



BSI Standards Publication

Gas meters - Diaphragm gas meters

National foreword

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English Version

Gas meters - Diaphragm gas meters

Compteurs de gaz - Compteurs de volume de gaz à
parois déformables

Gaszähler - Balgengaszähler

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Contents

Page

European foreword.....	5
1 Scope	6
2 Normative references	6
3 Terms, definitions and symbols	7
3.1 Terms and definitions	7
3.2 Symbols	10
4 Working conditions	11
4.1 Flow range	11
4.2 Maximum working pressure	12
4.3 Temperature range	12
4.4 Climatic environment	12
4.5 Installation orientation	13
5 Metrological performance	13
5.1 Errors of indication	13
5.1.1 Requirements	13
5.1.2 Test procedure – Errors of indication	13
5.2 Pressure absorption	14
5.2.1 Requirements	14
5.2.2 Test procedure – Pressure absorption	15
5.3 Starting flow rate	15
5.3.1 Requirements	15
5.3.2 Test procedure – Starting flow rate	15
5.4 Metrological stability	16
5.4.1 Requirements	16
5.4.2 Test procedure – Metrological stability	16
5.5 Overload flow rate	16
5.5.1 Requirements	16
5.5.2 Test procedure – Overload flow rate	16
5.6 Environment and humidity	16
5.6.1 Requirements	16
5.6.2 Test procedure – Environment and humidity	16
5.7 Influence of other devices attached to the meter	16
5.7.1 Requirements	16
5.7.2 Test procedure – Influence of other devices	17
5.8 Cyclic volume	17
5.8.1 Requirements	17
5.8.2 Test procedure – Cyclic volume	17
6 Construction and materials	17
6.1 General	17
6.2 Resistance to interference	17
6.2.1 Mechanical interference	17
6.2.2 Electromagnetic interference	17
6.3 Robustness	18
6.3.1 General	18
6.3.2 Meter case	18

6.3.3	External leak tightness	18
6.3.4	Resistance to internal pressure.....	18
6.3.5	Meter case sealing	19
6.3.6	Connections	19
6.3.7	Resistance to vibration.....	23
6.3.8	Resistance to impact.....	25
6.3.9	Resistance to mishandling.....	27
6.4	Corrosion protection	28
6.4.1	General	28
6.4.2	External corrosion.....	29
6.4.3	Internal corrosion	30
6.5	Resistance to storage temperature range	30
6.5.1	Requirements.....	30
6.5.2	Test procedure – Resistance to storage temperature range.....	30
6.6	Optional features	31
6.6.1	Pressure measuring point	31
6.6.2	Electrical insulating feet	31
6.6.3	Magnetic index drive	31
6.6.4	Devices to prevent the registration of reverse flow.....	32
6.6.5	Devices to prevent reverse flow	32
6.6.6	Resistance to high temperatures	32
6.6.7	Diaphragm gas meters provided with a built-in gas temperature conversion device	34
6.6.8	Additional functionalities.....	34
7	Mechanical performance	34
7.1	Meter assembly	34
7.1.1	General	34
7.1.2	Durability.....	34
7.1.3	Meter error of indication at declared gas temperature limits	39
7.1.4	Error of indication subject to declared ambient temperature limits	40
7.2	Index.....	41
7.2.1	Construction details.....	41
7.2.2	Index windows and surround	42
7.3	Diaphragms and components in the gas path	43
7.3.1	Requirements for diaphragms and non-rubber components in the gas path	43
7.3.2	Requirements for rubber components in the gas path.....	43
7.3.3	Toluene/iso-octane vapour test.....	43
7.3.4	Water vapour test.....	45
7.3.5	Ageing	47
8	Marking	47
8.1	All meters.....	47
8.2	Two-pipe meters.....	48
8.3	Durability and legibility of marking	48
8.3.1	Requirements.....	48
8.3.2	Ultraviolet exposure test	48
8.3.3	Indelibility.....	48
8.3.4	Adhesion	49
9	Meters supplied for testing	49
9.1	General	49
Annex A (normative)	Production requirements for gas meters.....	53
A.1	General	53

A.2	Technical requirements.....	53
A.3	Declaration of conformity	54
A.4	Provision of information	55
Annex B (normative) Diaphragm gas meters provided with a built-in gas temperature conversion device		
		56
B.1	Scope	56
B.2	Metrological performance	56
B.3	Marking.....	62
Annex C (normative) Tests for meters to be used in open locations.....		
		63
C.1	Humidity.....	63
C.2	Weathering.....	63
Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2014/32/EU Measuring Instruments Directive aimed to be covered.....		
		65
Bibliography		71

European foreword

This document (EN 1359:2017) has been prepared by Technical Committee CEN/TC 237 “Gas meters”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2018, and conflicting national standards shall be withdrawn at the latest by January 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1359:1998.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive.

