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Corresponding Tables

Gas meters

OIML R 137 2012 –

MID 2014/32/EU Annex I and IV (MI-002 I)



WELMEC

European Cooperation in Legal Metrology

WELMEC is a cooperation between the legal metrology authorities of the Member States of the European Union and EFTA.

This document is one of a number of Guides published by WELMEC to provide guidance to manufacturers of measuring instruments and to Notified Bodies responsible for conformity assessment of their products.

The Guides are purely advisory and do not themselves impose any restrictions or additional technical requirements beyond those contained in relevant EU 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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Foreword

1. The column “Comments” indicates when necessary the relevant text of OIML R 137 and related explanations concerning the compliance with relevant MID requirement.
2. The column “Conclusion” gives the conclusion on the compliance between MID and OIML R 137 for the relevant requirement.

The indication “Covered” means that:

- the requirement of OIML R 137 is identical to the one of MID; or
- the requirement of OIML R 137 is more severe than the one of MID; or
- All the requirement of OIML R 137 fulfils MID requirements (even when MID allows other alternatives),
- In case the requirement is not fully covered, a short statement explains what is covered.

The indication “Not Covered” means that the MID requirement is either not compatible with the relevant OIML R 137 requirement or not included in OIML R 137.

The OIML R 137 is only applicable for gas meters. Therefore the specific requirements for conversion devices as stated in MI-002 are not applicable.

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

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
ANNEX I			
<p>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.</p> <p>Unless stated otherwise in the instrument-specific annexes, MPE is expressed as a bilateral value of the deviation from the true measurement value.</p>	<p>5.3.1</p> <p>12.6.7</p>	<p><i>“A gas meter shall be designed and manufactured such that its errors do not exceed the applicable MPE under rated operating conditions.”</i></p> <p>In OIML R137 12.6.7 the temperature tests are described. The accuracy test for rated operating temperature in the range Q_{min} to Q_i is not required</p>	Partially covered
<p>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.</p> <p>Where the instrument is intended to be used in a specified permanent continuous electromagnetic field the permitted performance during the radiated electromagnetic field-amplitude modulated test shall be within MPE.</p>	<p>5.13.7</p> <p>5.13.3</p> <p>5.13.7</p>	<p>Table 5 defines the test program for electronic meters subject to disturbances. In Annex B the test program for flow disturbances is described.</p> <p>Table 5 defines the requirements for permanent continuous electromagnetic fields. In Annex A specific test details are mentioned.</p>	Covered
<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>5.1</p>	<p>In 5.1 the rated operating conditions are stated.</p>	Covered

<p align="center">Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)</p>	<p align="center">OIML R 137 (2012)</p>	<p align="center">Comments</p>	<p align="center">Conclusion</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><u>Temperature limits:</u></p> <p>Upper temperature limit 30 °C / 40 °C / 55 °C / 70 °C</p> <p>Lower temperature limit 5 °C / -10 °C / -25 °C / -40 °C</p>	<p align="center">5.1</p>	<p><i>“Rated operating conditions for a gas meter shall be as follows:</i></p> <table border="1" data-bbox="952 343 1697 446"> <tr> <td align="center">low</td> <td align="center">–40 °C, –25 °C, –10 °C and +5 °C</td> </tr> <tr> <td align="center">high</td> <td align="center">+30 °C, +40 °C, +55 °C and +70 °C</td> </tr> </table>	low	–40 °C, –25 °C, –10 °C and +5 °C	high	+30 °C, +40 °C, +55 °C and +70 °C	<p align="center">Covered</p>
low	–40 °C, –25 °C, –10 °C and +5 °C						
high	+30 °C, +40 °C, +55 °C and +70 °C						
<p>1.3.2 (a) Mechanical environments are classified into classes M1 to M3 as described below</p> <p>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.</p>	<p align="center">5.12 A.5.1 A.5.2</p>	<p>M1 is applicable.</p>	<p align="center">Covered for M1</p>				

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
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.		OIML R137 provides the adequate severity levels but the testing of the accuracy during the application of the disturbance is not required	Partially covered
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.		OIML R137 provides no adequate severity levels for M3	Not covered
(b) The following influence quantities shall be considered in relation with mechanical environments: - Vibration - Mechanical shock	5.12	<i>“A gas meter shall withstand vibrations and shocks...”</i> <i>“The fault after the application of vibrations and shocks shall be less than or equal to 0.5 times the maximum permissible error.”</i>	Covered
1.3.3 (a) Electromagnetic environments are classified into E1, E2 or E3 as described below, unless otherwise laid down in the appropriate instrument-specific annexes. 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.	5.13.7	Severity levels for electromagnetic environment tests of OIML R 137-1 correspond to level E2 of MID and of OIML D 11 except for surges on data lines. Severity level for surges on data lines correspond to level E1 in all cases.	Covered
E2: This class applies to instruments used in locations with electromagnetic disturbances corresponding to those likely to be found in other industrial buildings.		Severity levels for electromagnetic environment tests of OIML R 137-1 & 2 correspond to level E2 of MID and of OIML D 11 except for surges on data lines	Partially covered

