WELMEC 8.15
Issue 1

WELMEC

European cooperation in legal metrology

Measuring Instruments Directive 2004/22/EC
Measuring Systems for Liquids other than Water
Corresponding Tables
OIML R 117 1995 – MID-005

November 2006

WELMEC

European cooperation in legal metrology

WELMEC is a cooperation between the legal metrology services 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.

Published by:
WELMEC Secretariat
Federal Office of Metrology and Surveying (BEV)
Arltgasse 35
A-1160 Vienna
Austria

Tel: +43 676 8210 3608
Fax: +43 1 49 20 875 8006

Email : welmec@bev.gv.at
Website: www.welmec.org

FOREWORD

The Measuring Instruments Directive (MID) 2004/22/EC entered into force on the 30th October 2006. In this new approach directive the presumption of conformity is mentioned in Article 13. In addition to the use of harmonised standards (Art. 13 point 1) a new route is open for the presumption of conformity by using OIML recommendations (Art. 13 point 2).

"*Member States shall presume conformity with the essential requirements referred to in Annex I and in the relevant instrument-specific Annexes in respect of a measuring instruments that complies with the corresponding parts of the normative documents and lists referred to in Article 16(1)(a), the references in respect of which have been published in the Official Journal of the European Union, C series."*

Article 4(i) defines that

"normative document" means a document containing technical specifications adopted by the Organisation International de Métrologie Légale (OIML), subject to the procedure stipulated in Article 16(1)".

In Article 16 (1) (a) the functions of the Measuring Instruments Committee are described as follows:

"*identify normative documents drawn up by OIML and, in a list, indicate the parts thereof compliance with which gives rise to a presumption of conformity with the corresponding essential requirements of this Directive".*

In the WELMEC Committee Meeting in May 2005 WELMEC agreed to support the work of the Commission on this issue and the MI-xxx Annexes of the MID has been given to the Working Groups of WELMEC to develop corresponding tables including comments as a basis for the publication foreseen in the Directive. A timetable has been established and rules for drawing up these tables have been given by the WELMEC Committee. To prepare a proposal at least 3 experts has been involved. The drafts have been discussed in the responsible Working Group (including industry). The results have been sent do the WELMEC Secretariat and the WELMEC Committee Members has been asked for Comments. These drafts have been discussed during the WELMEC Committee Meeting in May 2006 and have been adopted as WELMEC guides.

The documents have been sent to the European Commission for further consideration and for drafting the publication required in the directive. This has been done in a small Working Group with the European Commission (June, July 2006).

The European Commission presented the simplified tables to the Commission Working Group on Measuring Instruments for further comment and subsequently obtained a positive advice from the Measuring Instruments Committee on 25 September 2006.

The simplified tables are published In the Official Journal of the European Union, series C n° 269, p I of 4 November 2006. As guidance, WELMEC is publishing the full tables with all the comments and detailed information underlying the simplified tables to aid all interested and concerned parties.

The European Commission webpage gives the link to the documents of WELMEC.

Table of correspondence
Requirements of MID Annex 1, MI 005 and OIML R 117 ed. 1995
Plus when mentioned D 11 (2004)

Directive 2004/22/EC **Essential requirements in Annex 1 and Annex MI 005**	**OIML R 117 (1995) and when specified D11 (2004)**	**Comments**
ANNEX 1		
ESSENTIAL REQUIREMENTS		
A measuring instrument shall provide a high level of metrological protection in order that any party affected can have confidence in the result of measurement, and shall be designed and manufactured to a high level of quality in respect of the measurement technology and security of the measurement data.		Also objective of OIML. In particular close 4 of R 117 giving presumption of conformity concerning the security of data.
The requirements that shall be met by measuring instruments are set out below and are supplemented, where appropriate, by specific instrument requirements in Annexes MI-001 to MI-010 that provide more detail on certain aspects of the general requirements.		Comment only, so see below the details of correspondence
The solutions adopted in the pursuit of the requirements shall take account of the intended use of the instrument and any foreseeable misuse thereof.		Also objective of OIML
DEFINITIONS	VIM	VIM (reference document shared by BIPM, IEC,IFCC,ISO,IUPAC,IUAPP, OIML)
Measurand The measurand is the particular quantity subject to measurement.	VIM 2.6	
Influence quantity An influence quantity is a quantity that is not the measurand but that affects the result of measurement.	VIM 2.7 T4.1 T4.2 T4.5 T.4.3	
Rated Operating Conditions The rated operating conditions are the values for the measurand and influence quantities making up the normal working conditions of an instrument.	VIM 5.5 T4.4	
Disturbance An influence quantity having a value within the limits specified in the appropriate requirement but outside the specified rated operating conditions of the measuring instrument. An influence quantity is a disturbance if for that influence quantity the rated operating conditions are not specified.	T4.3	CCV corresponds to significant fault With the editorial difference that CCV is a limit

