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Issue 1

# WELMEC

European cooperation in legal metrology

## Measuring Instruments Directive 2004/22/EC Length Measuring Instruments Corresponding Tables OIML R 66 1985 – MID-009 II



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.

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The Measuring Instruments Directive (MID) 2004/22/EC entered into force on the 30<sup>th</sup> 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**  
**Requirement of MID Annex I, MI 009 (Length Measuring Instruments) and OIML R66 (1985)**

**REQUIREMENTS**

Directive 2004/22/EC	OIML R66 1985	Comments
<b>Essential requirements of Annex 1 and common part and chapter II of Annex MI-009</b>		
<i>ANNEX I</i>		
<b>ESSENTIAL REQUIREMENTS</b>		
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
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, see details below.
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
<b>DEFINITIONS</b>		VIM (reference document shared by BIPM, EC IFCC, ISO, IUPAC, IUAPP, OIML)
<b>Measurand</b> The measurand is the particular quantity subject to measurement.	VIM 2.6	
<b>Influence quantity</b> An influence quantity is a quantity that is not the measurand but that affects the result of measurement.	VIM 2.7	

<p><b>Rated Operating Conditions</b></p> <p>The rated operating conditions are the values for the measurand and influence quantities making up the normal working conditions of an instrument .</p>	VIM 5.5	
<p><b>Disturbance</b></p> <p>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.</p>	T.5.1.2 4.1.2, 4.3.3 A.6	2 <sup>nd</sup> sentence is a comment.
<p><b>Critical change value</b></p> <p>The critical change value is the value at which the change in the measurement result is considered undesirable.</p>		Comment only
<p><b>Material Measure</b></p> <p>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.</p>		Not applicable to Length Measuring Instruments (LMI).
<p><b>Direct sales</b></p> <p>A trading transaction is direct sales if:</p> <ul style="list-style-type: none"> <li>– the measurement result serves as the basis for the price to pay and;</li> <li>– 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;</li> <li>– all the parties in the transaction accept the measurement result at that time and place.</li> </ul>		Comment only
<p><b>Climatic environments</b></p> <p>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.</p>		Comment only

<p><b>Utility</b> A utility is regarded as a supplier of electricity, gas, heat or water.</p>		Comment only. Not applicable to LMI.
<b>REQUIREMENTS</b>		
<b>1. Allowable Errors</b>		
<p>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</p>	1.3.	MID [Article 4(f)] – “putting into use”, OIML R66 “initial verification” and “in-service inspection”
<p>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. 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>		No equivalent statement in OIML R66.
<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 account of the requirements laid down in the appropriate instrument-specific annexes.</p>	1.5.	climatic: Temperature: -10 °C to +40 °C rel. humidity: 65 % ± 10 %
<p>1.3.1. <i>Climatic environments</i> 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>	1.5.	Climatic: The terms condensing or non-condensing humidity and intended location are not mentioned in OIML R66 in the sense of MID.

Table 1

Temperature Limits						
Upper temperature limit	30 °C	40 °C	55 °C	70 °C		
Lower temperature limit	5 °C	- 10 °C	- 25 °C	- 40 °C		
1.3.2. (a) Mechanical environments are classified into classes M1 to M3 as described below.						Appropriate requirements or tests are not described in OIML R66.
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 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.						
(b) The following influence quantities shall be considered in relation with mechanical environments:						Not mentioned in OIML R66.
<ul style="list-style-type: none"> <li>- Vibration;</li> <li>- Mechanical shock</li> </ul>						
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.						Appropriate requirements or tests are not described in OIML R66.

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.		
E2 This class applies to instruments used in locations with electromagnetic disturbances corresponding to those likely to be found in other industrial buildings.		
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: <ul style="list-style-type: none"> <li>– voltage reductions caused by energising the starter-motor circuits of internal combustion engines</li> <li>– load dump transients occurring in the event of a discharged battery being disconnected while the engine is running.</li> </ul>		
(b) The following influence quantities shall be considered in relation with electromagnetic environments: <ul style="list-style-type: none"> <li>– Voltage interruptions,</li> <li>– Short voltage reductions,</li> <li>– Voltage transients on supply lines and/or signal lines,</li> <li>– Electrostatic discharges,</li> <li>– Radio frequency electromagnetic fields,</li> <li>– Conducted radio frequency electromagnetic fields on supply lines and/or signal lines,</li> <li>– Surges on supply lines and/or signal lines.</li> </ul>		Not mentioned in OIML R66.
1.3.4. Other influence quantities to be considered, where appropriate, are: <ul style="list-style-type: none"> <li>– Voltage variation,</li> <li>– Mains frequency variation,</li> <li>– Power frequency magnetic fields,</li> <li>– Any other quantity likely to influence in a significant way the accuracy of the instrument.</li> </ul>	1.5.	Only voltage variation (-15 % to +10 %) and frequency variation ( $\pm 2$ %) are mentioned in OIML R66.