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

Significant changes from the previous editions include:

- conformity with the MID 2014/32/EU regarding declared errors of the same sign and testing $Q_{\min}$ at the minimum and maximum declared gas temperatures;
- corrosion protection restructured;
- endurance testing for residential meters revised to reflect better the in-service life;
- provision for meters with electronic indexes and integrated valves, and requirements for additional functionalities as given in EN 16314;
- adhesion testing of labels.

Annex B has been restructured to give additional requirements for meters provided with a built-in gas temperature conversion device.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the requirements and tests for the construction, performance, safety and production of class 1,5 diaphragm gas meters (referred to as meters). This applies to meters with co-axial single pipe, or two pipe connections, that are used to measure volumes of fuel gases, which are within the limits of test gases of the 1st, 2nd and 3rd families described in EN 437. The meters have maximum working pressures not exceeding 0,5 bar and maximum actual flow rates not exceeding $160 \text{ m}^3\text{h}^{-1}$ over a minimum ambient temperature range of -10°C to 40°C and a gas temperature range as specified by the manufacturer with a minimum range of 40 K.

This standard applies to meters with and without built-in temperature conversion that are installed in locations with vibration and shocks of low significance (see MID Annex 1 Chapter 1.3.2 (a), class M1). It also applies to meters in:

- closed locations (indoor or outdoor with protection as specified by the manufacturer) both with condensing humidity, or with non-condensing humidity;

or, if specified by the manufacturer:

- open locations (outdoor without any covering) both with condensing humidity and with non-condensing humidity;
- in locations with electromagnetic disturbances corresponding to those likely to be found in residential, commercial and light industrial buildings (see MID Annex 1 Chapter 1.3.3 (a), class E1).

Unless otherwise stated, all pressures given in this document are gauge pressure.

Requirements for electronic indexes, batteries, valves incorporated in the meter and other additional functionalities are given in EN 16314.

Unless otherwise stated in a particular test, the tests are carried out on meters that include additional functionality devices intended by the manufacturer.

Clauses 1 to 9 and Annexes B and C are for design and type testing only.

NOTE The content of OIML Publication 'International Recommendation R 137' has been taken into account in the drafting of this standard.

If no specific requirements are given for test equipment, the instruments used should be traceable to a national or international reference standard and the uncertainty (2σ) should be better than $1/5$ of the maximum value of the parameter to be tested. For differential results the repeatability (2σ)/resolution should be better than $1/5$ of the maximum value of the parameter to be tested.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 549, *Rubber materials for seals and diaphragms for gas appliances and gas equipment*

EN 16314:2013, *Gas meters - Additional functionalities*

EN 60730-1:2011, *Automatic electrical controls for household and similar use - Part 1: General requirements (IEC 60730-1:2011)*

EN ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation (ISO 228-1)*

EN ISO 1518-1, *Paints and varnishes - Determination of scratch resistance - Part 1: Constant-loading method (ISO 1518-1)*

EN ISO 2409, *Paints and varnishes - Cross-cut test (ISO 2409)*

EN ISO 2812-1:2007, *Paints and varnishes - Determination of resistance to liquids - Part 1: Immersion in liquids other than water (ISO 2812-1:2007)*

EN ISO 4628-2, *Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Part 2: Assessment of degree of blistering (ISO 4628-2)*

EN ISO 4628-3:2016, *Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Part 3: Assessment of degree of rusting (ISO 4628-3:2016)*

EN ISO 4892-2:2013, *Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps (ISO 4892-2:2013)*

EN ISO 6270-1, *Paints and varnishes - Determination of resistance to humidity - Part 1: Continuous condensation (ISO 6270-1)*

EN ISO 6272-2, *Paints and varnishes - Rapid-deformation (impact resistance) tests - Part 2: Falling-weight test, small-area indenter (ISO 6272-2)*

EN ISO 9227:2012, *Corrosion tests in artificial atmospheres — Salt spray tests (ISO 9227)*

EN ISO 11664-4, *Colorimetry - Part 4: CIE 1976 L*a*b* Colour space (ISO 11664-4)*