Critical change value The critical change value is the value at which the change in the measurement result is considered undesirable.	T3.12	where SF corresponds to all errors beyond the limit
Material Measure A material measure is a device intended to reproduce or supply in a permanent manner during its use one or more known values of a given quantity.		not applicable
Direct sales A trading transaction is direct sales if: – the measurement result serves as the basis for the price to pay and; – at least one of the parties involved in the transaction related to measurement is a consumer or any other party requiring a similar level of protection and; – all the parties in the transaction accept the measurement result at that time and place.	T2.14	
Climatic environments Climatic environments are the conditions in which measuring instruments may be used. To cope with climatic differences between the Member States, a range of temperature limits has been defined.	A.2	
Utility A utility is regarded as a supplier of electricity, gas, heat or water.		Not applicable.
1. **Allowable Errors**		
1.1. Under rated operating conditions and in the 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. Unless stated otherwise in the instrument-specific annexes, MPE is expressed as a bilateral value of the deviation from the true measurement value	T3.4 2.5 2.6 2.7 2.8 3.1.2 4.1.1 A.4.1 to A.4.5 A.4.10	A.4.10 over and under voltage
1.2. Under rated operating conditions and in the presence of a disturbance, the performance requirement shall be as laid down in the appropriate instrument specific requirements.	4.1.1.1 and 4.1.1.2, A.4.5 to A.4.9, A.4.10 last part	
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.		Not covered by R117.

<table>
<tr><td>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 account of the requirements laid down in the appropriate instrument-specific annexes.</td><td></td><td>See below</td></tr>
<tr><td>1.3.1. Climatic environments
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 MI-001 to MI-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.

Table 1
<table>
<tr><td></td><td colspan="4">Temperature Limits</td></tr>
<tr><td>Upper temperature limit</td><td>30 °C</td><td>40 °C</td><td>55 °C</td><td>70 °C</td></tr>
<tr><td>Lower temperature limit</td><td>5 °C</td><td>- 10 °C</td><td>- 25 °C</td><td>- 40 °C</td></tr>
</table></td><td>2.3.1, 3.1.1.1, A.2, A4.1 and A4.2
D 11 10.1.1 and 10.1.2 (class H1, H2, H3)</td><td>Climatic environnments limited to 40 and 55 °C for dried and to –10 °C and –25 °C for cold. See in addition last paragraph of A.2. For other temperature ranges see D 11 10.1.1 and 10.1.2. class H1 and H2 for closed location and H3 for open location
The water test specified in D11 is performed for ATEX certification.</td></tr>
<tr><td>1.3.2. (a) Mechanical environments are classified into classes M1 to M3 as described below.</td><td>A.2</td><td>The Manufacturer chooses the level.</td></tr>
<tr><td>M1 This class applies to instruments used in locations with vibration and shocks of low significance, e.g. for instruments fastened to light supporting structures subject to negligible vibrations and shocks transmitted form local blasting or pile-driving activities, slamming doors, etc.</td><td></td><td>Without particular reasons applicable to all measuring systems except those on trucks.</td></tr>
<tr><td>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, conveyor belts, etc.</td><td></td><td>Without particular reasons applicable to all measuring systems on trucks.</td></tr>
</table>

