

Gas meters — Rotary displacement gas meters

The European Standard EN 12480:2002, with the incorporation of Amendment A1:2006, has the status of a British Standard

ICS 91.140.40

National foreword

This British Standard is the official English language version of EN 12480:2002, including amendment A1:2006. It partially supersedes BS 4161-6:1987 which will be withdrawn once BS EN 12261:2002 is published.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by **A1** **A1**.

The UK participation in its preparation was entrusted to Technical Committee GSE/25, Gas meters, which has the responsibility to:

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English version

Gas meters - Rotary displacement gas meters

Compteurs de gaz - Compteurs de gaz à déplacement
rotatifs

Gaszähler - Drehkolbengaszähler

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COMITÉ EUROPÉEN DE NORMALISATION
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Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

This European Standard 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of an identical text or by endorsement, at the latest by August 2002, and conflicting national standards shall be withdrawn at the latest by August 2002.

In the preparation of this European Standard, the content of OIML Publication, "International Recommendations 6" and "International Recommendations 32" and the content of member bodies national standards on rotary displacement gas meters have been taken into account.

Annexes A, B and C are normative.

This standard includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Foreword to amendment A1

This document (EN 12480:2002/A1:2006) has been prepared by Technical Committee CEN/TC 237 "Gas meters", the secretariat of which is held by BSI.

This Amendment to the European Standard EN 12480:2002 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2006, and conflicting national standards shall be withdrawn at the latest by November 2006.

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 2004/22, Measuring Instruments Directive (MID).

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

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

1 SCOPE

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.

This European Standard applies to rotary displacement gas meters used to measure the volume of 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 16 bar over a gas temperature range of at least – 10 °C to + 40 °C.

A1 This standard applies to meters that are installed in locations with vibration and shocks of low significance 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

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. **A1**

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*.

EN 50014, *Electrical apparatus for potentially explosive atmospheres - General requirements*.

EN 50020, *Electrical apparatus for potentially explosive atmospheres - 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 2768-1, *General tolerances – Part 1: Tolerances for linear and angular dimensions without individual tolerance indications.*

ISO 7005-1, *Metallic flanges - Part 1 : Steel flanges.*

ISO 7005-2, *Metallic flanges - Part 2 : 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

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 cycle of the element(s) displaces a fixed volume of gas which is cumulatively registered and indicated by an indicating device. $\boxed{A_1}$ It is designed to measure, memorize and display the volume of a fuel gas that has passed through it $\boxed{A_1}$

3.1.2

actual flowrate

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

$\boxed{A_1}$ 3.1.3

class 1,0 meter

meter which has an error of indication between -2% and $+2\%$ for flow rates Q where $Q_{\min} \leq Q < Q_t$, -1% and $+1\%$ for flow rates Q where $Q_t \leq Q \leq Q_{\max}$ and when the errors between Q_t and $Q_{\max}$ all have the same sign, they do all not exceed $0,5\%$ $\boxed{A_1}$

3.1.4

working pressure

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

3.1.5

maximum working pressure ($p_{\max}$)

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

3.1.6

metering pressure (p_m)

absolute pressure at which the volume of the gas is measured

3.1.7

pressure loss

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

3.1.8

metering conditions

conditions of the gas prevailing at the point of measurement

3.1.9**base conditions**

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

3.1.10**specified conditions**

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

3.1.11**normal conditions of use**

conditions referring to the meter operating :

- at an inlet pressure up to the maximum working pressure
- within the range of flow rates
- within the operational temperature and gas temperature range
- with the distributed gas

A1 3.1.12**operating temperature range A1**

range of temperatures for which the meter satisfies the requirements of this specification

3.1.13**storage temperature range**

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

A1 Text deleted A1**A1 3.1.14 A1****cyclic volume**

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

A1 3.1.15 A1**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 :

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

where

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

A1 3.1.16 A1**normal ambient conditions**

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

A1 3.1.17 **$Q_{\min}$**

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

3.1.18 **$Q_{\max}$**

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

3.1.19 **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

3.1.20 **Q_r**

overload flowrate, the highest flowrate at which the meter operates for a short period of time without deteriorating A1