ISO 834-1, *Fire-resistance tests — Elements of building construction — Part 1: General requirements*

ISO 5168, *Measurement of fluid flow — Procedures for the evaluation of uncertainties*

ISO 7005-1:2011, *Pipe flanges — Part 1: Steel flanges for industrial and general service piping systems*

ASTM D1003, *Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1

air

air of density approximately $1,2 \text{ kgm}^{-3}$

3.1.2

gas volume meter

instrument designed to measure, memorize and display the volume of a fuel gas that has passed through it

3.1.3

diaphragm gas meter

gas volume meter in which the gas volume is measured by means of measuring chambers with deformable walls

3.1.4

actual flow rate

flow rate at the gas pressure and gas temperature conditions prevailing in the gas distribution line in which the meter is fitted, at the meter inlet

3.1.5

working pressure

difference between the pressure of the gas at the inlet of the meter and the atmospheric pressure

3.1.6

maximum working pressure

upper limit of the working pressure for which the meter has been designed, as declared by the manufacturer and marked on the meter data plate

3.1.7

pressure absorption

difference between the pressure measured at the inlet and outlet connections of the meter whilst the meter is operating

3.1.8

external leak tightness

leak tightness of the gas carrying components of the gas meter with respect to the atmosphere

3.1.9

error of indication

E

value that shows the relationship in percentage terms of the difference between the volume indicated by the meter and the volume that has actually passed through the meter, to the latter volume

Note 1 to entry: Error of indication, as a percentage, is calculated using the Formula (1):

$$E = 100 \frac{V_i - V_c}{V_c} \quad (1)$$

where

V_i is the indicated volume

V_c is the volume which has actually passed through the meter.

3.1.10**normal condition of use**

condition referring to the meter operating:

- at a pressure up to the maximum working pressure (with or without a flow of gas);
- within the range of flow rates;
- within the ambient and gas temperature range;
- with the distributed gas

3.1.11**base condition**

fixed condition (temperature and pressure) to which a volume of gas is converted

3.1.12**cyclic volume**

volume of gas corresponding to the working cycle of the gas meter

Note 1 to entry: This means that all the moving components, except for the indicating device and the intermediate transmissions, resume for the first time the position they occupied at the beginning of the cycle.

3.1.13**distributed gas**

gas locally available

3.1.14**metering conditions**

condition of the gas at the point of measurement

Note 1 to entry: E.g. temperature and pressure of the measured gas.

3.1.15**temperature conversion device**

device which converts the volume measured to a corresponding volume at the base gas temperature

Note 1 to entry: The volume at base gas temperature, V_b in cubic metres (m^3) is given by the equation

$$V_b = \frac{T_b}{T} \times V \quad (2)$$

where

V is the volume at metering conditions, in cubic metres (m^3);

T is the gas temperature at metering conditions, in Kelvin (K);

T_b is the base gas temperature, in Kelvin (K).

3.1.16**meter error curve**

plot of average error of indication against actual flow rate

3.1.17

class 1,5 meter

meter which has an-MPE at production-of:

$\pm 3\%$ where $Q_{\min} \leq Q < Q_t$

and

$\pm 1,5\%$ where $Q_t \leq Q \leq Q_{\max}$

3.1.18

MPE

maximum permissible error for a class 1,5 diaphragm gas meter

3.1.19

MPE-Initial

maximum permissible error for a Class 1,5 diaphragm gas meter before testing in accordance with this standard

3.1.20

MPE-Subsequent

maximum permissible error for a Class 1,5 diaphragm gas meter following the completion of specific individual tests within this standard

3.2 Symbols

For the purposes of this document, the following symbols and definitions apply.

3.2.1

Q

volume flowrate

actual flow of gas passing through the diaphragm gas meter

3.2.2

$Q_{\min}$

minimum flowrate

lowest flowrate at which the gas meter provides indications that satisfy the requirements regarding MPE

3.2.3

Q_t

transitional flowrate

flowrate occurring between the maximum and minimum flowrates at which the flowrate range is divided into two zones, the 'upper zone' and the 'lower zone', each zone having a characteristic MPE

3.2.4

$Q_{\max}$

maximum flowrate

highest flowrate at which the gas meter provides indications that satisfy the requirements regarding MPE

3.2.5 **Q_r** **overload flowrate**

highest flowrate at which the meter operates for a short period of time without deteriorating

3.2.6 **V**

cyclic volume

3.2.7 **$p_{\max}$**

maximum working pressure

3.2.8 **t_b**

base gas temperature

3.2.9 **t_m**

ambient temperature

3.2.10 **t_g**

gas temperature

3.2.11 **t_{sp}**

specified centre temperature for meters with temperature conversion

3.2.12 **g_n**

nominal gravitational acceleration

4 Working conditions**4.1 Flow range**

The flow rate range shall be one of those given in Table 1.

