

WELMEC 8.11
Issue 1

WELMEC

European cooperation in legal metrology

**Measuring Instruments Directive 2004/22/EC
Water Meters
Corresponding Tables
OIML R 49 2006 and R 49-2 2004 – MID-001**



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

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.

Water meters
Cross Reference Table 2004/22/EC vs. OIML R49 2006
and when mentioned R49-2 (2004)

Directive 2004/22/EC Essential requirements of Annex 1 and Annex MI-001	OIML R49-1 (2006) (R49-2 (2004) when mentioned)	Comment
Water meters intended for the measurement of volumes of clean, cold or heated water in residential, commercial and light industry	1	water meters used to meter the actual volume of cold potable water and hot water
1.1 Allowable errors 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.	3.2 3.2.7	Water meters shall be designed and manufactured such that their errors (of indication) do not exceed the maximum permissible errors as defined in 3.2.1 or 3.2.2 under rated operating conditions. The requirements relating to the maximum permissible errors shall be met for all temperature and pressure variations occurring within the rated operating conditions of the water meter.
1.1 Unless stated otherwise in the instrument-specific annexes, MPE is expressed as a bilateral value of the deviation from the true measurement value.	3.2.2	Accuracy class 2 water meters The maximum permissible error for the upper flowrate zone ($Q_2 \leq Q \leq Q_4$) is $\pm 2\%$, for temperatures from 0,1 °C to 30 °C, and $\pm 3\%$ for temperatures greater than 30 °C. The maximum permissible error for the lower flowrate zone ($Q_1 \leq Q < Q_2$) is $\pm 5\%$.
1.2 Under rated operating conditions and in presence of a disturbance, the performance requirement shall be as laid down in the appropriate instrument-specific requirements.		Comment only. see responses to requirements of MI-001
1.2 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.		Comment only. see responses to requirements of MI-001

<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.</p>	<p>A.2</p> <p>A.3</p> <p>A.6</p> <p>6.2.9</p>	<p>Water meters with electronic devices are divided into three classes according to climatic and mechanical environmental conditions (in accordance with OIML D11):</p> <ul style="list-style-type: none"> - class B for fixed meters installed in a building - class C for fixed meters installed outdoors and - class I for mobile meters <p>Water meters with electronic devices are divided into two electromagnetic environments: E1: Residential, commercial and light industrial; and E2: Industrial.</p> <p>The severity levels for each environmental requirement are defined in table A.1</p> <p>Pattern approval certificate The following information shall appear on the pattern approval certificate: environmental classification, if applicable (see A.2)</p>
<p>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.</p> <p>Temperature limits: Upper temperature limit 30°C, 40 °C, 55 °C, 70 °C Lower temperature limit 5 °C, -10 °C, -25 °C, -40 °C</p>	<p>5.4</p>	<p>See general description concerning 1.3. In addition to this: Rated operating conditions R49 states that the rated operating conditions for a water meter shall be as follows: Ambient temperature range: + 5 °C to + 55 °C</p> <p>MID allows manufacturer to apply for other temperature ranges</p>
<p>1.3.2 (a) Mechanical environments are classified into classes M1 to M3 as described below 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. 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. 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.</p> <p>(b) The following influence quantities shall be considered in relation with mechanical environments:</p> <ul style="list-style-type: none"> - Vibration - Mechanical shock 	<p>A.6</p>	<p>See general description concerning 1.3. In detail: Vibration and mechanical shock are considered in the case of environmental class I (mobile meters)</p>