<p align="center">Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)</p>	<p align="center">OIML R 137 (2012)</p>	<p align="center">Comments</p>	<p align="center">Conclusion</p>
<p>E3: This class applies to instruments supplied by the battery of a vehicle. Such instruments shall comply with the requirements of E2 and the following additional requirements</p> <ul style="list-style-type: none"> - voltage reductions caused by energizing the starter-motor circuits of internal combustion engines, - load dump transients occurring in the event of a discharged battery being disconnected while the engine is running. 		<p>Level E3 is not relevant for the instruments covered by MID since MI-002 is limited to gas meters intended for residential, commercial and light industry use.</p>	<p>Not relevant</p>
<p>(b) The following influence quantities shall be considered in relation with electromagnetic environments:</p> <ul style="list-style-type: none"> - voltage interruptions - short voltage reductions - voltage transients on supply lines and/or signal lines - electrostatic discharges - radio frequency electromagnetic fields - conducted radio frequency electromagnetic fields on supply lines and/or signal lines - surges on supply lines and/or signal lines 	<p align="center">5.13.7</p>	<p>Table 5 lists all these tests as relevant for gas meters that include electronic components.</p>	<p>Covered</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. 	<p align="center">5.13.7</p>	<p>Chapter A.7 describes the tests to conduct on mains power and chapter A.8 describes the test to conduct on battery power.</p> <p>Test for other quantities likely to influence in a significant way the accuracy of the instrument are not described.</p>	<p>Partially covered</p>

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
1.4			
1.4.1	chapter 5 A.1	Chapter 5 defines the type examination tests and summarises the associated requirements. “When the effect of one influence quantity is being evaluated, all other influence quantities are to be held within the limits of the reference conditions.”	Covered
1.4.2	A.4.2.1 A.4.2.2	Steady-state (non condensing) and cyclic (condensing) damp heat tests have to be performed in all cases.	Covered

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
2 Reproducibility The application of the same measurand in a different location or by different user, all other conditions being the same, shall result in the close agreement of successive measurements. The difference between the measurement results shall be small when compared with the MPE.	5.6	<p><i>“For flow rates equal to or greater than Q_t the reproducibility of error at the specific flow rate shall be less than or equal to one third of the maximum permissible error.”</i></p> <p>The requirement of OIML R137 does not cover the flow rate range $Q_{min} \leq Q \leq Q_t$</p>	Partially covered
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.	5.7	<p><i>“The repeatability of error of three consecutive measurements at the specific flow rate shall be less than or equal to one third of the maximum permissible error.”</i></p>	Covered
4 Discrimination and sensitivity A measuring instrument shall be sufficiently sensitive and the discrimination threshold shall be sufficiently low for the intended measurement task.	6.3.3	<p><i>“Resolution</i></p> <p><i>The quantity corresponding to the least significant digit shall not exceed the quantity of gas passed during one hour at Q_{min}.</i></p> <p><i>If the least significant digit (e.g. last drum) shows a decimal multiple of the quantity measured, the faceplate or electronic display shall bear:</i></p> <p><i>a) either one (or two, or three, etc.) fixed zero(s) after the last drum or digit; or</i></p> <p><i>b) the marking: “x 10” (or “x 100”, or “x 1 000”, etc.),</i></p> <p><i>so that the reading is always in the units mentioned in 4.1.”</i></p>	Covered

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)		OIML R 137 (2012)	Comments	Conclusion
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.	5.10	The aim of the durability test is to demonstrate the stability of the metrological characteristics of the meter.	Covered
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.	6.1.1 6.7	<i>"A gas meter shall be made of such materials and be so constructed to withstand the physical, chemical and thermal conditions to which it is likely to be subjected and to correctly fulfil its intended purposes throughout its life."</i> Section 6.7 requires checks, limits and alarms that are mandatory for electronic gas meters.	Covered
7	Suitability			
7.1	A measuring instrument shall have no feature likely to facilitate fraudulent use, whereas possibilities for unintentional misuse shall be minimal.	6.1.4 9.1.1	<i>"A gas meter shall be constructed and installed in such a way that mechanical interference capable of affecting its accuracy is either prevented, or results in permanently visible damage to the gas meter or to the verification marks or protection marks."</i> <i>"Protection of the metrological properties of the meter is accomplished via hardware (mechanical) sealing or via electronic sealing."</i>	Covered
7.2	A measuring instrument shall be suitable for its intended use taking account of the practical working conditions and shall not require unreasonable demands of the user in order to obtain a correct measurement result.	6	Technical requirements	Covered