Table 1 — Flow rate range

$Q_{\max}$ m^3h^{-1}	$Q_{\min}$ m^3h^{-1}	Q_t m^3h^{-1}	Q_r m^3h^{-1}
2,5	0,016	0,25	3,0
4	0,025	0,4	4,8
6	0,04	0,6	7,2
10	0,06	1,0	12,0
16	0,1	1,6	19,2
25	0,16	2,5	30,0
40	0,25	4,0	48,0
65	0,4	6,5	78,0
100	0,65	10,0	120,0
160	1	16,0	192,0

A gas meter may have a lower value for the minimum flow rate, $Q_{\min}$, than that shown in Table 1, but this lower value shall be equal to one of the values shown in the table or to a decimal submultiple of these values.

NOTE The values given in Table 1 ensure conformity with the requirements of the MID for a minimum ratio $Q_{\max}$ to $Q_{\min}$ of 150:1.

4.2 Maximum working pressure

Unless required otherwise for a particular test, all meters shall be capable of meeting the requirements up to the maximum working pressure of the meter, $P_{\max}$, which shall be declared and shall be marked on the index plate of the meter.

4.3 Temperature range

All meters shall be capable of meeting the requirements for a minimum ambient temperature range of $-10\text{ }^{\circ}\text{C}$ to $40\text{ }^{\circ}\text{C}$ and a minimum gas temperature range of 40 K (see 7.1.3) and a minimum storage temperature range of $-20\text{ }^{\circ}\text{C}$ to $60\text{ }^{\circ}\text{C}$ (see 6.5). The gas temperature range shall be within the ambient temperature range.

The gas temperature range and the ambient temperature range shall be declared and shall be marked on the index plate of the meter.

The manufacturer may declare a wider ambient temperature range using a minimum temperature of $-10\text{ }^{\circ}\text{C}$, $-25\text{ }^{\circ}\text{C}$ or $-40\text{ }^{\circ}\text{C}$ and a maximum temperature of $40\text{ }^{\circ}\text{C}$, $55\text{ }^{\circ}\text{C}$ or $70\text{ }^{\circ}\text{C}$ and/or a wider storage temperature range. The meter shall be capable of meeting the requirements over this declared wider range.

4.4 Climatic environment

Meters that conform to the requirements of this standard are deemed suitable for installation in closed locations (indoor or outdoor with protection as specified by the manufacturer) with condensing or non-condensing humidity.

If the manufacturer declares that the meter is also suitable for installation in open locations (outdoor without any protection) with condensing or non-condensing humidity, it shall meet the requirements of Annex C.

4.5 Installation orientation

The meter shall be designed for installation upright as specified by the manufacturer.

5 Metrological performance

5.1 Errors of indication

5.1.1 Requirements

When tested by the method given in 5.1.2 a) the individual errors of indication of the meter shall be within the initial permissible error (MPE-Initial) limits specified in Table 2.

Table 2 — Maximum permissible errors

Flow rate m^3h^{-1}	Maximum permissible errors	
	Initial	Subsequent
$Q_{\min} \leq Q < Q_t$	$\pm 3 \%$	$\pm 6 \%$
$Q_t \leq Q \leq Q_{\max}$	$\pm 1,5 \%$	$\pm 3 \%$

The meter, including any additional functionality devices intended by the manufacturer, shall have the error adjusted as close to zero as the adjustments allow, without systematically favouring any party.

After the meter has been subjected to other influences, given in the individual clauses of this standard, the average of the errors of indication of the meter shall either:

- not vary from the average of the initial errors of indication by more than that allowed by those clauses or;
- be within the error limits specified within those clauses;

whichever is applicable, when tested by the methods given in 5.1.2 b), 5.1.2 c) or 5.1.2 d).

5.1.2 Test procedure — Errors of indication

- a) Thermally stabilize the meter to be tested for a minimum of 4 h at the temperature of the test laboratory and carry out the error of indication test using air at laboratory temperature.

