SLOVENSKI STANDARD
SIST EN 17526:2022

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Plinomeri - Plinomer na osnovi termičnega merjenja masnega toka

Gas meters - Thermal-mass flow-meter based gas meter

Gaszähler - Thermische Massendurchflussgaszähler

Compteurs de gaz - Compteur de gaz thermique de débit massique

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ICS:

91.140.40 Sistemi za oskrbo s plinom Gas supply systems

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English Version

Gas meter - Thermal-mass flow-meter based gas meter

Compteurs de gaz - Compteur de gaz basé sur un débitmètre massique par effet thermique

Gaszähler - Thermische Massendurchflussgaszähler

This European Standard was approved by CEN on 11 July 2021.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 17526:2021) 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of an identical text or by endorsement, at the latest by June 2022, and conflicting national standards shall be withdrawn at the latest by June 2022.

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 has been prepared under a Standardization Request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) / Regulation(s).

For relationship with EU Directive(s) / Regulation(s), see informative Annex ZA, which is an integral part of this document.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This document specifies requirements and tests for the construction, performance, safety and production of battery powered class 1,5 Capillary Thermal-Mass Flow sensor gas meters (hereinafter referred to as meter(s)). This applies to meters having co-axial single pipe, or two pipe connections, which are used to measure volumes of fuel gases of the 2nd and/or 3rd family, as given in EN 437:2018.

In general, the term “thermal mass flow meters” applies to a flow-measuring device using heat transfer to measure and indicate gas flowrate, as defined in ISO 14511.

NOTE 1 Although the word “mass” is present in the definition of the measurement principle, gas meters covered by this document provide measurement of gas at base conditions of temperature and pressure.

These meters have a maximum working pressure not exceeding 0,5 bar and a maximum flowrate not exceeding 160 m^3/h 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 °C.

This document applies to meters indicating volume at base conditions, which are installed in locations with vibration and shocks of low significance. It applies to meters in:

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

or, if specified by the manufacturer:

— open locations (outdoor without any covering) both with condensing humidity or with non-condensing humidity;

and in locations with electromagnetic disturbances likely to be found in residential, commercial and light industrial use.

For meters which indicate unconverted volume, reference can be made to Annex C.

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

Requirements for electronic indexes, valves and additional requirements for batteries incorporated in the meter and any other additional functionalities are given in EN 16314:2013.

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 13 are for design and type testing only.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 437:2018, *Test gases — Test pressures — Appliance categories*

EN 549:2019, *Rubber materials for seals and diaphragms for gas appliances and gas equipment*

EN 1092-1:2018, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

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

EN ISO 228-1:2003, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

EN ISO 1518-1:2019, *Paints and varnishes — Determination of scratch resistance — Part 1: Constant-loading method (ISO 1518-1:2019)*

EN ISO 2409:2020, *Paints and varnishes — Cross-cut test (ISO 2409:2020)*

EN ISO 2812-1:2017, *Paints and varnishes — Determination of resistance to liquids — Part 1: Immersion in liquids other than water (ISO 2812-1:2017)*

EN ISO 4628-2:2016, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 2: Assessment of degree of blistering (ISO 4628-2:2016)*

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 4892-3:2016, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps (ISO 4892-3:2016)*

EN ISO 6270-1:2018, *Paints and varnishes — Determination of resistance to humidity — Part 1: Condensation (single-sided exposure) (ISO 6270-1:2017)*

EN ISO 6272-1:2011, *Paints and varnishes — Rapid-deformation (impact resistance) tests — Part 1: Falling-weight test, large-area indenter (ISO 6272-1:2011)*

EN ISO 9227:2017, *Corrosion tests in artificial atmospheres — Salt spray tests (ISO 9227:2017)*

EN ISO/CIE 11664-4:2019, *Colorimetry — Part 4: CIE 1976 L*a*b* colour space (ISO/CIE 11664-4:2019)*

EN 50561-1:2013, *Power line communication apparatus used in low-voltage installations — Radio disturbance characteristics - Limits and methods of measurement — Part 1: Apparatus for in-home use*

EN 55032:2015, *Electromagnetic compatibility of multimedia equipment — Emission Requirements*

EN IEC 60079-0:2018[1)], *Explosive atmospheres — Part 0: Equipment — General requirements (IEC 60079-0:2017)*

EN 60079-10-1:2015, *Explosive atmospheres — Part 10-1: Classification of areas — Explosive gas atmospheres (IEC 60079-10-1:2015)*

EN 60079-11:2012, *Explosive atmospheres — Part 11: Equipment protection by intrinsic safety "i" (IEC 60079-11:2011)*

EN IEC 60079-15:2019, *Explosive atmospheres — Part 15: Equipment protection by type of protection "n" (IEC 60079-15:2017)*

1) As impacted by EN IEC 60079-0:2018/AC:2020-02.