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
7.3 The errors of a utility measuring instrument at flows or currents outside the controlled range shall not be unduly biased.	5.11 6.7.2	Flow rates over Q_{max} are covered by chapter 5.11, that gives requirements for the overload flow test. An electronic gas meter may also have the capability to detect and act upon overload flow conditions. The requirements of OIML R137 do not cover flow rates below Q_{min}	Partially covered
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.		A gas meter is an integrating instrument. Thus, this requirement is not applicable.	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.	6.1.1 6.1.4	<i>“A gas meter shall be made of such materials and be so constructed to withstand the physical, chemical and thermal conditions to which it is likely to be subjected, and to correctly fulfil its intended purposes throughout its life.”</i> <i>“A gas meter shall be constructed and installed in such a way that mechanical interference capable of affecting its accuracy is either prevented, or results in permanently visible damage to the gas meter or to the verification marks or protection marks.”</i>	Covered

<p align="center">Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)</p>	<p align="center">OIML R 137 (2012)</p>	<p align="center">Comments</p>	<p align="center">Conclusion</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>6.4.1</p> <p>12.2</p> <p>1.1.1</p> <p>Annex I</p>	<p><i>“A gas meter shall be designed and constructed incorporating:</i></p> <p><i>a) an integral test element, or</i></p> <p><i>b) a pulse generator, or</i></p> <p><i>c) arrangements permitting the connection of a portable test unit. “</i></p> <p>The test procedure is described in the manual, delivered during the type evaluation.</p> <p><i>“Software identification</i></p> <p><i>The legally relevant parts of the software of a gas meter and/or its constituents shall be clearly identified with the software version or any other token. The identification may apply to more than one part but at least one part shall be dedicated to the legal purpose. The identification shall be inextricably linked to the software and shall be:</i></p> <ul style="list-style-type: none"> <i>• presented or printed on command, or</i> <i>• displayed during operation, or</i> <i>• displayed at switch-on for those gas meters that can be switched on and off. “</i> <p>Requirements for not influencing the metrological software are described in Annex I.</p> 	<p>Covered</p> <p>Covered</p>
<p>8 Protection against corruption</p>			

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
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.	5.13.8 6.5.1 9.1.4.2	<p><i>“Gas meters provided with ancillary devices shall be designed such that all functions of the ancillary devices (e.g. provisions for communication purposes) do not affect the metrological behavior.”</i></p> <p><i>“Ancillary devices shall not affect the correct operation of the instrument. If an ancillary device is not subject to legal metrology control this shall be clearly indicated.”</i></p> <p><i>“For gas meters of which parts may be disconnected, the following provisions shall be fulfilled:</i></p> <p><i>a) Access to the parameters that contribute to the determination of results of measurements shall not be possible via a disconnected port unless the provisions in 9.1.4 are fulfilled.</i></p> <p><i>b) Interposing any device which may influence the accuracy shall be prevented by means of electronic and data processing securities or, if not possible, by mechanical means.</i></p> <p><i>c) Moreover, these gas meters shall be equipped with provisions which do not allow the meter to operate if the various parts are not configured according to the manufacturer’s specifications. “</i></p>	Covered
8.2 A hardware component that is critical for metrological characteristics shall be designed so that it can be secured. Security measures foreseen shall provide for evidence of an intervention.	9.1.1 9.1.3	<p><i>“Protection of the metrological properties of the meter is accomplished via hardware (mechanical) sealing or via electronic sealing.”</i></p> <p><i>“In case of hardware sealing, the location of the marks shall be chosen in such a way that the dismantling of the part sealed by one of these marks results in permanently visible damage to this seal.”</i></p>	Covered