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, conveyor belts, etc.		Specific applications.
(b) The following influence quantities shall be considered in relation with mechanical environments: – Vibration; – Mechanical shock.	A.2 D 11 11.1.1 severity level 1 for M2 D 11 11.1.1 severity level 2 for M3	Nevertheless R117 does not give presumption of conformity to requirements on vibration on specific technologies such as Coriolis meters. Waiting for OIML R117-1 to address this matter it is expected that the manufacturer will give the necessary information. If applicable and necessary, the requirement on sinus vibration has to be applied ID 11.1.2 Level 1 , 2 or 3. Not applicable
1.3.3. (a) Electromagnetic environments are classified into classes E1, E2 or E3 as described below, unless otherwise laid down in the appropriate instrument-specific annexes.	A.2	

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.		Provisions corresponding to E2 in OIML D11 fulfil the requirements for these corresponding uses in MID. Except for surges on signal lines, see 1.3.3.c
E2 This class applies to instruments used in locations with electromagnetic disturbances corresponding to those likely to be found in other industrial buildings.		Provisions corresponding to E2 in OIML D11 fulfil the requirements for these corresponding uses in MID. Except for surges on signal lines, see 1.3.3.c
E3 This class applies to instruments supplied by the battery of a vehicle. Such instruments shall comply with the requirements of E 2 and the following additional requirements:	D11 12.1, 12.2,12.4, 13.4, 13.5, 13.6,13.8,14.2 8.5.2	Provisions corresponding to E2+ chapter 14.2 in OIML D11, fulfil the requirements for E3 in MID. Tests from D11 12.1, 12.2 and 14.2 apply. D 11 8.5.2 recommends severity level Code C/F in 14.2.1 and IV in 14.2.2. and 14.2.3
– voltage reductions caused by energising 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.	Not covered in D11.	

(b) The following influence quantities shall be considered in relation with electromagnetic environments: (c) – 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.		A2. The following tests with appropriate severity level in D11 give presumption of conformity with MID: Voltage interruptions13.4 and/or 13.6, –Short voltage reductions 13.4 and/or 13.6, –Bursts and transients on supply lines 13.5 and/or signal lines 12.4, –Electrostatic discharges 12.2, –Radio frequency electromagnetic fields 12.1.1, –Conducted radio frequency electromagnetic fields on supply lines and/or signal lines 12.1 2, –Surges on signal lines12.5 severity level 2 for E1 and E2 and/or supply lines 13.8

1.3.4. Other influence quantities to be considered, where appropriate, are: – Voltage variation, – Mains frequency variation, – Power frequency magnetic fields, – Any other quantity likely to influence in a significant way the accuracy of the instrument.	 A2 and A.4.5 or D 11 13.2 (E1 and E2) and 14.2.1 (E3) Not defined Not defined Not defined	 Not relevant. Not relevant except for particular technologies.
1.4. When carrying out the tests as envisaged in this Directive, the following paragraphs apply:		
1.4.1. *Basic rules for testing and the determination of errors* 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. 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.	6.1.11.2 and Annex A	General concepts applicable in legal metrology: see OIML D11.
1.4.2. Ambient humidity – 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. – 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.	D11 10.2.1 Annex A.4.3 or D 11 10.2.2	For damp heat-steady test refer to OIML D11 (10.2.1)

2.	**Reproducibility** The application of the same measurand in a different location or by a 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.		Not relevant
3.	**Repeatability** 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.	T3.8, 3.1.2.2 and 6.1.5.2.1	
4.	**Discrimination and Sensitivity** A measuring instrument shall be sufficiently sensitive and the discrimination threshold shall be sufficiently low for the intended measurement task.		Not relevant.
5.	**Durability** A measuring instrument shall be designed to maintain an adequate stability of its metrological characteristics over a period of time estimated by the manufacturer, provided that it is properly installed, maintained and used according to the manufacturer's instruction when in the environmental conditions for which it is intended.	T.4.7, 3.1.2.3, 6.1.5.3 T.3.13, 4.1.3	Mechanical durability: T.4.7, 3.1.2.3, 6.1.5.3 Electronic durability: T.3.13, 4.1.3
6.	**Reliability** 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.	4	
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 3.1.3 to 3.1.8 3.2 to 3.8 5	
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 and 5	General objective of OIML.