Immediately before commencing the test, pass a quantity of air equal to at least 50 cyclic volumes of the meter under test, through the meter under test at a flow rate of $Q_{\max}$.

Carry out this test six times at each of the flow rates $Q_{\min}$, $3 Q_{\min}$, $0,1 Q_{\max}$, $0,2 Q_{\max}$, $0,4 Q_{\max}$, $0,7 Q_{\max}$ and $Q_{\max}$, ensuring that the flow rates between each individual test are different (i.e. it is not permissible to carry out consecutive tests at the same flow rate).

Pass a volume of air, the actual volume of which is measured by a traceable standard, through the meter under test and note the volume indicated by the meter index. The minimum volume of air to be passed through the meter under test is specified by the manufacturer and agreed with the Accredited test house.

Calculate the six errors of indication at each of the flow rates using the equation given in 3.1.9. Calculate the mean of each of the six errors of indication and record the results as the meter error curve.

- b) Thermally stabilize the meter to be tested for a minimum of 4 h at the temperature of the test laboratory and carry out the error of indication test using air at laboratory temperature.

Pass a volume of air, the actual volume of which is measured by a traceable standard, through the meter under test and note the volume indicated by the meter index. The minimum volume of air to be passed through the meter under test is specified by the manufacturer and agreed with the Accredited test house.

Carry out this test three times at each of the flow rates $Q_{\min}$, $3 Q_{\min}$, $0,1 Q_{\max}$, $0,2 Q_{\max}$, $0,4 Q_{\max}$, $0,7 Q_{\max}$ and $Q_{\max}$; ensure that the flow rates between each individual test are different (i.e. it is not permissible to carry out consecutive tests at the same flow rate).

Calculate the three errors of indication at each of the flow rates using the equation given in 3.1.9. Calculate the mean of the three errors of indication and record the results as the meter error curve.

- c) Thermally stabilize the meter to be tested for a minimum of 4 h to the temperature of the test laboratory and carry out the error of indication test using air at laboratory temperature.

Pass a volume of air, the actual volume of which is measured by a traceable standard, through the meter under test and note the volume indicated by the meter index. The minimum volume of air to be passed through the meter under test is specified by the manufacturer and agreed with the Accredited test house.

Carry out this test three times at each of the flow rates $0,1 Q_{\max}$, $0,4 Q_{\max}$ and $Q_{\max}$, ensuring that the flow rates between each individual test are different (i.e. it is not permissible to carry out consecutive tests at the same flow rate).

Calculate the three errors of indication at each of the flow rates using the equation given in 3.1.9. Calculate the mean of the three errors of indication and record the results as the meter error curve.

- d) Thermally stabilize the meter to be tested for a minimum of 4 h to the temperature of the test laboratory and carry out the error of indication test using air at laboratory temperature.

Pass a volume of air, the actual volume of which is measured by a traceable standard, through the meter under test and note the volume indicated by the meter index. The minimum volume of air to be passed through the meter under test is specified by the manufacturer and agreed with the Accredited test house.

Carry out this test three times at each of the flow rates $Q_{\min}$, $0,1 Q_{\max}$, $0,4 Q_{\max}$ and $Q_{\max}$, ensuring that the flow rates between each individual test are different (i.e. it is not permissible to carry out consecutive tests at the same flow rate).

Calculate the three errors of indication at each of the flow rates using the equation given in 3.1.9. Calculate the mean of the three errors of indication and record the results as the meter error curve.

5.2 Pressure absorption

5.2.1 Requirements

The mean pressure absorption of a meter over at least one cyclic volume, with a flow of air with a density of $1,2 \text{ kgm}^{-3}$, at a flow rate equal to $Q_{\max}$, shall not exceed the values given in Table 3.

Table 3 — Pressure absorption

$Q_{\max}$ m^3h^{-1}	Maximum permissible values for mean pressure absorption	
	Initial mbar	Subsequent mbar
2,5 to 16 inclusive	2	2,2
25 to 65 inclusive	3	3,3
100 and 160	4	4,4

5.2.2 Test procedure — Pressure absorption

Supply the meter under test with a flow of air at a flow rate equal to $Q_{\max}$ for a minimum of 10 cycles. Measure the differential pressure across the meter for at least one cyclic volume using a suitable measuring instrument, accurate to 0,1 mbar.

The distance between the pressure test points and the meter connections shall not exceed three times the nominal connection diameter.

Record the differential pressures over at least one measuring cycle, and calculate the mean value.