<p>1.3.4 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. 	A1	<p>See general description concerning 1.3.</p> <p>In detail:</p> <p>As laid down in table A.1, the following influence quantities are considered in relation with the electromagnetic environments:</p> <ul style="list-style-type: none"> - power voltage variation - Static Magnetic Field <p>Appropriate severity levels for class E1 are defined in table A.1.</p> <p>Appropriate test procedures are defined in Part 2, § 7.5 and 7.12</p> <p>Influences of Frequency variation is only applicable to water meters connected to AC supply, which is very rare. WELMEC WG 11 suggests that for water meters supplied with AC to use the appropriate IEC standard.</p> <p>For the influence of Power Frequency Magnetic fields WELMEC WG 11 suggests that this influence is considered to be Not Applicable.</p>
<p>1.4 When carrying out the tests as envisaged in this Directive, the following paragraphs apply:</p> <p>1.4.1 <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</p> <p>A.1</p> <p>R 49-2</p> <p>7.2.4</p> <p>7.3.4</p> <p>to</p> <p>7.12.5</p>	<p>6.1 Reference conditions</p> <p>All influence quantities, except for the influence quantity being tested, shall be held to the following values during pattern evaluation tests on a water meter:</p> <p>Flowrate: $0.7 \sqrt{(Q2 + Q3)} \pm 0.03 \sqrt{(Q2 + Q3)}$;</p> <p>Water temperature: ± 5 °C of the reference value in table 1;</p> <p>Ambient temperature: (20 ± 5) °C;</p> <p>Ambient relative humidity: (60 ± 15) %;</p> <p>Ambient atmosph. pressure: (86 to 106) kPa</p> <p>When the effect of one influence quantity is being evaluated, all other influence quantities are to be held relatively constant, at values close to reference conditions (see 6.1 and A.4).</p> <p>Each acceptance criteria defines, if the metrological test shall be carried out during or after the application of the influence quantity</p>
<p>1.4.2 <i>Ambient humidity</i></p> <ul style="list-style-type: none"> - 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. 	<p>A.6</p> <p>A.6.3</p>	<p>Table A.1 prescribes the damp heat cyclic (condensing) test for all water meters.</p> <p>A.6.3 describes this test.</p>

<p>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's instruction when in the environmental conditions for which it is intended.</p>	<p>3.2 4.1.1 6.2.7 R 49-2 6.9</p>	<p>Accuracy class and maximum permissible error These requirements shall be met durably. Water meters with electronic devices shall be designed and manufactured in such a way that significant faults do not occur when they are exposed to the disturbances specified in A.6. These requirements shall be met durably. The water meter shall undergo the endurance tests detailed in Table 4, according to the permanent flowrate Q_3 and the overload flowrate Q_4 of the meter, simulating service conditions. After each of these tests the errors of the water meter shall again be measured at the flowrates given in 6.2.4.1 and the criteria given in 6.2.7.1 or 6.2.7.2 shall be applied. Description of the corresponding endurance test method and the acceptance criteria</p>
<p>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.</p>	<p>4.3 R49-2 6 and 7</p>	<p>Checking facilities All tests described in chapters 6 and 7</p>
<p>7 Suitability 7.1 A measuring instrument shall have no feature likely to facilitate fraudulent use, whereas possibilities for unintentional misuse shall be minimal.</p>	<p>3.3.3 5.2 6.2.4.2 6.3.5</p>	<p>Correction devices Correction devices shall not be used for adjusting the errors (of indication) of a water meter to values other than as close as practical to zero, even when these values are within the maximum permissible errors. Adjustment and correction The water meter may be fitted with an adjustment device, and/or a correction device. If these devices are mounted on the outside of the water meter, provision for sealing shall be made (see 5.8.2). If all the errors (of indication) of the water meter have the same sign, at least one of the errors shall not exceed one half of the maximum permissible error. (concerning pattern approval) If all the errors (of indication) of the water meter have the same sign, at least one of the errors shall not exceed one half of the maximum permissible error. (concerning initial verification)</p>
<p>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.</p>	<p>R49-2 6 and 7</p>	<p>The tests described in chapters 6 and 7</p>