7.3.	The errors of a utility measuring instrument at flows or currents outside the controlled range shall not be unduly biased.		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 and 5	General objective of OIML.
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. 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.	3.1.5, 3.7.7, 4.3.4.3, 4.3.5, 5.4.4, 5.6.5, 5.7.3 6.1.3	"The test procedure shall be described in the operation manual." Not covered
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.	2.2.3 and 2.20.2.2, 2.20.2.3	
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, 3.1.3	

8.3. Software that is critical for metrological characteristics shall be identified as such and shall be secured. Software identification shall be easily provided by the measuring instrument. Evidence of an intervention shall be available for a reasonable period of time.	6.1.3 2.19.2 1st paragraph, 2.20.2.1 b	2.19.2 1st paragraph, only if on the indicating device See Welmec Guide 7.2
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.	4 5.1.11 2.20	
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. **Information to be borne by and to accompany the instrument**		
9.1. A measuring instrument shall bear the following inscriptions: – manufacturer's mark or name; – information in respect of its accuracy, plus, when applicable: – information in respect of the conditions of use; – measuring capacity; – measuring range; – identity marking; – number of the EC-type examination certificate or the EC design examination certificate; – information whether or not additional devices providing metrological results comply with the provisions of this Directive on legal metrological control.	2.19 2.2.3	Welmec Working group 10 is developing a guide on others solutions giving presumption of conformity

9.2. An instrument of dimensions too small or of too sensitive a composition to allow it to bear the relevant information shall have its packaging, if any, and the accompanying documents required by the provisions of this Directive suitably marked.		Not relevant
9.3. 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: – 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 of use; – conditions for compatibility with interfaces, sub-assemblies or measuring instruments.	2.19	2.19 for the first three points; other three not covered.
9.4. Groups of identical measuring instruments used in the same location or used for utility measurements do not necessarily require individual instruction manuals.		Not applicable.
9.5. Unless specified otherwise in an instrument-specific annex, the scale interval for a measured value shall be in the form $1x10^n$, $2x10^n$, or $5x10^n$, where n is any integer or zero. The unit of measurement or its symbol shall be shown close to the numerical value.	2.9.1 3.2.1.2 3.2.2.1 3.3.3	
9.6 A material measure shall be marked with a nominal value or a scale, accompanied by the unit of measurement used.		Not applicable.
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.	2.3.2, 2.9.1, 3.1.1.2	
9.8. All marks and inscriptions required under any requirement shall be clear, non-erasable, unambiguous and non-transferable.	2.19	
10. **Indication of result**		

10.1. Indication of the result shall be by means of a display or hard copy.	T.1.1, T1.4, T.3.1, 2.9.2, T.1.5 5.1.7, 5.2.7, 5.4.9, 5.5.5	The definition of Meter in MI-005 always requires a display.
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 presented result shall be permitted under normal conditions of use. Additional indications may be shown provided they cannot be confused with the metrologically controlled indications.	2.9.3, 2.9.4, 2.9.5, 2.9.6, 3.2 3.3 5.1.10 (second §)	Indicating device for volume: 2.9.3, 2.9.4, 2.9.5, 2.9.6, 3.2 (all) Indicating device for price: 3.3 (all) 5.1.10 (second §)
10.3. In the case of hard copy the print or record shall also be easily legible and non-erasable.	3.4 all and 5.1.7	
10.4. 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. 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.	T.3.1, 5.10 2.2.3	
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 consumer. The reading of this display is the measurement result that serves as the basis for the price to pay.		Not applicable.
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 and; – the measuring instrument is normally intended for use in the absence of one of the trading parties.	T1.5, T2.12, T.3.1 3.5 5.10.1.2 and 5.10.3	

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 5.11	
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.	6.1.2	General applicable considerations
ANNEX MI-005 MEASURING SYSTEMS FOR THE CONTINUOUS AND DYNAMIC MEASUREMENT OF QUANTITIES OF LIQUIDS OTHER THAN WATER		
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".	1.1 2.9.1	
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.	T.1.1 T.1.2: T1.13	T.1.2: measurement transducer T1.13: “at metering conditions”
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.	T.1.3 T.1.4:	 T.1.4: indicating device
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.	T.1.10	