5.3 Starting flow rate**5.3.1 Requirements**

When tested by the method given in 5.3.2, the starting flow rate shall not be greater than those specified in Table 4.

Table 4 — Starting flow rates

$Q_{\max}$ m^3h^{-1}	Maximum starting flow rate dm^3h^{-1}
2,5	3
4 and 6	5
10	8
16 and 25	13
40	20
65 and 100	32
160	50

5.3.2 Test procedure — Starting flow rate

Run the meter under test at $Q_{\max}$ for 10 min, using air at laboratory temperature.

NOTE This test does not check the metrological characteristics of the meter.

Leave the meter under test at rest for a period of 2 h to 4 h. Do not add lubricant for the test.

Connect the meter under test in series with, and upstream of, a flow measuring instrument of known accuracy and traceability, and a flow regulating device accurate to two decimal places.

Check the leak tightness of the complete test apparatus and supply air at ambient temperature up to a maximum pressure of 2 mbar and maintain the flow rate at the maximum allowable starting flow rate. At this maximum starting flow rate, ascertain that the meter under test registers continuously for at least one cyclic volume.

Record the result as pass or fail.

5.4 Metrological stability

5.4.1 Requirements

The errors of indication found at each of the specified test flow rates shall not differ by more than 0,6 %.

5.4.2 Test procedure – Metrological stability

Using the calculated errors of indication, obtained when carrying out the initial error of indication test in 5.1.2 a) at flowrates $0,1 Q_{\max}$, $0,2 Q_{\max}$, $0,4 Q_{\max}$, $0,7 Q_{\max}$ and $Q_{\max}$, check that for each flowrate the spread of the six individual results is within 0,6 %.

Record the result as a pass or fail.

5.5 Overload flow rate

5.5.1 Requirements

After exposure to an overload flow rate of Q_r as given in Table 1, the error of indication shall remain within the MPE-Initial limits specified in Table 2.

5.5.2 Test procedure – Overload flow rate

Supply 1 meter with air for 1 h at a flow rate of Q_r . Determine the error of indication as specified in 5.1.2 c).

Record the result as a pass or fail.

5.6 Environment and humidity

5.6.1 Requirements

NOTE Test methods for meters suitable for use in open locations are given in Annex C.

After testing in accordance with 5.6.2, the error of indication shall remain within the MPE-Initial limits as specified in Table 2 and the index and markings shall remain legible.

5.6.2 Test procedure – Environment and humidity

Test one meter for error of indication in accordance with 5.1.2 c) and then in accordance with EN ISO 6270-1 for a duration of 120 h. Then retest the meter for error of indication in accordance with 5.1.2 c) and visually inspect it for legibility of the index and the markings.

Record the result as a pass or fail.

5.7 Influence of other devices attached to the meter

5.7.1 Requirements

If any device (e.g. an additional functionality device covered by EN 16314) that the manufacturer permits to be connected to the meter influences its metrological performance, then this influence shall be less than 1/5th MPE.

5.7.2 Test procedure – Influence of other devices

Test 1 meter 10 times for error of indication at Q_t , varying the flow rate between each test by at least $0,05 Q_{\max}$. Then attach the influencing device to the meter and determine the error of indication at Q_t again 10 times. Calculate the mean of each set of results. The difference between the means of the 2 errors of indication shall be less than 1/5th MPE.

Report the result as pass or fail.

5.8 Cyclic volume

5.8.1 Requirements

The cyclic volume of any meter at base conditions shall be within $\pm 5 \%$ of the cyclic volume indicated on the index plate.

5.8.2 Test procedure – Cyclic volume

The possible range of cyclic volume is determined by multiplying the value of the volume corresponding to one complete revolution of the test element, or the value of the smallest scale interval, by the transmission ratio of the measuring device to the indicating device, at the extreme of the transmission gear ratios.

Report the result as pass or fail.

6 Construction and materials

6.1 General

No additional lubricants shall be required during the life of the meter.

The meter connections shall be fitted with suitable non-sealing plugs or covers to prevent the entry of foreign matter during transit and storage.

Production requirements for the meter are given in Annex A.

6.2 Resistance to interference

6.2.1 Mechanical interference

6.2.1.1 Requirement

The meter shall be constructed in such a way that any mechanical interference capable of affecting the measuring accuracy causes permanently visible damage to the meter or the verification or protection marks.

6.2.1.2 Test

By visual inspection.

Report the result as pass or fail.