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
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.	1.1.3	<p><i>“The legally relevant software part shall be secured against unauthorized modification, loading, or changes by swapping the memory device. In addition to mechanical sealing, technical means may be necessary to protect gas meters equipped with an operating system or an option to load software.</i></p> <p><i>Only clearly documented functions are allowed to be activated by the user interface, which shall be realized in such a way that it does not facilitate fraudulent use. OIML R 137-1&2:2012 (E) 31</i></p> <p><i>Parameters that fix the legally relevant characteristics of the gas meter shall be secured against unauthorized modification. For the purpose of verification, displaying of the current parameter settings shall be possible.</i></p> <p><i>Note: Device-specific parameters may be adjustable or selectable only in a special operational mode of the instrument. They may be classified as those that should be secured (unalterable) and those that may be accessed (alterable parameters) by an authorized person, e.g. the instrument owner or product vendor.</i></p> <p><i>Software protection comprises appropriate sealing by mechanical, electronic and/or cryptographic means, making an unauthorized intervention impossible or evident.”</i></p>	Covered
8.5 For utility measuring instruments the display of the total quantity supplied or the displays from which the total quantity supplied can be derived, whole or partial reference to which is the basis for payment, shall not be able to be reset during use.	6.3.1	<p><i>“Indicating devices shall be non-resettable and shall be non-volatile (i.e. they shall be able to show the last stored indication after the device has recovered from an intervening power failure).”</i></p>	Covered

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
9			
9.1	7	All the listed inscriptions are included.	Covered
9.2	7.1	<p><i>“As relevant, the following information shall be marked on the casing or on an identification plate.”</i></p> <p>OIML R 137-1 requirement is more severe than the one in MID since the information is available on the instrument whatever its size.</p>	Covered

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
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 use - conditions for compatibility with interfaces, sub-assemblies or measuring instruments.	8.1	The information is stated in the instruction manual.	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.	8.1	<i>“Unless the simplicity of the measuring instrument makes this unnecessary, each individual instrument shall be accompanied by an instruction manual for the user. However, groups of identical measuring instruments delivered to the same customer do not necessarily require individual instruction manuals.”</i>	Covered
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.	6.4.2 6.3.1	<i>“The scale interval shall be in the form 1×10^n, 2×10^n, or 5×10^n (n being a positive or negative whole number or zero).” “The indicating device associated with the gas meter shall indicate the quantity of gas measured in volume or mass in the corresponding units. The reading shall be clear and unambiguous.”</i>	Covered

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
9.6 A material measure shall be marked with a nominal value or a scale, accompanied by the unit of measurement used.		Gas meters are not material measures.	Not relevant
9.7 The units of measurement used and their symbols shall be in accordance with the provisions of Community legislation on units of measurement and their symbols.	4.1	<i>“Measurement units All quantities shall be expressed in SI units [3] or as other legal units of measurement [4], unless a country’s legal units are different.”</i>	Covered
9.8 All marks and inscriptions required under any requirement shall be clear, non-erasable, unambiguous and non-transferable.	7.1	<i>“All markings shall be easily legible and indelible under rated conditions of use. Any marking other than those prescribed in the type approval document shall not lead to confusion.”</i>	Covered
10 Indication of result			
10.1 Indication of the result shall be by means of a display or a hard copy.	6.3.1	<i>“The indicating device may be: a) a mechanical indicating device as described in 6.3.4, b) an electromechanical or electronic indicating device as described in 6.3.5, c) a combination of a) and b).”</i> Hard copy is not applicable because MID under article 10.5 of Annex I always requires a display for a gas meter.	Covered
10.2 The indication of any result shall be clear and unambiguous and accompanied by such marks and inscriptions necessary to inform the user of the significance of the result. Easy reading of the present result shall be permitted under normal conditions of use. Additional indications may be shown provided they cannot be confused with the metrologically controlled indications.	6.3.1	<i>“The reading shall be clear and unambiguous. It may be possible to use one display for other indications as well, as long as it is clear which quantity is being displayed.”</i>	Covered

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
10.3 In the case of hard copy the print or record shall also be easily legible and non-erasable.	3.1.8	A printing device is considered in OIML R 137-1 as an ancillary device. In the event that the ancillary device is subject to legal metrology control, it shall fulfil the requirements of OIML R 137-1 and in particular those related to legibility and non-erasability defined in 6.3.1 of OIML R 137-1.	Covered
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.		R137 does not mention direct sales trading.	Not covered
10.5 Whether or not a measuring instrument intended for utility measurement purposes can be remotely read it shall in any case be fitted with a metrologically controlled display accessible without tools to the customer. The reading of this display is the measurement result that serves as the basis for the price to pay.	6.1.5	<i>“The indicating device can be connected to the meter body physically or remotely. In the latter case the data to be displayed shall be stored in the gas meter.</i> OIML R137 does not forbid to design a meter with a remote display only but MID does.	Partially covered
11 Further processing of data to conclude the trading transaction			