1.4. When carrying out the tests as envisaged in this Directive, the following paragraphs apply:		
<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>		Appropriate tests are not described in OIML R66.
<p>1.4.2. <i>Ambient humidity</i></p> <ul style="list-style-type: none"> <li>– 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.</li> <li>– 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.</li> </ul>		Appropriate tests are not described in OIML R66.
<p>2. <b>Reproducibility</b></p> <p>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.</p>		No equivalent statement in OIML R66.

<p>3. <b>Repeatability</b> 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>		No equivalent statement in OIML R66.
<p>4. <b>Discrimination and Sensitivity</b> A measuring instrument shall be sufficiently sensitive and the discrimination threshold shall be sufficiently low for the intended measurement task.</p>		Not mentioned in OIML R66.
<p>5. <b>Durability</b> 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.</p>	.5.1	
<p>6. <b>Reliability</b> 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>		Not mentioned in OIML R66.
<p>7. <b>Suitability</b></p>		
<p>7.1. A measuring instrument shall have no feature likely to facilitate fraudulent use, whereas possibilities for unintentional misuse shall be minimal.</p>		Not mentioned in OIML R66.
<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>		Not mentioned in OIML R66.

7.3. The errors of a utility measuring instrument at flows or currents outside the controlled range shall not be unduly biased.		Not applicable to LMI.
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 mentioned in OIML R66.
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.	2.1.	
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.		Not mentioned in OIML R66.  Not mentioned in OIML R66.
<b>8. Protection against corruption</b>		
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.		Not mentioned in OIML R66.
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.		Not mentioned in OIML R66.

<p>8.3. Software that is critical for metrological characteristics shall be identified as such and shall be secured.</p> <p>Software identification shall be easily provided by the measuring instrument.</p> <p>Evidence of an intervention shall be available for a reasonable period of time.</p>		Not mentioned in OIML R66.
<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>		Not mentioned in OIML R66.
<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>		Not applicable to LMI.
<p><b>9. Information to be borne by and to accompany the instrument</b></p>		
<p>9.1. A measuring instrument shall bear the following inscriptions:</p> <ul style="list-style-type: none"> <li>– manufacturer's mark or name;</li> <li>– information in respect of its accuracy,</li> </ul> <p>plus, when applicable:</p> <ul style="list-style-type: none"> <li>– information in respect of the conditions of use;</li> <li>– measuring capacity;</li> <li>– measuring range;</li> <li>– identity marking;</li> <li>– number of the EC-type examination certificate or the EC design examination certificate;</li> <li>– information on whether or not additional devices providing metrological results comply with the provisions of this Directive on legal metrological control.</li> </ul>	<p>3.</p> <p>2.5. to 2.10.</p>	<p>The number of the EC-type examination certificate or the EC design examination certificate is not mentioned in OIML R66.</p> <p>Not exactly in the sense of MID.</p>



9.8. All marks and inscriptions required under any requirement shall be clear, non-erasable, unambiguous and non-transferable.	3. 4.	
<b>10. Indication of result</b>		
10.1. Indication of the result shall be by means of a display or hard copy.	2.3.2 + 2.3.3. 2.8.	
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.	2.5. 2.8. 2.9.	Not mentioned in OIML R66.
10.3. In the case of hard copy the print or record shall also be easily legible and non-erasable.		Not mentioned in OIML R66.
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.		No relevant section in OIML R66.
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.		No relevant section in OIML R66.
<b>11. Further processing of data to conclude the trading transaction</b>		

<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"> <li>– the measurement is non-repeatable and;</li> <li>– the measuring instrument is normally intended for use in the absence of one of the trading parties.</li> </ul>		No relevant section in OIML R66.
<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>		No relevant section in OIML R66.
<p>12. <b>Conformity evaluation</b> A measuring instrument shall be designed so as to allow ready evaluation of its conformity with the appropriate requirements of this Directive.</p>		
<p style="text-align: center;"><b>ANNEX MI-009</b></p> <p style="text-align: center;"><b>DIMENSIONAL MEASURING INSTRUMENTS</b></p> <p style="text-align: center;"><b>here LENGTH MEASURING INSTRUMENTS</b></p> <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 area measuring instruments defined below.</p>		
<p><b>DEFINITIONS</b></p>		
<p><b>Length measuring instrument</b> A length measuring instrument serves for the determination of the length of rope-type materials (e.g. textiles, bands, cables) during feed motion of the product to be measured.</p>	1.1.	In contradiction to MID the scope of OIML R66 is extended to road measuring wheels.
<p><b>CHAPTER I — Requirements common to all dimensional measuring instruments</b></p>		