6.2.2 Electromagnetic interference

The meter shall conform to the requirements of EN 16314:2013, 4.1.2.

6.3 Robustness

6.3.1 General

Meters meeting the requirements of 6.3 are suitable for use in locations with vibration and shocks of low significance; e.g. they can be floor mounted or fastened to light supporting structures and will be subject to negligible vibrations and shocks including, but not limited to local blasting or pile driving activities, or slamming doors.

6.3.2 Meter case

The external surface of the meter case, which is in direct contact with the ambient air, and the internal surface of the meter case, which is in direct contact with the gas, shall be of sufficient thickness to meet the requirements of this standard.

6.3.3 External leak tightness

6.3.3.1 Requirements

The meter shall be leak tight under normal conditions of use. When tested in accordance with 6.3.3.2, no leakage shall be observed.

6.3.3.2 Test procedure – External leak tightness

Test the meter in three stages as follows:

- a) Pressurize the meter under test, at normal laboratory temperature, with air to 25 mbar and carry out the test given in either 6.3.3.2 a) or 6.3.3.2 b).
- b) Then pressurize the meter under test, at normal laboratory temperature, with air to a minimum of 1,5 times the declared maximum working pressure and not less than 350 mbar and carry out the test given in either 6.3.3.2 a) or 6.3.3.2 b).
- c) Then allow the pressure to reduce to atmospheric pressure, then re-pressurize the meter under test, at normal laboratory temperature, with air to 25 mbar and carry out the test given in either 6.3.3.2 a) or 6.3.3.2 b).

For each stage test by either:

- i) immerse the meter without its index in water and observe it for leakage for 30 s after any external trapped air has been dispersed, after which no leakage should be observed, or
- ii) use any equivalent procedure utilizing calibrated and certificated test equipment with a declared resolution and full traceability.

Record the results of all three tests and report as pass or fail.

6.3.4 Resistance to internal pressure

6.3.4.1 Requirements

Resistance to internal pressure tests shall be carried out with no interruptions to the gas flow including, but not limited to, valves in the open position.

When tested in accordance with the method given in 6.3.4.2, any residual deformation of the unpressurized meter case shall not exceed 0,75 % of the linear dimension over which it is measured. After the test, the meter case shall remain leak tight in accordance with 6.3.3.

6.3.4.2 Test procedure – Resistance to internal pressure

Pressurize the meter under test, at normal laboratory temperature, with air or water to a minimum of 1,5 times the declared maximum working pressure and not less than 350 mbar.

Maintain the test pressure for 30 min and then release.

Ensure that the rate of pressurization or depressurization does not exceed 350 mbar.s⁻¹.

Record the result as pass or fail.

6.3.5 Meter case sealing

6.3.5.1 Requirements

Mechanical means for sealing shall be provided for the gas-containing components of the meter case, where the failure of any seals and/or adhesives can cause external leakage, e.g. at the junction of the top and bottom case of the meter.

6.3.5.2 Test procedure – Meter case sealing

Conduct a visual inspection of a fully assembled meter case to confirm the presence of appropriate mechanical means of sealing.

Record the result as pass or fail.

6.3.6 Connections

6.3.6.1 Orientation

6.3.6.1.1 Requirements

The connections of meters with top mounted two pipe connections shall have the centrelines of these connections within 1° of vertical, with respect to the horizontal plane of the meter.

The distance between the centrelines of the connections, measured at the free end of the connections, shall be within $\pm 0,5$ mm of the nominal distance between centrelines, or within $\pm 0,25$ % of the nominal distance between centrelines, whichever is the greater, and the centrelines shall be within 1° of being parallel.

The free ends of the connections shall be level within 2 mm, or within 1 % of the nominal distance between the centrelines of the connections, whichever is the greater, with respect to the horizontal plane of the meter.

6.3.6.1.2 Test procedure – Orientation

Take measurements using appropriate instruments, capable of measuring to an accuracy better than that required in 6.3.6.1.1.

Record the result as pass or fail.