<p>7.3 The errors of a utility measuring instrument at flows or currents outside the controlled range shall not be unduly biased.</p>	<p>3.2.8 R 49-2 6.6</p>	<p>Partly fulfilled The water meter totalization shall not change when the flowrate is zero. Flow reversal test</p>
<p>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.</p>	<p>3.2.8</p>	<p>Partly fulfilled The water meter totalization shall not change when the flowrate is zero.</p>
<p>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.</p>	<p>5.1</p>	<p>Materials and construction of water meters The water meter shall be manufactured from materials of adequate strength and durability for the purpose for which the water meter is to be used. The water meter shall be manufactured from materials which shall not be adversely affected by the water temperature variations, within the working temperature range (see 5.4). All parts of the water meter in contact with the water flowing through it shall be manufactured from materials which are conventionally known to be non-toxic, non-contaminating and biologically inert ⁽⁴⁾. The complete water meter shall be manufactured from materials which are resistant to internal and external corrosion, or which are protected by a suitable surface treatment. The water meter indicating device shall be protected by a transparent window. A cover of a suitable type may also be provided as additional protection. The water meter shall incorporate devices for elimination of condensation, where there is a risk of condensation forming on the underside of the window of the water meter indicating device.</p>
<p>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.</p> <p>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.</p>	<p>3.3.4</p>	<p>3.3.4 Calculator All parameters necessary for the elaboration of indications that are subject to legal metrological control, such as a calculation table or correction polynomial, shall be present in the calculator at the beginning of the measurement operation.</p> <p>WELMEC WG11 suggests to use WELMEC Guide 7.2 for the second requirement.</p>

<p>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.</p>	<p>4.3 5.8.3</p>	<p>Checking facilities</p> <p>Electronic sealing devices When access to parameters that influence the determination of the results of measurements is not protected by mechanical sealing devices, the protection shall fulfil the following provisions: (a) Access shall only be allowed to authorized people, e.g. by means of a code (key-word) or of a special device (e.g. a hard key). The code shall be capable of being changed; and (b) It shall be possible for at least the last intervention to be memorized. The record shall include the date and a characteristic element identifying the authorized person making the intervention (see (a) above). The traceability of the last intervention shall be assured for at least two years, if it is not overwritten on the occasion of a further intervention. If it is possible to memorize more than one intervention and if deletion of a previous intervention must occur to permit a new record, the oldest record shall be deleted.</p>
<p>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.</p>	<p>5.7.1.3 5.8.2</p>	<p>There are no general requirements to avoid resetting of the meter except for the case of overflow.</p> <p>Water meters shall include protection devices which can be sealed so as to prevent, both before and after correct installation of the water meter, dismantling or modification of the meter, its adjustment device or its correction device, without damaging these devices.</p>

<p>9 Information to be borne by and to accompany the instrument</p> <p>9.1 A measuring instrument shall bear the following inscriptions:</p> <ul style="list-style-type: none"> - 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 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. 	5.6	<p>Marks and inscriptions</p> <ul style="list-style-type: none"> (a) Unit of measurement: cubic metre (see 5.7.1.2); (b) Accuracy class, where it differs from accuracy class 2; (c) Numerical value of Q_3, the ratio Q_3/Q_1, and the ratio Q_2/Q_1 where it differs from 1.6; (d) Pattern approval sign according to national regulations; (e) Name or trademark of the manufacturer; (f) Year of manufacture and serial number (as near as possible to the indicating device); (g) Direction of flow (shown on both sides of the body; or on one side only provided the direction of flow arrow will be easily visible under all circumstances); (h) Maximum admissible pressure (map) if it exceeds 1 MPa (10 bar); (i) Letter V or H, if the meter can only be operated in the vertical or horizontal position; (j) The temperature class where it differs from T30; and (k) The manufacturer may indicate the maximum pressure loss. <p>For water meters with electronic devices, the following additional inscriptions shall be applied where appropriate:</p> <ul style="list-style-type: none"> (l) For an external power supply: the voltage and frequency; (m) For a replaceable battery: the latest date that the battery is to be replaced; and (n) For a non-replaceable battery: the latest date by which the meter is to be replaced.
<p>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.</p>	5.6	<p>Marks and inscriptions</p> <p>The water meter shall be clearly and indelibly marked with the following information, either grouped or distributed on the casing, the indicating device dial, an identification plate, or on the meter cover if it is not detachable.</p>
<p>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:</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. 	5.6	<p>Marks and inscriptions</p> <p>The water meter shall be clearly and indelibly marked with the following information, either grouped or distributed on the casing, the indicating device dial, an identification plate, or on the meter cover if it is not detachable.</p>
<p>9.4 Groups of identical measuring instruments used in the same location or used for utility measurements do not necessarily require individual instruction manuals.</p>	Not applicable	