Conversion Device 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: – 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 Note: A conversion device includes the relevant associated measuring instruments.	T.1.12	R 117 doesn't cover conversion from mass to volume.
Base conditions The specified conditions to which the measured quantity of liquid at metering conditions is converted.	T.1.14	
Measuring System A system that comprises the meter itself and all devices required to ensure correct measurement or intended to facilitate the measuring operations.	T.1.7 T.1.5 T.1.8, T.1.12, T.2.7 T.1.6: T.1.15 to T.1.21 T.1.8T.1.9: T.1.11	T.1.7 T.1.5: ancillary device T.1.8, T.1.12, T.2.7 T.1.6: additional device (T.1.15 to T.1.21) T.1.8: Pre-setting device T.1.9: Adjustment device T.1.11: correction device
Fuel dispenser A measuring system intended for the refuelling of motor vehicles, small boats and small aircraft.	T.2.1	
Self-service arrangement An arrangement that allows the customer to use a measuring system for the purpose of obtaining liquid for his own use.	T.2.6	

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.	T.2.7	
Minimum measured quantity (MMQ) The smallest quantity of liquid for which the measurement is metrologically acceptable for the measuring system.	T.3.5	
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.		Not defined in R 117
Interruptible/non interruptible A measuring system is considered as interruptible/non interruptible when the liquid flow can/cannot be stopped easily and rapidly.	T.3.14	
Flow rate range The range between the minimum flow rate (Qmin) and maximum flow rate (Qmax).		Not defined in R 117 but used in R 117.
SPECIFIC REQUIREMENTS		
1. **RATED OPERATING CONDITIONS** **The manufacturer shall specify the rated operating conditions for the instrument, in particular;**	2.3 , 3.1.1	
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.	2.3.4	

<table>
<tr>
<td>

(ii) meter and measuring system:

Table 1

<table>
<tr><th>Specific measuring system</th><th>Characteristic of liquid</th><th>Minimum ratio of Q_{max}: Q_{min}</th></tr>
<tr><td rowspan="2">Fuel dispensers</td><td>Not Liquefied gases</td><td>10:1</td></tr>
<tr><td>Liquefied gases</td><td>5:1</td></tr>
<tr><td>Measuring system</td><td>Cryogenic liquids</td><td>5:1</td></tr>
<tr><td>Measuring systems on pipeline and systems for loading ships</td><td>All liquids</td><td>Suitable for use</td></tr>
<tr><td>All other measuring systems</td><td>All liquids</td><td>4:1</td></tr>
</table>

</td>
<td>2.3.3

5.1.1
5.7.1
5.6.1

2.3.3</td>
<td>R 117 foresees the case of ratios smaller than 4 but for application of MID ratios smaller than 4 are not acceptable for the line “all other measuring systems”</td>
</tr>
<tr>
<td>1.2 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:
– Temperature range;
– Pressure range;
– Density range;
– Viscosity range.</td>
<td>1.2, 2.3.1, 3.1.1.1</td>
<td></td>
</tr>
<tr>
<td>1.3. The nominal value of the AC voltage supply and/or limits of the DC voltage supply.</td>
<td>Annex A.4.5 and A.4.10</td>
<td></td>
</tr>
<tr><td></td><td></td><td></td></tr>
<tr>
<td>1.4. The base conditions for converted values.

Note: Paragraph 1.4 is without prejudice to the Member States' obligations to require use of a temperature of either 15ºC 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.</td>
<td>T.1.14</td>
<td></td>
</tr>
<tr>
<td>2. ACCURACY CLASSIFICATION AND MAXIMUM PERMISSIBLE ERRORS(MPEs)</td>
<td></td>
<td></td>
</tr>
</table>

[1] OJ L 316, 31.10.1992, p. 12. Directive repealed by Directive 2003/96/EC (OJ L 283, 31.10.2003, p. 51).

<table>
<tr>
<td>2.1. For quantities equal to or greater than 2 litres the MPE on indications is:

<table>
<tr><td></td><td colspan="5">Accuracy Class</td></tr>
<tr><td></td><td>0,3</td><td>0,5</td><td>1,0</td><td>1,5</td><td>2,5</td></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>
Table 2</td>
<td>2.5.1 , 2.6, 2.7, 3.1.2, 3.1.5, 4.1.1</td>
<td>T.1.7
T.1.5: ancillary device
T.1.8, T.1.12, T.2.7
T.1.6: additional device (T.1.15 to T.1.21)
T.1.8: Pre-setting device
T.1.9: Adjustment device
T.1.11: correction device

In the case of a conversion device, the verification can be based on a modular or a global approach.
As specified in the last paragraph of 2.7.4, line A applies in the case of a global approach.
In the case of a modular approach others provisions in 2.7 provide the same level of conformity.</td>
</tr>
</table>

<table>
<tr><td>2.2. For quantities less than two litres the MPE on indications is:

<table>
<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</td><td>2.5.2</td><td></td></tr>
<tr><td>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}).</td><td>T.3.6, 2.5.3</td><td></td></tr>
<tr><td>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: $E_{min} \geq 2R$, where R is the smallest scale interval of the indication device.