3.2 Symbols

Table 1

	Represented quantity	SI Unit
DN	Diameter	dimensionless
p	Absolute pressure	Pa, bar
Q	Volume flowrate	m ³ /h
V	Volume	m ³
T	Temperature	°C
E	Error	%
ρ	Density of gas	kg·m ⁻³
U_B	Battery voltage	V
I	Current	A
	SUBSCRIPTS:	
m	Metering conditions of the gas	
b	Base conditions	
t	Transitional	
c	actual	
i	indicated	

4 WORKING RANGE

4.1 General

A1 Gas meters shall be classified according class 1,0. **A1** 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 Table 2, when the meter is tested with air of density approximately $1,2 \text{ kg}\cdot\text{m}^{-3}$.

4.2 Flowrate range

The declared values of the maximum flowrate and the corresponding minimum flowrate of rotary displacement gas meters are given in the Table 2.

In addition, decimal multiples and sub-multiples of the values given in the last five rows of Table 2 can be used.

A1 Table 2

$Q_{\max}$ (m^3/h)	Flowrate range							
	1:20	1:30	1:50	1:65	1:100	1:160	1:200	1:250
	$Q_{\min}$ (m^3/h)							
16	0,8	0,5	0,3	0,25	0,16	0,10	0,08	0,065
25	1,3	0,8	0,5	0,4	0,25	0,16	0,13	0,10
40	2	1,3	0,8	0,65	0,4	0,25	0,2	0,16
65	3,2	2	1,3	1	0,65	0,4	0,3	0,25
100	5	3,2	2	1,6	1	0,65	0,5	0,4
160	8	5	3,2	2,5	1,6	1	0,8	0,65
250	13	8	5	4	2,5	1,6	1,3	1
400	20	13	8	6,5	4	2,5	2,0	1,6
650	32	20	13	10	6,5	4	3,2	2,5
1 000	50	32	20	16	10	6,5	5	4
1 600	80	50	32	25	16	10	8	6,5
2 500	130	80	50	40	25	16	13	10
4 000	200	130	80	65	40	25	20	16
6 500	320	200	130	100	65	40	32	25

A1

4.3 Pressure range

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

4.4 Temperature range

[A1] All meters shall be capable of meeting the requirements for a minimum ambient temperature range of −10 °C to +40 °C and a minimum gas temperature range of 40 K and minimum storage temperature range of −20 °C to +60 °C (see 6.3.4). The gas temperature range shall be within the ambient temperature range.

The manufacturer shall declare the gas temperature range and the ambient temperature range.

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 and/or a wider storage temperature range. The meter shall be capable of meeting the requirements over this declared wider range. **[A1]**

5 METROLOGICAL PERFORMANCE

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 **[A1]**Table 3**[A1]**.

[A1] Table 3 **[A1]**

Flow rate <i>Q</i> m³/h	Maximum permissible errors
$Q_{min} \leq Q < Q_t$	± 2 %
$Q_t \leq Q \leq Q_{max}$	± 1 %

Transitional flowrate values, Q_t , are given in **[A1]**Table 4**[A1]**:

[A1] When the errors between Q_t and Q_{max} all have the same sign they shall not exceed 0,5 %. **[A1]**

Table 4

Flowrate range	Q_t
1:20	0,20 $Q_{\max}$
1:30	0,15 $Q_{\max}$
1:50	0,10 $Q_{\max}$
> 1:50	0,05 $Q_{\max}$

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 kg·m⁻³), or gas specified in the scope, at normal ambient conditions.

The meter is tested at the following flow rates (± 10 %):

a) type test:

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):

$Q_{\min}$; 0,25 $Q_{\max}$; $Q_{\max}$.

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

5.2 Pressure loss

5.2.1 Requirements

The maximum pressure loss at $Q_{\max}$, when using air with density $1,2 \text{ kg}\cdot\text{m}^{-3}$, 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 tapplings to ensure that flow pattern distortions do not affect the pressure readings.