<p>9.5 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>5.7.1.2</p> <p>5.7.2</p>	<p>Unit of measurement, symbol and its placement The indicated volume of water shall be expressed in cubic metres. The symbol m^3 shall appear on the dial or immediately adjacent to the numbered display.</p> <p>Types of indicating device Type 1 – Analogue device</p> <p>The value expressed in cubic metres for each scale division shall be of the form 10^n, where n is a positive or negative whole number or zero, thereby establishing a system of consecutive decades. Each scale shall either be graduated in values expressed in cubic metres or accompanied by a multiplying factor (x 0.001; x 0.01; x 0.1; x 1; x 10; x 100; x 1 000, etc.).</p> <p>Type 2 – Digital device The indicated volume shall be given by a line of adjacent digits appearing in one or more apertures. The advance of a given digit shall be completed while the digit of the next immediately lower decade changes from 9 to 0.</p>
<p>9.6 A material measure shall be marked with a nominal value or a scale, accompanied by the unit of measurement used.</p>	<p>Not applicable</p>	
<p>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.</p>	<p>5.7.1.2</p>	<p>The indicated volume of water shall be expressed in cubic metres. The symbol m^3 shall appear on the dial or immediately adjacent to the numbered display.</p>
<p>9.8 All marks and inscriptions required under any requirement shall be clear, non-erasable, unambiguous and non-transferable.</p>	<p>5.6</p>	<p>The water meter shall be clearly and indelibly marked ...</p>
<p>10 Indication of result</p> <p>10.1 Indication of the result shall be by means of a display or a hard copy.</p>	<p>2.1</p>	<p>Terminology Water meter An instrument intended to measure continuously, memorize and <u>display</u> the volume of water passing through the measurement transducer at metering conditions. <i>Note 1.</i> A water meter includes at least a measurement transducer, a calculator (including adjustment or correction devices if present) and an <u>indicating device</u>.</p>
<p>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.</p>	<p>5.7.1.1</p> <p>5.7.1.2</p>	<p>The indicating device of the water meter shall provide an easily read, reliable and unambiguous visual indication of the indicated volume.</p> <p>The indicated volume of water shall be expressed in cubic metres. The symbol m^3 shall appear on the dial or immediately adjacent to the numbered display.</p>
<p>10.3 In the case of hard copy the print or record shall also be easily legible and non-erasable.</p>	<p>Not applicable</p>	

<p>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.</p>	Not applicable	
<p>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.</p>	5.7	Indicating device
<p>11 Further processing of data to conclude the trading transaction</p> <p>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:</p> <ul style="list-style-type: none"> - the measurement is non-repeatable - the measuring instrument is normally intended for use in the absence of one of the trading parties. 	Not applicable	
<p>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.</p>	Not applicable	
<p>12 Conformity evaluation</p> <p>A measuring instrument shall be designed so as to allow ready evaluation of its conformity with the appropriate requirements of this Directive.</p>	6.2	<p>Pattern approval</p> <p>Before undergoing pattern evaluation tests, each pattern of water meter submitted shall be examined externally to ensure that it complies with the provisions of the relevant preceding clauses of this Recommendation.</p> <p>The evaluation tests shall be made on the minimum number of samples of each pattern</p>