6.3.6.2 Threads and flanges for single and two pipe meters

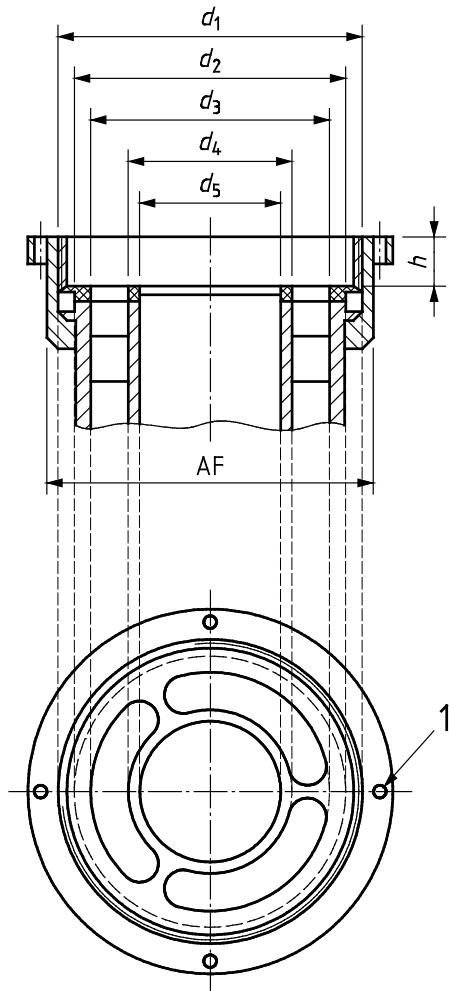
6.3.6.2.1 Requirements

The threads of threaded meter connections on two pipe meters shall be as specified by the meter manufacturer.

Flanges of flanged meter connections shall have dimensions which are in accordance with one of the types of flange given in ISO 7005-1:2011, Table 10 as declared by the meter manufacturer.

NOTE The fact that the dimensions are taken from ISO 7005-1:2011, Table 10 (the PN 10 table) does not denote that the meter has a pressure rating of 10 bar.

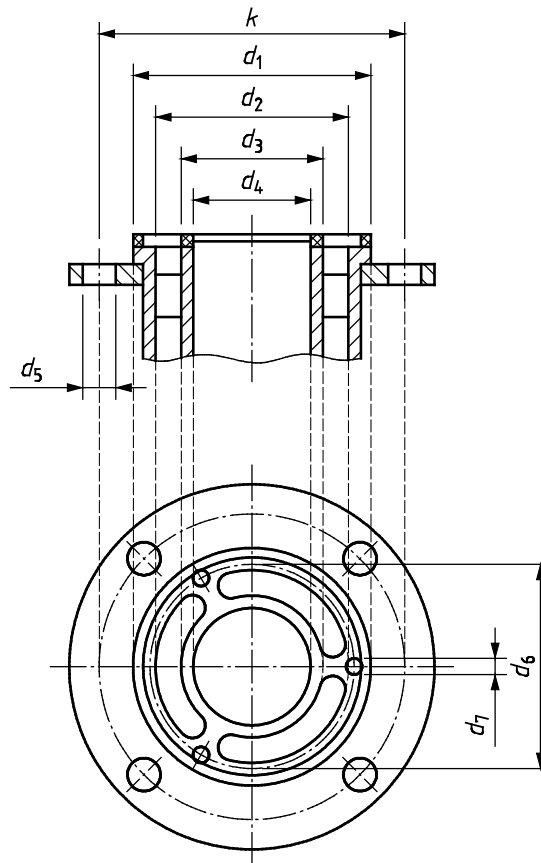
The connections of meters having a co-axial single pipe connection shall be in accordance with Figure 1a or b.



$Q_{\max}$ m^3h^{-1}	d_1^a	d_2	d_3	d_4	d_5	h	AF
≤ 10	G2	54	46	32	26	9_0^{+3}	65
16/25	G2 3/4	76,5	63	48	41	9_0^{+4}	90

^a designation for threads to EN ISO 228-1

1a) Co-axial single pipe screw connections



$Q_{\max}$ m^3h^{-1}	d_1	d_2	d_3	d_4	d_5	d_6	d_7	No. of holes (d_7)	K	No. of bolt holes
40	98	82	60	50	12	75	2,6	3	125	4
65	158	114	82,5	68	18	139	3	3	180	8
100	188	133	95	77	18	160	3	3	210	8
160	240	194	133	113	22	217	3	4	270	8

1b) Co-axial single pipe flanged connections

Key

- d diameter of the indicated dimension
- k diameter between the centres of the bolt holes
- 1 sealing hole
- AF across flats
- h height of the indicated dimension

Figure 1 — Co-axial single pipe connections

6.3.6.2.2 Test procedure — Threads and flanges for single and two pipe meters

Measurements are taken using appropriate instruments capable of measuring to an accuracy better than that required in 6.3.6.2.1.