Condition 2

E_{min} is given by the formula: $E_{min} = (2\ MMQ) \times (A/100)$, where:
– MMQ is the minimum measured quantity,

– A is the numerical value specified in line A of Table 2.</td><td>T.3.6

3.2.1.43.3.3
2.5.3</td><td>3.2.1.4: indicating device
3.3.3: price indicating device</td></tr>
<tr><td>2.4.2. For minimum measured quantities of less than two litres, the above mentioned condition 1 applies and Emin is twice the value specified in Table 3, and related to line A of Table 2.</td><td>2.5.3</td><td></td></tr>
<tr><td>2.5. Converted indication

In the case of a converted indication the MPEs are as in line A of Table 2.</td><td>2.7.4 last paragraph and 2.5.1</td><td></td></tr>
</table>

2.6. Conversion devices

MPEs on converted indications due to a conversion device are equal to ± (A - B), A and B being the values specified in Table 2. 2.7.1

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. 2.8

(b) Associated measuring instruments 2.7.2

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	± 0,3ºC	± 0,5ºC			± 1,0ºC
Pressure	Less than 1 MPa: ± 50 kPa From 1 to 4 MPa: ± 5% Over 4 MPa: ± 200 kPa				
Density	± 1 kg/m^3		± 2 kg/m^3		± 5 kg/m^3

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

(c) Accuracy for calculating function 2.7.3

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 paragraph 2.6 applies to any calculation, not only conversion. 2.8

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 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.	T.5.4 to T.5.8 T.3.11 and T.3.12 4.3.1 4.1.1.1 4.1.1.2 4.1.5 Electronic device: annexe A	4.1.1.1 for interruptible MS and 4.1.1.2 for non interruptible MS
3.2. The critical change value is the greater of MPE/5 for a particular measured quantity or E_{min}.	T.3.11 and T.3.12 Annex A	
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.	T.4.7, 6.1.5.3 3.1.2.3	
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.	2.9.5 5.10.1.3	

5.2. It shall not be possible to divert the measured quantity in normal conditions of use unless it is readily apparent.	2.16, 2.18.2, 2.17 5.1.5 5.2.6 5.7.5 5.9.2	2.16, 2.18.2, 2.17 5.1.5: fuel dispensers 5.2.6: Measuring systems on road tankers 5.7.5: LPG dispensers 5.9.2: Blend

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.	2.10 2.11 T.1.20 5.1.2, 5.1.3 5.2.3, 5.2.8 5.3.1 (§ 2) 5.4.3: 5.4.3.1 and 5.4.3.2 5.4.10 5.5.2.1 and 5.5.4: 5.6.2 5.8.1.2, 5.8.3.1.3, 5.8.3.2, 5.8.3.3.1 5.9.1	2.10 2.11: gas indicator (T.1.20) 5.1.2, 5.1.3: fuel dispensers 5.2.3, 5.2.8: measuring systems on road tankers: 5.3.1 (§ 2): measuring systems for the unloading of ships tank and of rail and road tankers using an intermediate tank 5.4.3: measuring systems for LPG (others than dispensers) 5.4.3.1 and 5.4.3.2 : LPG dispensers 5.4.10: measuring systems for Liquefied Carbon Dioxide (others than dispensers) 5.5.2.1 and 5.5.4: measuring systems for milk 5.6.2: measuring systems on pipeline and systems for loading ships dispensers 5.8.1.2, 5.8.3.1.3, 5.8.3.2, 5.8.3.3.1: measuring systems intended for the refuelling of aircraft 5.9.1 (referring to 5.1.2 and 5.1.3): blend dispensers
5.4.	Instruments for direct sales.	T.2.14	