<p>Rated operating conditions</p> <p>The manufacturer shall specify the rated operating conditions for the instrument, in particular:</p> <p>1 The flowrate range of the water. the values for the flowrate range shall fulfil the following conditions: $Q_3/Q_1 \geq 10$ $Q_2/Q_1 = 1,6$ $Q_4/Q_3 = 1,25$ For 5 years from the date of entry into force of this Directive the ration Q_2/Q_1 may be:1,5, 2,5, 4 or 6,3.</p>	<p>1</p> <p>3.1.4</p> <p>3.1.5</p> <p>3.1.6</p>	<p>In OIML :</p> <p>The value of the ratio Q_3/Q_1 shall be chosen from the following list:</p> <p>10 12.5 16 20 25 31.5 40 50 63 80</p> <p>100 125 160 200 250 315 400 500 630 800</p> <p>The list may be extended to higher values in the series.</p> <p>MID specifies that tThe ratio Q_2/Q_1 shall be 1.6. However, for a transitional period of 5 years from 30 April, 2004, Q_2/Q_1 may be 1,5, 2.5, or 4, or 6.3, provided that $Q_3/Q_2 > 5$.</p> <p>MID requires that the ratio Q_4/Q_3 shall be 1.25 and the ratio Q_3/Q_1 shall be greater or equal to 10</p>
--	---	--

<p>2 The temperature range of water. The values for the temperature range shall fulfil the following conditions: 0,1 °C to at least 30 °C, or 30 °C to at least 90 °C. The meter may be designed to operate over both ranges.</p>	<p>3.2.3</p>	<p>Meter temperature classes The meters form water temperature classes corresponding to the various ranges, chosen by the manufacturer from the values given in Table 1.</p> <p style="text-align: center;">Table 1 – Meter Temperature Classes</p> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Class</th> <th>Reference condition (°C)</th> </tr> </thead> <tbody> <tr> <td>mAT (°C)</td> <td></td> </tr> <tr> <td>MAT (°C)</td> <td></td> </tr> <tr> <td>T30</td> <td>0,1 30 20</td> </tr> <tr> <td>T50</td> <td>0,1 50 20</td> </tr> <tr> <td>T70</td> <td>0,1 70 20 and 50</td> </tr> <tr> <td>T90</td> <td>0,1 90 20 and 50</td> </tr> <tr> <td>T130</td> <td>0,1 130 20 and 50</td> </tr> <tr> <td>T180</td> <td>0,1 180 20 and 50</td> </tr> <tr> <td>T30/70</td> <td>30 70 50</td> </tr> <tr> <td>T30/90</td> <td>30 90 50</td> </tr> <tr> <td>T30/130</td> <td>30 130 50</td> </tr> <tr> <td>T30/180</td> <td>30 180 50</td> </tr> </tbody> </table>	Class	Reference condition (°C)	mAT (°C)		MAT (°C)		T30	0,1 30 20	T50	0,1 50 20	T70	0,1 70 20 and 50	T90	0,1 90 20 and 50	T130	0,1 130 20 and 50	T180	0,1 180 20 and 50	T30/70	30 70 50	T30/90	30 90 50	T30/130	30 130 50	T30/180	30 180 50
Class	Reference condition (°C)																											
mAT (°C)																												
MAT (°C)																												
T30	0,1 30 20																											
T50	0,1 50 20																											
T70	0,1 70 20 and 50																											
T90	0,1 90 20 and 50																											
T130	0,1 130 20 and 50																											
T180	0,1 180 20 and 50																											
T30/70	30 70 50																											
T30/90	30 90 50																											
T30/130	30 130 50																											
T30/180	30 180 50																											

