



SLOVENSKI STANDARD
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Plinomeri - Rotacijski plinomeri

Gas meters - Rotary displacement meters

Compteurs de gaz - Compteurs de gaz à déplacement rotatif

Compteurs de gaz - Compteurs à pistons rotatifs

Ta slovenski standard je istoveten z: prEN 12480

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Gas meters - Rotary displacement meters

Compteurs de gaz - Compteurs à pistons rotatifs

Compteurs de gaz - Compteurs de gaz à déplacement
rotatif

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Foreword

This document (prEN 12480:2010) has been prepared by Technical Committee CEN/TC 237 “Gas meters”, the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12480:2002.

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(s).

For relationship with EU Directives, see informative Annex ZA and ZB, which are an integral part of this document.

1 SCOPE

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This European Standard specifies ranges, construction, performances, output characteristics and testing of rotary displacement gas meters (hereinafter referred to as RD meters or simply meters) for gas volume measurement.

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This European Standard applies to rotary displacement gas meters used to measure the volume of at least fuel gases of the 1st, 2nd and 3rd gas families, the composition of which is specified in EN 437, at a maximum working pressure up to and including 20 bar over an ambient and gas temperature range of at least – 10 °C to + 40 °C.

This standard applies to meters that are installed in locations with vibration and shocks of low significance (class M1 according to MID) and in

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

or, if specified by the manufacturer,

- open locations (outdoor without any covering) with condensing humidity or with non-condensing humidity.

For use in open location, the meters shall fulfil the specification in annex G

and in locations with electromagnetic disturbances.

Unless otherwise specified in this standard:

- all pressures used are gauge;
- all influence quantities, except the one under test, are kept relatively constant at their reference value.

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This standard also applies to meters with a maximum allowable pressure PS and the volume V of less than 6 000 bar · litres or with a product of PS and DN of less than 3 000 bar, as defined by EU directive 97/23/EC.

The risk philosophy adopted in this standard is based on the analysis of hazards on account of pressure. The standard applies principles to eliminate or reduce hazards. Where these hazards cannot be eliminated appropriate protection measures are specified.

Any residual hazard identified has to be communicated to the user where appropriate.

Depending on the installation situation additional requirements may apply to cover the risks arising from traffic, wind, earthquake loading and external fire.

This European Standard is primarily written to address metrological aspects and conformity assessment of RD meters. This standard clearly identifies in annex ZA and ZB which clauses are specific to the metrological or pressure containing requirements, or those that are applicable to both. As well as providing conformity assessment requirements, this standard provides requirements that shall be fulfilled prior to delivery of the product, i.e. Individual meter testing.

2 NORMATIVE REFERENCES

This European Standard incorporates by dated or undated references provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 437, *Test gas - Test pressures – Appliance categories*

EN 10204, *Metallic products - Types of inspection documents*

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EN 12405, *Gas-volume electronic conversion devices*

EN 12156-3, *Valves – Shell design strength – Part 3: Experimental method*

EN 60079-0:2007, *Electrical apparatus for explosive gas atmospheres - General requirements*

EN 60079-11:2007, *Equipment protection by intrinsic safety "i"*

EN 60947-5-6, *Low voltage switchgear and controlgear – Part 5-6: Control circuit devices and switching elements – DC interface for proximity sensors and switching amplifiers (NAMUR) (IEC 60947-5-6:1999)*

EN 60529, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*

EN 60730-1:1995, *Automatic electrical controls for household and similar use - Part 1: General requirements (IEC 60730-1:1993, modified)*

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

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

ISO 1518: 2009, *Paints and varnishes — Scratch test*

ISO 2768-1, *General tolerances – Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

ISO 7005-1, *Metallic flanges - Part1: Steel flanges*

ISO 7005-2, *Metallic flanges - Part2: Cast iron flanges*

3 TERMINOLOGY

3.1 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply:

3.1.1 actual flow rate

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

3.1.2 Accuracy class 1,0

meter which has an error of indication between -2% and $+2\%$ for flow rates Q where $Q_{\min} \leq Q < Q_t$, and between -1% and $+1\%$ for flow rates Q where $Q_t \leq Q \leq Q_{\max}$

3.1.3 base conditions

fixed conditions to which a volume of gas is converted, having been initially measured at prevailing metering conditions

3.1.4 cyclic volume

volume of the gas measured by one complete revolution of the element(s)

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3.1.5 density of gas

the mass of gas divided by the volume

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3.1.6 design temperature range (TS)

range of temperatures for which the meter is designed as specified by the manufacturer and marked on the meter

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3.1.7 diameter

nominal size of diameter

3.1.8 error of indication

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

where

$$E = \frac{V_i - V_c}{V_c} \cdot 100$$

V_i is the indicated volume and V_c is the volume which has actually flowed through the meter

a pressure of $(1\,013,25 \pm 100)$ mbar and temperature of $(20 \pm 0,5)$ °C

3.1.9 maximum allowable pressure (PS)

maximum pressure for which the meter is designed as specified by the manufacturer