EN 60529:1991[2)], *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

EN 60695-11-5:2017, *Fire hazard testing — Part 11-5: Test flames — Needle-flame test method - Apparatus, confirmatory test arrangement and guidance (IEC 60695-11-5:2016)*

EN 60695-11-10:2013[3)], *Fire hazard testing — Part 11-10: Test flames — 50 W horizontal and vertical flame test methods (IEC 60695-11-10:2013)*

EN 60730-1:2016[4)], *Automatic electrical controls — Part 1: General requirements (IEC 60730-1:2013 , modified + COR1:2014)*

EN 61000-4-2:2009, *Electromagnetic compatibility (EMC) — Part 4-2: Testing and measurement techniques — Electrostatic discharge immunity test (IEC 61000-4-2:2008)*

EN 61000-4-3:2006[5)], *Electromagnetic compatibility (EMC) — Part 4-3: Testing and measurement techniques — Radiated, radio-frequency, electromagnetic field immunity test (IEC 61000-4-3:2006)*

EN 61000-4-8:2010, *Electromagnetic compatibility (EMC) — Part 4-8: Testing and measurement techniques — Power frequency magnetic field immunity test (IEC 61000-4-8:2009)*

EN 61000-6-1:2007, *Electromagnetic compatibility (EMC) — Part 6-1: Generic standards — Immunity for residential, commercial and light-industrial environments (IEC 61000-6-1:2005)*

EN 61000-4-9:2016, *Electromagnetic compatibility (EMC) — Part 4-9: Testing and measurement techniques — Impulse magnetic field immunity test (IEC 61000-4-9:2016)*

EN IEC 61000-6-2:2019, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity standard for industrial environments*

EN 62056-21:2002, *Electricity metering — Data exchange for meter reading, tariff and load control — Part 21: Direct local data exchange (IEC 62056-21:2002)*

ISO 834-1:1999, *Fire resistance tests — Elements of building construction — Part 1: General requirements*

ISO 12213-2:2006, *Natural gas — Calculation of compression factor — Part 2: Calculation using molar-composition analysis*

ASTM D 1003-13, *Standard Test Method for Haze and Luminous Transmittance of transparent plastics*

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2) As impacted by EN 60529:1991/AC:2006-12, EN 60529:1991/A1:2000, EN 60529:1991/A2:2013 and EN 60529:1991/A2:2013/AC:2019-02.

3) As impacted by EN 60695-11-10:2013/AC:2014.

4) As impacted by EN 60730-1:2016/A1:2019.

5) As impacted by EN 61000-4-3:2006/A1:2008, EN 61000-4-3:2006/A2:2010 and EN 61000-4-3:2006/IS1:2009.

3 Terms, definitions and symbols

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1 Terms and definitions

3.1.1
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

3.1.2
additional functionality
functions over and above that within the meter, which can be integral to the meter, or included within a connected device

3.1.3
additional functionality device
device that carries out additional functionalities

3.1.4
base conditions
fixed conditions to which a volume of gas is converted (e.g. base gas temperature 273,15 K plus 15 K at base gas pressure of 1 013,25 mbar)

3.1.5
class 1,5 meter
accuracy achieved by a meter, which has an error of indication between −3 % and +3 % for flow rates Q, where $Q_{min} \leq Q < Q_t$, and an error of indication between −1,5 % and +1,5 % for flow rates Q, where $Q_t \leq Q \leq Q_{max}$, where Q_{max} to $Q_{min} > 150$ and Q_{max} to $Q_t \geq 10$ and Q_r to Q_{max} is 1,2

3.1.6
contaminants
gas borne dust, vapour and other substances that could affect the operation of the meter

3.1.7
display
device which shows information from the meter (e.g. liquid crystal that displays registers, volume or flags)

3.1.8
distributed gas
locally available gas

3.1.9
disturbance
influence quantity having a value within the limits specified but outside the specified rated operating conditions of the measuring instrument

Note 1 to entry: An influence quantity is a disturbance if the rated operating conditions for that influence quantity are not specified.

3.1.10
durability
ability of an instrument to maintain its performance characteristics over a specified period of use

3.1.11
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:

Note 1 to entry:

$$\varepsilon = 100\frac{V_i - V_c}{V_c}$$

where

V_i is the indicated volume;

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

3.1.12
event
condition requiring action or to log an action

3.1.13
external leak tightness
leak tightness of the gas carrying components of the gas meter with respect to the atmosphere

3.1.14
galvanic connection/interface
hard wired serial connection or pulse output from the meter

3.1.15
gas meter
instrument designed to measure, memorize and display the volume of fuel gas that has passed through it

3.1.16
gauge pressure
absolute pressure minus atmospheric pressure

3.1.17
index
current reading of the total volume passed through the meter

3.1.18
maximum operating pressure
maximum pressure at which a system can be operated continuously under normal conditions

Note 1 to entry: Normal conditions are no fault in any device or stream.