<p><i>Electromagnetic immunity</i></p> <p>1. The effect of an electromagnetic disturbance on a dimensional measuring instrument shall be such that:</p> <ul style="list-style-type: none"> <li>– the change in measurement result is no greater than the critical change value as defined in paragraph 2.3; or</li> <li>– it is impossible to perform any measurement; or</li> <li>– there are momentary variations in the measurement result that cannot be interpreted, memorised or transmitted as a measuring result; or</li> <li>– there are variations in the measurement result severe enough to be noticed by all those interested in the measurement result.</li> </ul> <p>2. The critical change value is equal to one scale interval.</p>		Not mentioned in OIML R66.
<p><b>CHAPTER II— Length measuring instruments</b></p>		
<p><i>Characteristics of the product to be measured</i></p>		
<p>1. Textiles are characterised by the characteristic factor K. This factor takes the stretchability and force per unit area of the product measured into account and is defined by the following formula:</p> $K = \varepsilon \cdot (G_A + 2,2 \text{ N/m}^2), \text{ where}$ <p><math>\varepsilon</math> is the relative elongation of a cloth specimen 1 m wide at a tensile force of 10 N,  <math>G_A</math> is the weight force per unit area of a cloth specimen in N/m<sup>2</sup>.</p>		Not mentioned in OIML R66.



<i>Operating conditions</i>																	
<p><b>2.1. Range</b></p> <p>Dimensions and K-factor, where applicable, within the range specified by the manufacturer for the instrument. The ranges of K-factor are given in Table 1:</p> <p style="text-align: center;"><i>Table 1</i></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Group</th> <th style="width: 50%;">Range of K</th> <th style="width: 40%;">Product</th> </tr> </thead> <tbody> <tr> <td>I</td> <td><math>0 &lt; K &lt; 2 \times 10^{-2} \text{ N/m}^2</math></td> <td>low stretchability</td> </tr> <tr> <td>II</td> <td><math>2 \times 10^{-2} \text{ N/m}^2 &lt; K &lt; 8 \times 10^{-2} \text{ N/m}^2</math></td> <td>medium stretchability</td> </tr> <tr> <td>III</td> <td><math>8 \times 10^{-2} \text{ N/m}^2 &lt; K &lt; 24 \times 10^{-2} \text{ N/m}^2</math></td> <td>high stretchability</td> </tr> <tr> <td>IV</td> <td><math>24 \times 10^{-2} \text{ N/m}^2 &lt; K</math></td> <td>very high stretchability</td> </tr> </tbody> </table>			Group	Range of K	Product	I	$0 < K < 2 \times 10^{-2} \text{ N/m}^2$	low stretchability	II	$2 \times 10^{-2} \text{ N/m}^2 < K < 8 \times 10^{-2} \text{ N/m}^2$	medium stretchability	III	$8 \times 10^{-2} \text{ N/m}^2 < K < 24 \times 10^{-2} \text{ N/m}^2$	high stretchability	IV	$24 \times 10^{-2} \text{ N/m}^2 < K$	very high stretchability
Group	Range of K	Product															
I	$0 < K < 2 \times 10^{-2} \text{ N/m}^2$	low stretchability															
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III	$8 \times 10^{-2} \text{ N/m}^2 < K < 24 \times 10^{-2} \text{ N/m}^2$	high stretchability															
IV	$24 \times 10^{-2} \text{ N/m}^2 < K$	very high stretchability															
<p>2.2. Where the measured object is not transported by the measuring instrument, its speed must be within the range specified by the manufacturer for the instrument.</p>																	
<p>2.3. If the measurement result depends on the thickness, the surface condition and the kind of delivery (e.g. from a big roll or from a pile), corresponding limitations are specified by the manufacturer.</p>																	

Not mentioned in OIML R66.

No equivalent statement in OIML R66.

Not mentioned in OIML R66.

<i>MPEs</i>										
<p><b>3. Instrument</b></p> <p style="text-align: center;"><i>Table 2</i></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: center;">Accuracy class</th> <th style="width: 50%; text-align: center;">MPE</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">I</td> <td style="text-align: center;">0,125 %, but not less than 0,005 <math>L_m</math></td> </tr> <tr> <td style="text-align: center;">II</td> <td style="text-align: center;">0,25 %, but not less than 0,01 <math>L_m</math></td> </tr> <tr> <td style="text-align: center;">III</td> <td style="text-align: center;">0,5 %, but not less than 0,02 <math>L_m</math></td> </tr> </tbody> </table> <p>Where <math>L_m</math> is the minimum measurable length, that is to say the smallest length specified by the manufacturer for which the instrument is intended to be used.</p> <p>The true length value of the different types of materials should be measured using suitable instruments (e.g. tapes of length). Thereby, the material which is going to be measured should be laid out on a suitable underlay (e.g. a suitable table) straight and unstretched.</p>	Accuracy class	MPE	I	0,125 %, but not less than 0,005 $L_m$	II	0,25 %, but not less than 0,01 $L_m$	III	0,5 %, but not less than 0,02 $L_m$	<p>Initial verification 1.3</p> <p>Appendix II</p>	
Accuracy class	MPE									
I	0,125 %, but not less than 0,005 $L_m$									
II	0,25 %, but not less than 0,01 $L_m$									
III	0,5 %, but not less than 0,02 $L_m$									
<i>Other requirements</i>										
4. The instruments must ensure that the product is measured unstretched according to the intended stretchability for which the instrument is designed.		Not specified in OIML R66.								