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
11.1 A measuring instrument other than a utility measuring instrument shall record by a durable means the measurement result accompanied by information to identify the particular transaction, when: - the measurement is non-repeatable - the measuring instrument is normally intended for use in the absence of one of the trading parties.		Gas meters addressed by MID are utility meters.	Not relevant
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.		See comment in 11.1.	Not relevant
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.	10 11.1.1 12.3	Suitability for testing: the instrument shall be designed such as to allow initial and subsequent verification and metrological supervision. Test method: all equipment used and incorporated as part of the execution of the test procedures shall be suitable for the testing of the meter(s) under test. Design examination: Each type of gas meter submitted shall be inspected externally to ensure that it complies with the provisions of the relevant preceding clauses of these requirements.	Covered

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
ANNEX IV (MI-002)			
The relevant requirements of Annex I, the specific requirements of this Annex and the conformity assessment procedures listed in this Annex, apply to gas meters and volume conversion devices defined below, intended for residential, commercial and light industrial use.			Covered
A volume conversion device constitutes a sub-assembly according to Article 4, definition (b), second indent. For a volume conversion device, the essential requirements for the gas meter shall apply, if applicable.			
<div style="display: flex;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-weight: bold; margin-right: 10px;">Definitions</div> <div> <p>Gas meter</p> <p>Minimum flowrate</p> <p>Maximum flowrate</p> <p>Transitional flowrate</p> <p>Overload flowrate</p> </div> </div>	<p>3.1.1</p> <p>3.3.3</p> <p>3.3.2</p> <p>3.3.4</p> <p>3.4.3 & 5.11</p>		Covered
1 Rated operating conditions The manufacturer shall specify the rated operating conditions of the gas meter, taking into account:	12.2	<p><i>“Applications for type evaluation of a gas meter shall be accompanied by the following documentation:</i></p> <p><i>Metrological characteristics of the meter, including:</i></p> <ul style="list-style-type: none"> <i>- a description of the principle(s) of measurement;</i> <i>- metrological specifications such as accuracy class and rated operating conditions;</i> <i>- any steps which should be performed prior to testing the meter. “</i> 	Covered

<p align="center">Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)</p>	<p align="center">OIML R 137 (2012)</p>	<p align="center">Comments</p>	<p align="center">Conclusion</p>																		
<p>1.1 The flowrate range of the gas shall fulfil at least the following conditions:</p> <table border="1" data-bbox="235 435 732 639"> <thead> <tr> <th>Class</th> <th>Q_{max}/Q_{min}</th> <th>Q_{max}/Q_t</th> <th>Q_t/Q_{max}</th> </tr> </thead> <tbody> <tr> <td>1.5</td> <td>≥ 150</td> <td>≥ 10</td> <td>1.2</td> </tr> <tr> <td>1.0</td> <td>≥ 20</td> <td>≥ 5</td> <td>1.2</td> </tr> </tbody> </table>	Class	Q_{max}/Q_{min}	Q_{max}/Q_t	Q_t/Q_{max}	1.5	≥ 150	≥ 10	1.2	1.0	≥ 20	≥ 5	1.2	<p>5.2</p>	<p>“ <i>The flow rate characteristics of a gas meter shall be defined by the values of Q_{max}, Q_t and Q_{min}. Their ratios and relations shall be within the ranges as stated in Table 1.</i></p> <p align="center"><i>Table 1 Flow rate characteristics</i></p> <table border="1" data-bbox="1072 529 1583 722"> <thead> <tr> <th>Q_{max} / Q_{min}</th> <th>Q_{max} / Q_t</th> </tr> </thead> <tbody> <tr> <td>≥ 50</td> <td>≥ 10</td> </tr> <tr> <td>≥ 5 and < 50</td> <td>≥ 5</td> </tr> </tbody> </table> <p>“</p> <p>The flowrate ratios are compatible only when the ratio is comprise between 20 and 50 (excluded) and when the ratio is greater or equal to 150.</p> <p>Only covered for class 1.5 a ratio of $Q_{max}/Q_{min} \geq 150$ and for class 1 by a ratio of $Q_{max}/Q_{min} \geq 20$.</p>	Q_{max} / Q_{min}	Q_{max} / Q_t	≥ 50	≥ 10	≥ 5 and < 50	≥ 5	<p>Partially covered</p>
Class	Q_{max}/Q_{min}	Q_{max}/Q_t	Q_t/Q_{max}																		
1.5	≥ 150	≥ 10	1.2																		
1.0	≥ 20	≥ 5	1.2																		
Q_{max} / Q_{min}	Q_{max} / Q_t																				
≥ 50	≥ 10																				
≥ 5 and < 50	≥ 5																				
<p>1.2 The temperature range of the gas, with a minimum range of 40°C.</p>	<p>5.1 12.6.7.1</p>	<p>The ambient temperature range is defined as 50 K minimally (5.1). Due to the fact that all gas meters are tested with a flow test where gas temperature and ambient temperature are equal (12.6.7.1), this requirement is deemed to be met.</p>	<p>Covered</p>																		
<p>1.3 The fuel/gas related conditions.</p> <p>The gas meter shall be designed for the range of gases and supply pressures of the country of destination. In particular the manufacturer shall indicate:</p> <ul style="list-style-type: none"> – the gas family or group; – the maximum operating pressure. 	<p>5.1</p>	<p>“ <i>Rated operating conditions for a gas meter shall be as follows:</i></p> <p><i>Working pressure range: p_{min} to p_{max} inclusive</i></p> <p><i>Type of gases : The family of natural gases, industrial gases, or supercritical gases; to be specified by the manufacturer “</i></p>	<p>Covered</p>																		