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.	3.2.4 3.3.1, 3.3.3, 3.3.5, 3.3.8, 3.3.95.1.4, 5.1.5: 5.2.75.7.1 5.7.55.9.1, 5.9.2: 2.16 2.18.2, 2.17 5.1.5 5.2.65.7.5 5.9.2	3.2.4 (Zero setting device) 3.3.1, 3.3.3, 3.3.5, 3.3.8, 3.3.9: Price indicating device5.1.4, 5.1.5: fuel dispensers. 5.2.7: Measuring systems on road tankers 5.7.1 (referring to 5.1.4), 5.7.5:LPG dispensers 5.9.1 (referring to 5.1.4), 5.9.2: Blend dispensers 2.16 all except in 2.16.1 the words "or is readily apparent" are not applicable: general requirements 2.18.2, 2.17 5.1.5: fuel dispensers 5.2.6: Measuring systems on road tankers 5.7.5: LPG dispensers 5.9.2: Blend dispensers

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.	3.2.3 first sentence, 3.3.3 5.10.1.8 5.10.2.1.1 (note) 5.10.3.1.1	3.3.3 (referring to 3.2) 5.10.1.8: general requirements for self-service arrangement with fuel dispenser Unattended service mode 5.10.3.1.1, primary indication; print for customer, print or memory for supplier.
5.4.3. Measuring systems for direct sales shall be interruptible.	4.1.2 and T.2.14, 5.1.8 5.7.1 5.9.1	 5.7.1 (referring to 5.1.8) LPG dispensers 5.9.1 (referring to 5.1.8) Blend dispensers
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 except 2.10.8.2 and 2.10.9 5.1.2, 5.1.3,5.2.3,5.2.8, 5.4.3.1,5.4.3.2, 5.5.2.1, 5.5.4, 5.9.1	See OIML provisions corresponding to the essential requirement 5.3 with the exception of 2.10.8.2 and 2.10.9 A gas separator necessitating a gas indicator is not acceptable.

5.5. Fuel Dispensers		
5.5.1. Displays on fuel dispensers shall not be capable of being reset to zero during a measurement.	3.2.4.3 3.3.3	3.2.4.3: general requirements on indicating device 3.3.3
5.5.2. The start of a new measurement shall be inhibited until the display has been reset to zero.	5.1.5 (5.7.5 (5.9.2	5.1.5 (fuel dispensers) 5.7.5 (LPG fuel dispensers) 5.9.2 (blend dispensers)
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.	T.3.7 3.3.7, 3.3.6	3.3.7:price indicating device (also referring to 3.3.6)
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.	4.2	

<table>
<tr>
<td>7. PUTTING INTO USE
Table 5
<table>
<tr><th>Accuracy Class</th><th>Types of Measuring system</th></tr>
<tr><td>0.3</td><td>– Measuring systems on pipeline</td></tr>
<tr><td>0.5</td><td>– All measuring systems if not differently stated elsewhere in this Table, in particular:
– fuel dispensers (not for liquefied gases),
– measuring systems on road tankers for liquids of low viscosity (< 20 mPa.s)
– measuring systems for (un)loading ships and rail and road tankers*)
– measuring systems for milk
– measuring systems for refuelling aircraft</td></tr>
<tr><td>1.0</td><td>– Measuring systems for liquefied gases under pressure measured at a temperature equal to or above -10°C
– Measuring systems normally in class 0.3 or 0.5 but used for liquids
– 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 20L/h</td></tr>
<tr><td>1.5</td><td>Measuring systems for liquefied carbon dioxide.
Measuring systems for liquefied gases under pressure measured at a temperature below -10°C (other than cryogenic liquids).</td></tr>
<tr><td>2.5</td><td>measuring systems for cryogenic liquids (temperature below -153°C)</td></tr>
</table>
* 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.</td>
<td>2.4</td>
<td>R117 does not foresee this possibility

R117 does not foresee this possibility</td>
</tr>
<tr>
<td>8. UNITS OF MEASUREMENT

The metered quantity shall be displayed in millilitres, cubic centimetres, litres, cubic metres, grams, kilograms or tonnes.</td>
<td>2.9.1</td>
<td></td>
</tr>
</table>