: Table 4</p> <table><tr><td rowspan="2">Maximum permissible errors (MPE), and Significant faults, on measuring :</td><td colspan="5">Accuracy class of the measuring system</td></tr><tr><td>0,3</td><td>0,5</td><td>1,0</td><td>1,5</td><td>2,5</td></tr><tr><td>Temperature</td><td>±0,30 °C</td><td colspan="3">±0,50 °C</td><td>± 1 °C</td></tr><tr><td>Pressure</td><td colspan="5">Less than 1 MPa: ±50 kPa Between 1 MPa and 4 MPa: ± 5 % More than 4 MPa: ±200 kPa</td></tr><tr><td>Density (mass to volume conversion)</td><td colspan="2">± 1,0 kg/m³</td><td colspan="2">± 2,0 kg/m³</td><td>± 5,0 kg/m³</td></tr></table>	Maximum permissible errors (MPE), and Significant faults, on measuring :	Accuracy class of the measuring system					0,3	0,5	1,0	1,5	2,5	Temperature	±0,30 °C	±0,50 °C			± 1 °C	Pressure	Less than 1 MPa: ±50 kPa Between 1 MPa and 4 MPa: ± 5 % More than 4 MPa: ±200 kPa					Density (mass to volume conversion)	± 1,0 kg/m³		± 2,0 kg/m³		± 5,0 kg/m³	2.5.1 2.7.1 2.8 2.7.2.2.1 2.7.2.1.2		Covered except for cryogenic liquids
Maximum permissible errors (MPE), and Significant faults, on measuring :	Accuracy class of the measuring system																																
	0,3	0,5	1,0	1,5	2,5																												
Temperature	±0,30 °C	±0,50 °C			± 1 °C																												
Pressure	Less than 1 MPa: ±50 kPa Between 1 MPa and 4 MPa: ± 5 % More than 4 MPa: ±200 kPa																																
Density (mass to volume conversion)	± 1,0 kg/m³		± 2,0 kg/m³		± 5,0 kg/m³																												
			33/ 43																														

	These values apply to the indication of the characteristic quantities of the liquid displayed by the conversion device.			
2.6 (c)	(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).	2.7.2 1.2	Values defined in Table 4.1 are greater than those specified in the MID since a quadratic sum has been considered to define the relevant MPEs. For cryogenic liquids, values are equal to 0,25 % of the calculated quantity.	Covered, except for quadratic addition of partial MPEs; not covered for cryogenic liquids
2.7	The requirement (a) in paragraph 2.6 applies to any calculation, not only conversion.	2.8		Covered
2.8	The measuring system shall not exploit the MPEs or systematically favour any party.			Applicable from 1 June 2011, not covered.

3	Permissible effect of disturbances			
3.1	<p>The effect of an electromagnetic disturbance on a measuring system shall be one of the following:</p> <ul style="list-style-type: none"> the change in the measurement result is not greater than the critical change value as defined in paragraph 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 	<p>T.f.1</p> <p>4.3.1</p> <p>4.1.1.1</p> <p>4.1.1.2</p> <p>4.1.5</p>		Covered
3.2	The critical change value is the greater of MPE/5 for a particular measured quantity or E_{\min}	2.5.4		Covered

4	<p>Durability</p> <p>After an appropriate test, taking into account the period of time estimated by the manufacturer, has been performed, the following criterion shall be satisfied:</p> <p>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.</p>	<p>T.e.3</p> <p>A.7</p> <p>3.1.2.3</p>		Covered
5	Suitability			
5.1	<p>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.</p> <p>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.</p>	<p>2.9.4</p> <p>5.10.1.3</p>		Covered

5.2	It shall not be possible to divert the measured quantity in normal conditions of use unless it is readily apparent.	2.16 2.17.2 5.1.7 5.5.5 5.9.2	2.16 and 2.17.2 are general requirements. Sections 5.1.7, 5.5.5 and 5.9.2 are specific requirements for fuel dispensers, LPG dispensers and blend dispensers.	Covered
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5.3	<p>Any percentage of air or gas not easily detectable in the liquids shall not lead to a variation of error greater than:</p> <ul style="list-style-type: none"> ▪ 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. <p>However, the allowed variation shall never be smaller than 1 % of MMQ. This value applies in the case of air or gas pockets.</p>	2.10. 1		Covered
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5.4	Instruments for direct sales			
5.4.1	<p>A measuring system for direct sales shall be provided with means for resetting the display to zero.</p> <p>It shall not be possible to divert the measured quantity.</p>	<p>3.2.4.5</p> <p>5.1.5</p> <p>5.2.7</p> <p>5.5.1</p> <p>2.16.1</p> <p>5.1.7</p> <p>5.5.5</p> <p>5.9.2</p> <p>5.1.9</p>	<p>General requirement.</p> <p>For fuel dispensers (other than LPG).</p> <p>For measuring systems on road tankers.</p> <p>For LPG dispensers.</p> <p>Section 2.16.1 defines general requirements. Specific requirements are defined in 5.1.7, 5.5.5 and 5.9.2 for fuel dispensers, LPG dispensers and blend dispensers.</p> <p>OIML R 117-1 allows diversion of flow if readily apparent even in case of measuring systems for direct sales.</p>	Covered, except in case of a diversion readily apparent
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.	<p>3.2.3</p> <p>3.3.3</p> <p>5.10.1.7</p> <p>5.10.2.1.1</p> <p>5.10.2.1.3</p> <p>5.10.3.1.1</p> <p>5.11</p>	<p>First sentence.</p> <p>General requirements for self-service arrangements for fuel dispensers.</p> <p>Attended post-payment.</p> <p>Unattended service mode.</p> <p>Other self-service arrangements</p>	Covered