5.3 Metrological repeatability

5.3.1 Requirements

In the flow rate range from Q_t to $Q_{\max}$ the variation of the error of indication of the meter at each flow rate shall stay within a span of 0,2 %.

5.3.2 Test

The error of indication of the meter is determined at two flow rates in the following order: Q_t , $Q_{\max}$, Q_t , $Q_{\max}$, Q_t , $Q_{\max}$, where the change from Q_t to $Q_{\max}$ is done via $1,10 Q_{\max}$, in order to approach $Q_{\max}$ from a higher flow rate.

At each flow rate the error is determined three times without changing the flow rate. The cycle is repeated three times. The test shall be carried out with air, or gas, at atmospheric conditions ($\pm 100 \text{ mbar}$).

Check that the nine resulting errors of indication at each flow rate are within a span of 0,2 %, excluding any interaction between the meter and the test bench.

6 DESIGN AND MANUFACTURING

6.1 General

The gas meter shall be constructed in such a way that any mechanical interference, capable of affecting the meter error of indication, results in permanently visible damage to the meter, or its sealing or protection marks.

 A sealing drawing is part of the documentation for type approval. It shall include the metrological sealing as well as the sealing of all metrological relevant removable accessories. 

6.2 Material

6.2.1 General

The meter body and the internal mechanism shall be manufactured of materials suitable for the service conditions, and resistant to attack from the fluids which may pass through the meter.

Exterior surfaces of the meter shall be protected, if necessary, against corrosion.

The meter body and all other parts shall be constructed of sound materials designed to handle the pressure and temperatures for which they are rated.

6.2.2 Resistance to external corrosion

All parts of the meter shall be able to resist any corrosive substances contained in the external atmosphere with which they may be in contact during normal conditions of use.

Where necessary, meters shall be provided with a suitable coating to protect against corrosion. Any such protective coating shall meet the requirements of 6.2.3 and 6.2.4.

6.2.3 Penetration resistance

6.2.3.1 Requirements

After the test described in 6.2.3.2, the base material shall not be exposed.

6.2.3.2 Test

The penetration resistance of the protective coating is assessed using the apparatus described in Figure 1, with a spring loading of 29,4 N.

NOTE The scratching element of the apparatus is a 1 mm steel ball that is mounted by soft soldering in a spring loaded housing. The crocodile clip is attached to the meter connection and the apparatus is drawn evenly over the surface under test at a speed of $30 \text{ mm}\cdot\text{s}^{-1}$ to $40 \text{ mm}\cdot\text{s}^{-1}$ keeping the apparatus upright and pressed to the surface throughout the movement.

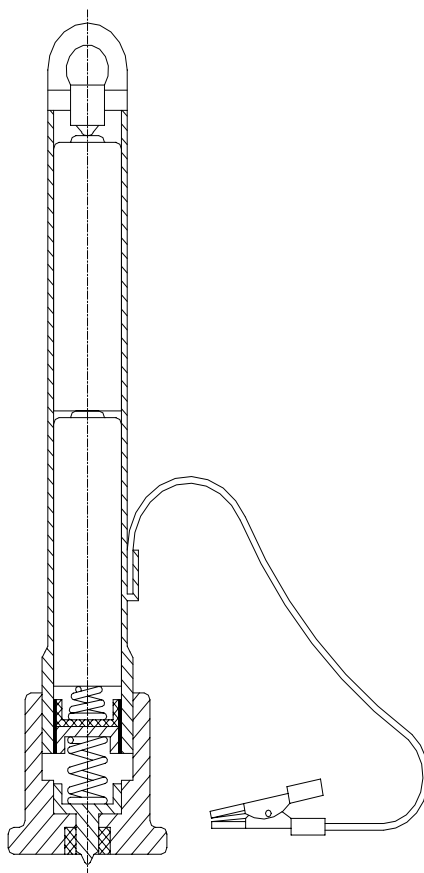


Figure 1 — Penetration resistance test apparatus