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)		OIML R 137 (2012)	Comments	Conclusion																																									
1.4	A minimum temperature range of 50 °C for the climatic environment.	5.1	<i>“ Rated operating conditions for a gas meter shall be as follows: Ambient temperature (Temperature range chosen shall at least cover 50 K) “</i>	Covered																																									
1.5	The nominal value of the AC voltage supply and/or the limits of DC supply	5.1	In 5.1 the rated operating conditions are stated.	Covered																																									
2 Maximum permissible error (MPEs)																																													
2.1	Gas meter indicating the volume at metering conditions or mass <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Class</td> <td>1,5</td> <td>1,0</td> </tr> <tr> <td>$Q_{min} \leq Q < Q_t$</td> <td>3 %</td> <td>2 %</td> </tr> <tr> <td>$Q_t \leq Q \leq Q_{max}$</td> <td>1,5 %</td> <td>1 %</td> </tr> </table>	Class	1,5	1,0	$Q_{min} \leq Q < Q_t$	3 %	2 %	$Q_t \leq Q \leq Q_{max}$	1,5 %	1 %	5.3 <i>“ A gas meter may be divided in three accuracy classes: 0.5, 1 and 1.5. A gas meter shall be classified according its accuracy in one of these classes. The value of the MPE is dependent on the applicable accuracy class as listed in Table 2 below.</i> <p style="text-align: center;">Table 2 Maximum permissible errors of gas meters</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="3">Flow rate Q</th> <th colspan="3">During type evaluation and initial verification</th> <th colspan="3">During subsequent verification and In-service *</th> </tr> <tr> <th colspan="3">Accuracy class</th> <th colspan="3">Accuracy class</th> </tr> <tr> <th>0.5</th> <th>1</th> <th>1.5</th> <th>0.5</th> <th>1</th> <th>1.5</th> </tr> </thead> <tbody> <tr> <td>$Q_{min} \leq Q < Q_t$</td> <td>± 1 %</td> <td>± 2 %</td> <td>± 3 %</td> <td>± 2 %</td> <td>± 4 %</td> <td>± 6 %</td> </tr> <tr> <td>$Q_t \leq Q \leq Q_{max}$</td> <td>± 0.5 %</td> <td>± 1 %</td> <td>± 1.5 %</td> <td>± 1 %</td> <td>± 2 %</td> <td>± 3 %</td> </tr> </tbody> </table> <p style="text-align: center; font-size: small;">* Note: National Authorities may decide to implement maximum permissible errors for subsequent or in-service verification.</p>	Flow rate Q	During type evaluation and initial verification			During subsequent verification and In-service *			Accuracy class			Accuracy class			0.5	1	1.5	0.5	1	1.5	$Q_{min} \leq Q < Q_t$	± 1 %	± 2 %	± 3 %	± 2 %	± 4 %	± 6 %	$Q_t \leq Q \leq Q_{max}$	± 0.5 %	± 1 %	± 1.5 %	± 1 %	± 2 %	± 3 %	Covered
Class	1,5	1,0																																											
$Q_{min} \leq Q < Q_t$	3 %	2 %																																											
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$Q_t \leq Q \leq Q_{max}$	± 0.5 %	± 1 %	± 1.5 %	± 1 %	± 2 %	± 3 %																																							
	The gas meter shall not exploit the MPEs or systematically favour any party.	5.4	R137 uses the weighted mean error concept.	Covered																																									