3.1.19
maximum error shift
maximum mean error shift at any of the tested flow rates

3.1.20
maximum flow rate
highest flow rate at which the gas meter provides indications that satisfy the requirements regarding maximum permissible error (MPE)

3.1.21
maximum permissible error
extreme value of measurement error, with respect to a known reference quantity value, permitted by specifications for a given measurement, measuring instrument, or measuring system

3.1.22
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 index or the data plate

3.1.23
mean error
arithmetic mean of consecutive errors of indication at a flow rate

3.1.24
memory
element which stores digital information

3.1.25
meter case
pressure containing structure of the meter

3.1.26
meter class
class to which a meter belongs, according to the metrological requirements of this document, i.e. class 1,5

3.1.27
meter error curve
plot of average error of indication against actual flow rate

3.1.28
minimum flow rate
lowest flowrate at which the gas meter provides indications that satisfy the requirements regarding MPE

3.1.29
normal conditions of use
conditions 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

3.1.30
pressure absorption
difference between the pressure measured at the inlet and outlet connections of the meter whilst the meter is operating

3.1.31
pressure measuring point
permanent fitting on the meter outlet enabling a direct measurement of the outlet pressure to be obtained

3.1.32
operating mode
method (sample frequency and timing) of obtaining volume flow measurements

3.1.33
optical port
serial data port using an infra-red transmitter and receiver

3.1.34
overload flow rate
highest flow rate at which the meter operates for a short period of time without deteriorating

3.1.35
reference conditions
condition of use prescribed for testing the performance of a measuring instrument or for inter-comparison of results of measurements

3.1.36
register
electronic device comprising both memory and display, which stores and displays information

3.1.37
sensor
element of a measuring instrument or measuring chain that is directly affected by the measurand

3.1.38
software identifier
sequence of characters, that identifies the software; the identifier is logically considered a part of the software

3.1.39
starting flow rate
lowest flow rate at which the meter is able to indicate a volume of gas passed

3.1.40
storage temperature range
range of temperatures at which the meter can be stored without being adversely affected

3.1.41
thermal mass flow-meter
TMF meter
flow-measuring device which uses heat transfer to measure and indicate mass flowrate

Note 1 to entry: The term thermal mass flowmeter also applies to the measuring portion of a thermal mass flow controller and not the control function.

[SOURCE: ISO 14511:2019, 3.2.3)

3.1.42
transitional flow rate
flow rate occurring between the maximum and minimum flow rates at which the flow rate range is divided into two zones, the upper zone and the lower zone, each zone having a characteristic MPE

3.1.43
volume
volume without specifying whether it is a corrected volume at measurement conditions or an uncorrected volume at measurement conditions

3.1.44
working pressure
difference between the pressure of the gas at the inlet of the meter and the atmospheric pressure

3.2 Symbols

D	outside diameter of the pipe in millimetres (mm)
g	acceleration due to gravity, in metres per square second ($m \cdot s^{-2}$)
H_i	lower calorific value
H_s	upper calorific value
MPE	maximum permissible error, in percent (%)
p_b	base pressure to which the indicated volume is referred
p_{max}	maximum operating pressure
Q_{max}	maximum flow rate
Q_{min}	minimum flow rate
Q_r	overload flow rate
Q_{start}	starting flow rate
Q_t	transitional flow rate
Q_x	distributed air or gas flow, referred to the base conditions of the meter, with x = min, max, t, r; as described below
t_b	base reference temperature to which the indicated volume is referred
t_g	gas temperature

t_m ambient temperature

t_{max} maximum operating temperature

t_{min} minimum operating temperature

t_{sp} specified centre temperature for a temperature converted meter

V_b volume read by the meter, at base conditions

W_i lower Wobbe index

W_s upper Wobbe index

ε error of indication

4 Working conditions

4.1 General

If no specific requirements are given, the test equipment shall be traceable to a national or international reference standard error of and the uncertainty shall be equal or better than:

a) for type evaluation: 1/5 of the maximum permissible error (*MPE*);

b) for verifications: 1/3 of the maximum permissible error (*MPE*).

4.2 Base conditions

Base conditions of temperature (t_b) and pressure (p_b) shall be specified by the manufacturer and marked on the data plate of the meter.

In particular, the following formula applies for the conversion of test volumes to the base conditions of the meter under test:

$$V_{t_b,p_b} = V_a \cdot \frac{t_b\,(°C) + 273{,}15}{t_a\,(°C) + 273{,}15} \cdot \frac{p_a\,(bar)}{p_b\,(bar)} \quad \text{where } p_a = p_{amb} + p_{gauge} \tag{1}$$

where

p_a is the absolute inlet pressure of the meter under test, i.e. the sum of two pressure contributes defined as follows:

p_{amb}: barometric pressure during test;

p_{gauge}: inlet gauge pressure of meter under test;

t_a is the steady temperature of the test volume;

V_a is the volume at actual condition.

4.3 Flow range

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