5.4.3	Measuring systems for direct sales shall be interruptible.	4.1.2 5.1.10 5.5.1 5.9.1	<i>"...However, measuring systems for direct selling to the public shall be interruptible."</i>	Covered
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 paragraph 5.3.	2.10 5.1.2 5.1.3 5.1.4 5.2.3 5.2.8 5.9.1	General requirements. Specific requirements for fuel dispensers. Specific requirements for measuring systems on road tankers. Specific requirements for blend dispensers.	Covered
5.5	Fuel dispensers			
5.5.1	Displays on fuel dispensers shall not be capable of being reset to zero during a measurement.	3.2.4.2 3.3.3		Covered
5.5.2	The start of a new measurement shall be inhibited until the display has been reset to zero.	5.1.7 5.5.5 5.9.1	For fuel dispensers. For LPG dispensers. For blend dispensers.	Covered

5.5.3	<p>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}.</p> <p>However this difference need not be less than the smallest monetary value.</p>	<p>T.d.1.2</p> <p>3.3.7</p>		Covered
6	<p>Power supply failure</p> <p>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.</p>	4.2		Covered

7	<div>Putting into use</div> <div>Table 5</div> <table><tr><th>Class</th><th>Type of measuring system</th></tr><tr><td>0,3</td><td>Measuring systems on pipelines</td></tr><tr><td>0,5</td><td><div>All measuring systems, if not differently stated elsewhere in this Table, in particular:</div><div><div>- fuel dispensers (not for liquefied gases),</div><div>- measuring systems on road tankers for liquids of low viscosity(< 20 mPa·s),</div><div>- measuring systems for (un)loading ships and rail and road tankers⁽¹⁾</div><div>- measuring systems for milk</div><div>- measuring systems for refuelling aircraft</div></div></td></tr><tr><td>1,0</td><td><div>Measuring systems for liquefied gases under pressure measured at a temperature equal to or above – 10 °C</div><div>Measuring systems normally in class 0,3 and 0,5 but used for liquids</div><div><div>- whose temperature is less than – 10 °C or greater than 50 °C</div><div>- whose dynamic viscosity is higher than 1000 mPa·s</div><div>- whose maximum volumetric flowrate is not higher than 20 L/h</div></div></td></tr></table>	Class	Type of measuring system	0,3	Measuring systems on pipelines	0,5	<div>All measuring systems, if not differently stated elsewhere in this Table, in particular:</div> <div><div>- fuel dispensers (not for liquefied gases),</div><div>- measuring systems on road tankers for liquids of low viscosity(< 20 mPa·s),</div><div>- measuring systems for (un)loading ships and rail and road tankers⁽¹⁾</div><div>- measuring systems for milk</div><div>- measuring systems for refuelling aircraft</div></div>	1,0	<div>Measuring systems for liquefied gases under pressure measured at a temperature equal to or above – 10 °C</div> <div>Measuring systems normally in class 0,3 and 0,5 but used for liquids</div> <div><div>- whose temperature is less than – 10 °C or greater than 50 °C</div><div>- whose dynamic viscosity is higher than 1000 mPa·s</div><div>- whose maximum volumetric flowrate is not higher than 20 L/h</div></div>	<div>2.4</div> <div>2.5.5</div>	<div>Class 2,5 is not in the scope of OIML R 117-1.</div>	<div>Covered</div>
Class	Type of measuring system											
0,3	Measuring systems on pipelines											
0,5	<div>All measuring systems, if not differently stated elsewhere in this Table, in particular:</div> <div><div>- fuel dispensers (not for liquefied gases),</div><div>- measuring systems on road tankers for liquids of low viscosity(< 20 mPa·s),</div><div>- measuring systems for (un)loading ships and rail and road tankers⁽¹⁾</div><div>- measuring systems for milk</div><div>- measuring systems for refuelling aircraft</div></div>											
1,0	<div>Measuring systems for liquefied gases under pressure measured at a temperature equal to or above – 10 °C</div> <div>Measuring systems normally in class 0,3 and 0,5 but used for liquids</div> <div><div>- whose temperature is less than – 10 °C or greater than 50 °C</div><div>- whose dynamic viscosity is higher than 1000 mPa·s</div><div>- whose maximum volumetric flowrate is not higher than 20 L/h</div></div>											
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	1,5	Measuring systems for liquefied carbon dioxide			
		Measuring systems for liquefied gases under pressure measured at a temperature below – 10 °C (other than cryogenic liquids)			
	2,5	Measuring systems for cryogenic liquids (temperature below – 153 °C)			
	<p>(1) 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.</p> <p><i>Note:</i> However, the manufacturer may specify a better accuracy for a certain type of measuring system</p>			<p><i>“A better accuracy for certain types of measuring system may be specified”.</i></p> <p>This may be specified either by the manufacturer when applying for type approval or by the national/regional regulation.</p>	
8	Units of measurement The metered quantity shall be displayed in millilitres, cubic centimetres, litres, cubic metres, grams, kilograms or tonnes.		2.9.1		Covered