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
2.2 For a gas meter with temperature conversion, which only indicates the converted volume, the MPE of the meter is increased by 0,5% in a range of 30°C extending symmetrically around the temperature specified by the manufacturer that lies between 15°C and 25°C. Outside this range, an additional increase of 0,5% is permitted in each interval of 10°C.	5.3.5	<p><i>“ For a gas meter with a built-in conversion device and displaying the volume at base conditions only, the maximum permissible errors as indicated in Table 2 are increased by 0.5 % in the temperature range of (tsp – 15) °C to (tsp + 15) °C. Outside this temperature range an additional increase of 0.5 % per additional interval of 10 °C is permitted to this extended MPE. The temperature tsp is specified by the manufacturer.</i></p> <p>According to R 137-1, the manufacturer is free to define the temperature. It is not required that it shall be selected between 15 °C and 25 °C.</p> <p>Only covered when the selected temperature tsp lies between 15 °C and 25 °C.</p>	Partially covered.
3 Permissible effect of disturbances			
3.1 Electromagnetic immunity			
3.1.1 The effect of an electromagnetic disturbance on a gas meter or volume conversion device shall be such that: – the change in the measurement result is no greater than the critical change value as defined in 3.1.3, 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.	5.13.7	<p><i>If a gas meter includes electronic components, the requirements as presented in Table 5 apply.</i></p> <p>Not covered for radiated and conducted RF EM Field tests</p>	Partially covered

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
3.1.2 After undergoing a disturbance, the gas 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.	12.6.15	<i>“For gas meters containing electronic components, additionally the requirements as described in 5.13.7 are applicable. Performance tests shall be executed using the test methods described in Part 2 Metrological controls and performance tests. An overview of the requirements is shown in Table 4 and Table 5. After each test it shall be verified that no loss of data has occurred.”</i>	Covered
3.1.3 The critical change value is the smaller of the two following values: – the quantity corresponding to half of the magnitude of the MPE in the upper zone on the measured volume; – the quantity corresponding to the MPE on the quantity corresponding to one minute at maximum flowrate.	Table 5 3.2.7	The critical change value, called ‘fault limit’ in R137, shall be smaller or equal to 0,5 MPE. <i>“fault (OIML D 11, 3.9) difference between the error of indication and the intrinsic error of a measuring instrument”</i> The second option of the MID is not included in OIML R137.	Partially covered
3.2 Effect of upstream-downstream flow disturbances Under installation conditions specified by the manufacturer, the effect of the flow disturbances shall not exceed one third of the MPE	5.13.3	<i>“ For types of gas meters of which the accuracy is affected by flow disturbances, the shift of the error due to these disturbances shall not exceed one third of the maximum permissible error. In case such a gas meter is specified to be installed in specific piping arrangements producing only mild flow disturbances, the meter shall be marked as such and may only be installed in those specific piping configurations for which its accuracy has proven to stay within this requirement.”</i>	Covered
4 Durability After an appropriate test, taking into account the period of time estimated by the manufacturer, has been performed, the following criteria shall be satisfied:		This is not a requirement.	
4.1 Class 1.5. meters			

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
4.1.1 The variation of the measurement result after the durability test when compared with the initial measurement result for the flow rates in the range Q_t to Q_{max} shall not exceed the measurement result by more than 2%	5.10	<p><i>“A gas meter shall meet the following requirements after being subjected to a flow with rate between $0.8 Q_{max}$ and Q_{max} comprising a quantity that is equivalent to a flow at Q_{max} during a period of 2 000 hours:</i></p> <ul style="list-style-type: none"> <i>• the maximum permissible errors as specified in Table 2 for subsequent verification and in-service, and</i> <i>• for flow rates from Q_t up to Q_{max} a fault of less than or equal to: 1.0 times the maximum permissible error applicable during type evaluation for class 1.5 “</i> <p>This means that the effect is 1,5% maximally, which is more restrictive than 2%.</p>	Covered
4.1.2 The error of indication after the durability test shall not exceed twice the MPE in paragraph 2.	5.10	<p>The error shall be within:</p> <ul style="list-style-type: none"> <i>• the maximum permissible errors as specified in Table 2 for subsequent verification and in-service</i> <p>This is an identical requirement.</p>	Covered
4.2 Class 1.0 meters			
4.2.1 The variation of the measurement result after the durability test when compared with the initial measurement result shall not exceed one-third of the MPE in paragraph 2.	5.10	<p><i>“A gas meter shall meet the following requirements after being subjected to a flow with rate between $0.8 Q_{max}$ and Q_{max} comprising a quantity that is equivalent to a flow at Q_{max} during a period of 2 000 hours:</i></p> <ul style="list-style-type: none"> <i>• the maximum permissible errors as specified in Table 2 for subsequent verification and in-service, and</i> <i>• for flow rates from Q_t up to Q_{max} a fault of less than or equal to: 0.5 times the maximum permissible error applicable during type evaluation for other classes. “</i> <p>This means that the OIML requires 0.5 MPE, where the MID requires 1/3 MPE.</p>	Not covered