3.1.10 minimum flow rate Q_{\min}

lowest flowrate at which the gas meter provides indications that satisfy the requirements regarding maximum permissible error (MPE)

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3.1.11 maximum flowrate Q_{\max}

highest flow rate at which the gas meter provides indications that satisfy the requirements regarding maximum permissible error (MPE)

3.1.12 meter family

A meter family in respect to the conformity assessment is a group of meters of different sizes but with similar construction (see Annex H). By specifying a meter family it is possible to reduce the number of tests and documents during assessment

3.1.13 metering conditions

conditions of the gas prevailing at the point of measurement

3.1.14 metering pressure (p_m)

absolute pressure at which the volume of the gas is measured

3.1.15 normal conditions of use

conditions referring to the meter operating :

- within the range of working pressure
- within the operational temperature and gas temperature range
- with the distributed gas

3.1.16 operating pressure range

limits of working pressure, as marked on the meter, for which the meter will continue to operate within its metrological characteristics as declared by the manufacturer

3.1.17 operating temperature range

range of temperatures for which the meter satisfies the metrological requirements of this standard

3.1.18 overload flowrate Q_r

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

3.1.19 pressure loss

non-recoverable pressure drop caused by the presence of the meter in the pipeline

3.1.20 rotary displacement meter (RD meter)

gas volume meter in which a rigid measuring compartment is formed between the walls of a stationary chamber and rotating element or elements. Each rotation of the element(s) displaces a fixed volume of gas which is cumulatively registered and indicated by an indicating device. It is designed to measure, memorize and display the volume of a fuel gas that has passed through it

3.1.21 specified conditions

condition of the gas at which the performance specifications of the meter are given

3.1.22 storage temperature range

range of temperatures at which the meter can be stored without being adversely affected

3.1.23 transitional flowrate Q_t

transitional flowrate, the 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 has a characteristic MPE

3.1.24 volume of meter

internal volume of meter excluding the volume of internal parts

3.1.25 working pressure

pressure of the gas at the inlet of the meter

3.1.26 limit pressure p_l

pressure at which yielding becomes apparent in any component of the meter or its fixtures

3.1.27 MPE

Maximum permissible error

3.1.28 WME

Weighted mean error

3.1.29 safety factor body S_b

ratio of the limit pressure p_l to the maximum allowable pressure PS applied to the meter body

3.1.30 safety factor others S

ratio of the limit pressure p_l to the maximum allowable pressure PS applied to other pressure containing parts of the meter

3.2 Symbols

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Table 1 — Symbols

3	chapter	Represented quantity	Symbol	SI Unit
	3.1.1	actual flow rate	Q	m ³ /h
	3.1.2	Accuracy class 1,0 meter		
	3.1.3	base conditions		
	3.1.4	cyclic volume	V_{cyc}	dm ³
	3.1.5	Density of gas	ρ	kg·m ⁻³
	3.1.6	Design temperature range	TS	°C
	3.1.7	Diameter	DN	dimensionless
	3.1.8	error of indication	E	%
	3.1.9	Maximum allowable pressure	PS	bar
	3.1.10	Minimum flow rate	Q_{min}	m ³ /h
	3.1.11	Maximum flow rate	Q_{max}	m ³ /h
	3.1.12	Meter family		
	3.1.13	metering conditions		
	3.1.14	metering pressure	p_m	bar
	3.1.15			
	3.1.16	Normal conditions of use		
	3.1.17	Operating pressure range	p	bar

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3.1.18	Operating temperature range	t	°C
3.1.19	Overload flow rate	Q _r	m³/h
3.1.20	Pressure loss		mbar
3.1.21	Rotary displacement meter		
3.1.22	Specified conditions		
3.1.23	storage temperature range	ts	°C
3.1.24	Transitional flow rate	Q _t	m³/h
3.1.25	Volume of meter	V	dm³
3.1.26	Working pressure		bar
3.1.27	Limit pressure	pl	bar
3.1.28	MPE		%
3.1.29	WME		%
3.1.30	Safety factor body	Sb	dimensionless
3.1.31	Safety factor others	S	dimensionless

	SUBSCRIPTS:		
	Metering conditions of the gas	m	
	Base conditions	b	
	minimum	min	
	Transitional	t	
	maximum	max	
	actual	c	
	indicated	i	

4 WORKING RANGE

4.1 General

Gas meters shall be classified according Accuracy Class 1,0. The values of maximum flow rates and the corresponding values of the upper limits of the minimum flow rates shall be one of those given in 4.2, when the meter is tested with air of density approximately 1,2 kg/m³.

4.2 Flow rate range

Unless specified by the purchaser, the values of the maximum and minimum flowrate of rotary displacement gas meters are:

Q_{max} (m³/h): 100, 160, 250, 400, 650

Q_{min} (m³/h): 10, 13, 16, 20, 25, 32, 40, 50, 65, 80

With Q_{max} ≥ 20 Q_{min}

In addition, decimal multiples and sub-multiples of the values given can be used.