3	The relative pressure range of the water, the range being 0,3 bar to at least 10 bar at Q_3 .	5.4	Rated operating conditions Working pressure range: 0.03 MPa (0.3 bar) to at least 1MPa (10 bar), except for meters of diameter ≥ 500 mm, where the Maximum Admissible Pressure (MAP) shall be 0.6 MPa (6 bar).
4	For the power supply: the nominal value of the AC voltage supply and/or the limits of DC supply.	5.6	Marks and inscriptions For water meters with electronic devices, the following additional inscriptions shall be applied where appropriate: (l) For an external power supply: the voltage and frequency; (m) For a replaceable battery: the latest date that the battery is to be replaced; and (n) For a non-replaceable battery: the latest date by which the meter is to be replaced.
5	MPE The MPE, positive or negative, on volumes delivered at flowrates between the transitional flowrate (Q_2) (included) and the overload flowrate (Q_4) is: 2 % for water having a temperature ≤ 30 °C 3 % for water having a temperature > 30 °C	3.2.2	Accuracy class 2 water meters The maximum permissible error for the upper flowrate zone ($Q_2 \leq Q \leq Q_4$) is ± 2 %, for temperatures from 0.1 °C to 30 °C, and ± 3 % for temperatures greater than 30 °C.
6	The MPE, positive or negative, on volumes delivered at flowrates between the minimum flowrate (Q_1) and the transitional flowrate (Q_2) (excluded) is 5 % for water having any temperature.	3.2.2	The maximum permissible error for the lower flowrate zone ($Q_1 \leq Q < Q_2$) is ± 5 %.
7.1	Permissible effect of disturbances Electromagnetic immunity		
7.1.1	The effect of an electromagnetic disturbance on a water meter shall be such that: - the change in the measurement result is no greater than the critical change value as defined in 8.1.4, or - the indication of the measurement result is such that it cannot be interpreted as a valid result, such as a momentary variation that cannot be interpreted, memorised or transmitted as a measuring result.	A.6.10 R 49-2 7.11.4	Electromagnetic susceptibility (Electromagnetic fields, radiated) Maximum allowable variations: The difference between the error (of indication) during the test and the intrinsic error shall not exceed the value given in 2.2.10 or significant faults are detected and acted upon by means of a checking facility. After the application of the disturbance, all the functions of the EUT shall operate as designed. The difference between the relative error (of indication), measured during the application of each carrier frequency band, and that obtained at the same flowrate before the test, under reference conditions, shall not exceed one half of the maximum permissible error in the upper flowrate zone. (see R 49-1 3.2).
7.1.2	After undergoing an electromagnetic disturbance the water meter shall: - recover to operate within MPE, and - have all measurement functions safeguarded, and - allow recovery of all measurement data present just before the disturbance.	R49-2 7.11.4	After the application of the disturbance, all the functions of the EUT shall operate as designed. The difference between the relative error (of indication), measured during the application of each carrier frequency band, and that obtained at the same flowrate before the test, under reference conditions, shall not exceed one half of the maximum permissible error in the upper flowrate zone. (see R 49-1 3.2).

<p>8.2 The manufacturer shall specify whether the meter is designed to measure reverse flow. In such a case, the reverse flow volume shall either be subtracted from the cumulated volume or shall be separately recorded. The same MPE shall apply to both forward and reverse flow.</p> <p>Water meters not designed to measure reverse flow shall either prevent reverse flow or shall withstand an accidental reverse flow without any deterioration or change in metrological properties.</p>	<p>3.2.6</p> <p>R49-2</p> <p>6.6</p>	<p>The manufacturer shall specify whether or not the water meter is designed to measure reverse flow.</p> <p>If a meter is designed to measure reverse flow, the actual volume passed during reverse flow shall either be subtracted from the indicated volume or the meter shall record it separately. The maximum permissible error of 3.2.1 and 3.2.2 shall be met both for forward and reverse flow.</p> <p>If a meter is not designed to measure reverse flow, the meter shall either prevent reverse flow, or it shall withstand accidental reverse flow without deterioration or change in its metrological properties for forward flow.</p> <p>see also test methods and acceptance criteria for flow reversal test</p>
<p>Units of measurement</p> <p>9 Metered volume shall be displayed in cubic meters.</p>	<p>5.7.1.2</p>	<p>The indicated volume of water shall be expressed in cubic metres.</p>
<p>Putting into use</p> <p>10 The Member State shall ensure that the requirements under 1, 2 and 3 are determined by the distributor or the person legally designated for installing the meter, so that the meter is appropriate for the accurate measurement of consumption that is foreseen or foreseeable.</p>		