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
4.2.2 The error of indication after the durability test shall not exceed the MPE in paragraph 2.	5.10	The error shall be within: • <i>the maximum permissible errors as specified in Table 2 for subsequent verification and in-service</i>	Not covered
5 Suitability			
5.1 A gas meter powered from the mains (AC or DC) shall be provided with an emergency power supply device or other means to ensure, during a failure of the principal power source, that all measuring functions are safeguarded.	6.6.2	<p><i>“An electronic gas meter shall be designed such that in the event of a mains power failure (AC or DC), the meter indication of the quantity of gas just before failure is not lost, and remains accessible for reading after failure without any difficulty.</i></p> <p><i>Any other properties or parameters of the meter shall not be affected by an interruption of the electrical supply.</i></p> <p><i>Note: Compliance with this requirement will not necessarily ensure that the gas meter will continue to register the quantity of gas that passed through the gas meter during a power failure, although National Authorities may require continuation of such registration.</i></p> <p><i>The connection to the mains power source shall be capable of being secured from tampering.”</i></p>	Not covered

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
5.2 A dedicated power source shall have a lifetime of at least five years. After 90% of its lifetime an appropriate warning shall be shown.	6.6.4	<p><i>“ If the instrument is powered by a replaceable power source, the manufacturer shall give detailed specifications for the replacement thereof.</i></p> <p><i>The date by which the power source is to be replaced shall be indicated on the meter. Alternatively, the estimated remaining life of the power source shall be displayed or a warning shall be given when the estimated remaining life of the power source is at or below 10 %.</i></p> <p><i>The properties and parameters of the meter shall not be affected during replacement of the power source.</i></p> <p><i>It shall be possible to replace the power source without breaking the metrological seal.</i></p> <p><i>The compartment of the power source shall be capable of being secured from tampering.”</i></p> <p>The requirement of MID is covered only by one of the alternatives and when the battery has a 5 years lifetime at least.</p>	Partially covered
5.3 An indicating device shall have a sufficient number of digits to ensure that the quantity passed during 8000 hours at Q _{max} does not return the digits to their initial values.	6.3.2	<p><i>“The indicating device shall be able to record and display the indicated quantity of gas corresponding to at least 1 000 hours of operation at the maximum flow rate Q_{max}, without returning to the original reading.”</i></p>	Not covered

Directive 2014/32/EU Essential requirements of Annex I and Annex IV (MI-002)	OIML R 137 (2012)	Comments	Conclusion
5.4 The gas meter shall be able to be installed to operate in any position declared by the manufacturer in its installation instruction.	12.6.4	<p><i>“Orientation</i></p> <p><i>Unless specified by the manufacturer that the gas meter is to be used only in certain mounting orientations it shall be established whether the orientation of the meter influences the measuring behaviour.</i></p> <p><i>The following orientations shall be examined:</i></p> <ul style="list-style-type: none"> <i>• horizontal,</i> <i>• vertical flow-up,</i> <i>• vertical flow-down,</i> <p><i>and the accuracy measurements as stated in 12.6.1 are performed in these orientations. If only certain orientations are stipulated by the manufacturer only those orientations shall be examined.”</i></p>	Covered
5.5 The gas meter shall have a test element, which shall enable tests to be carried out in a reasonable time.	6.4.1	<p><i>“A gas meter shall be designed and constructed incorporating:</i></p> <p><i>a) an integral test element, or</i></p> <p><i>b) a pulse generator, or</i></p> <p><i>c) arrangements permitting the connection of a portable test unit.”</i></p>	Covered
5.6 The gas meter shall respect the MPE in any flow direction or only in one flow direction clearly marked.	5.13.2	<p><i>“ Flow direction</i></p> <p><i>If the meter is marked as being able to measure the flow in both directions, the metrological requirements mentioned in 5.3 and 5.4 shall be fulfilled for each direction separately.”</i></p>	Covered
6 Units Metered quantity shall be displayed in cubic metre, or in kilogram.	4.1	<p><i>“All quantities shall be expressed in SI units [3] or as other legal units of measurement [4], unless a country’s legal units are different. In the next section the unit corresponding to the quantity indicated is expressed by <unit>.”</i></p> <p>Only covered if kg or m³ is used.</p>	Partially covered