4.3 Pressure range

The pressure range shall be from zero to the maximum allowable working pressure stated by manufacturer and shall be marked on the meter.

4.4 Temperature range

All meters shall be capable of meeting the requirements described in the appropriate tests for the gas temperature range, the ambient temperature range and the storage temperature range.

The manufacturer shall specify the temperature ranges:

- a minimum ambient temperature range of –10 °C to +40 °C (the manufacturer may declare a wider ambient temperature range using a minimum temperature of –10 °C, –25 °C, or –40 °C and a maximum temperature of 40 °C, 55 °C, or 70 °C)
- a minimum gas temperature range of 40 °C (the gas temperature range shall be within the ambient temperature range)
- a minimum storage temperature range of –20 °C to + 60 °C (see 6.3.4)..(the storage temperature range may be wider than or equal to the ambient temperature range)

5 METROLOGICAL PERFORMANCE

Uncertainty of test rig (best measurement capability) shall be at maximum 1/5 of MPE for conformity assessment (module B) and at maximum 1/3 of MPE for conformity assessment (modules D and F, including final product inspection of module H1).

5.1 Error of indication

5.1.1 Requirements

When tested in accordance with 5.1.2, the meter error of indication shall be within the limits specified in Table 2.

Table 2 — limits of maximum permissible errors

Flow rate Q m ³ /h	Maximum permissible errors
$Q_{\min} \leq Q < Q_t$	$\pm 2 \%$
$Q_t \leq Q \leq Q_{\max}$	$\pm 1 \%$

Transitional flow rate values, Q_t , are given in Table 3.

Table 3 — transitional flow rate values

Q_{\max}/Q_{\min} :	Q_t
$Q_{\max}/Q_{\min} < 30$	$0,20 Q_{\max}$
$Q_{\max}/Q_{\min} = 30$	$0,15 Q_{\max}$
$Q_{\max}/Q_{\min} > 30$	$\leq 0,10 Q_{\max}$

The gas meter shall not exploit the MPEs or systematically favour any party.

Each meter shall be adjusted so that the weighted mean error (WME) is as close to zero as the adjustment and the maximum permissible errors allow.

The WME shall have a value between -0,4 % and +0,4 %.

The WME is calculated as follows:

$$WME = \frac{\sum (Q_i / Q_{\max}) \cdot E_i}{\sum (Q_i / Q_{\max})}$$

Where:

Q_i / Q_{\max} is a weighting factor;

E_i is the error of indication at the flow rate Q_i given as a percentage.

When $Q_i = Q_{\max}$ a weighting factor of 0,4 instead of 1 shall be used.

5.1.2 Test

The test is carried out using air (density $1,2 \text{ kg m}^{-3}$), or gas specified in the scope, at normal ambient conditions if not otherwise specified for other tests (for example 5.4 and 5.5). The meter is tested at the following flow rates ($\pm 10 \%$):

a) conformity assessment:

1) For meters with flowrate range between 1:20 to 1:30:

Q_{\min} ; $0,05 Q_{\max}$; $0,1 Q_{\max}$ (when these values are larger than Q_{\min}); $0,25 Q_{\max}$; $0,4 Q_{\max}$; $0,7 Q_{\max}$; Q_{\max} .

2) for meters with a flowrate range $\geq 1:50$:

Q_{\min} ; $0,05 Q_{\max}$; $0,15 Q_{\max}$; $0,25 Q_{\max}$; $0,40 Q_{\max}$; $0,70 Q_{\max}$; Q_{\max} .

b) individual factory testing for error of indication (every meter shall be tested) at the flowrates indicated in Table 4:

When requested by the customer, the error of indication test can be carried out at specified conditions (close to the expected operational conditions).

If the test point is equal to Q_t , the tighter limit of the error of indication has to be applied.

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Table 4 — test points for individual meter testing

Q_{\max}/Q_{\min}	Q_{\min}	$0,015 Q_{\max}$	$0,05 Q_{\max}$	$0,25 Q_{\max}$	Q_{\max}
$20 \leq Q_{\max}/Q_{\min} < 30$	X			X	X
$30 \leq Q_{\max}/Q_{\min} < 160$	X		X	X	X
$Q_{\max}/Q_{\min} \geq 160$	X	X	X	X	X

5.2 Pressure loss

5.2.1 Requirements

The maximum pressure loss at Q_{\max} , when using air with density $1,2 \text{ kg m}^{-3}$, shall be declared by the manufacturer.

5.2.2 Test

The pressure loss shall be measured between a point 1 DN upstream and a point 1 DN downstream of the meter, on piping of the same DN as the meter.

Care shall be taken on selection and manufacturing of the pressure tappings to ensure that flow pattern distortions do not affect the pressure readings.