



NSAI
Standards

Irish Standard
I.S. EN 12405-1:2018

Gas meters - Conversion devices - Part 1: Volume conversion

I.S. EN 12405-1:2018

Incorporating amendments/corrigenda/National Annexes issued since publication:

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):

NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.

This document is based on:

EN 12405-1:2018

Published:

2018-10-10

This document was published under the authority of the NSAI and comes into effect on:

2018-10-29

ICS number:

91.140.40

NOTE: If blank see CEN/CENELEC cover page

NSAI
1 Swift Square,
Northwood, Santry
Dublin 9

T +353 1 807 3800
F +353 1 807 3838
E standards@nsai.ie
W NSAI.ie

Sales:
T +353 1 857 6730
F +353 1 857 6729
W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

National Foreword

I.S. EN 12405-1:2018 is the adopted Irish version of the European Document EN 12405-1:2018, Gas meters - Conversion devices - Part 1: Volume conversion

This document does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

For relationships with other publications refer to the NSAI web store.

Compliance with this document does not of itself confer immunity from legal obligations.

In line with international standards practice the decimal point is shown as a comma (,) throughout this document.

This page is intentionally left blank

EUROPEAN STANDARD

EN 12405-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2018

ICS 91.140.40

Supersedes EN 12405-1:2005+A2:2010

English Version

Gas meters - Conversion devices - Part 1: Volume conversion

Compteurs de gaz - Dispositifs de conversion - Partie 1:
Conversion de volume

Gaszähler - Umwerter - Teil 1: Volumenumwertung

This European Standard was approved by CEN on 2 June 2018.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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 United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents

	Page
European foreword.....	10
1 Scope.....	11
2 Normative references.....	11
3 Terms, definitions, symbols and classification.....	13
3.1 Terms and definitions.....	13
3.2 Symbols.....	17
3.3 Classification.....	18
3.3.1 Mechanical classes.....	18
3.3.2 Electromagnetic environmental classes.....	18
4 Principle of measurement.....	19
4.1 Conversion as a function of temperature.....	19
4.2 Conversion as a function of pressure and temperature.....	19
4.3 Conversion as a function of pressure, temperature and deviation from the ideal gas law.....	20
4.4 Correction of the volume at measurement conditions.....	20
5 Rated operating conditions.....	21
5.1 Specified field of measurement.....	21
5.1.1 General.....	21
5.1.2 Specified measurement range for gas pressure.....	21
5.1.3 Specified measurement range for gas temperature.....	21
5.1.4 Gas characteristics.....	21
5.1.5 Base conditions.....	21
5.2 Environmental conditions.....	21
5.2.1 Ambient temperature range.....	21
5.2.2 Humidity range.....	21
5.2.3 Mechanical environment.....	22
5.2.4 Electromagnetic environment.....	22
5.3 Power supply.....	22
6 Construction requirements.....	22
6.1 General.....	22
6.2 Casings.....	23
6.3 Indications.....	23
6.3.1 General.....	23
6.3.2 Electronic indicating device.....	25
6.4 Inputs for volume conversion.....	25
6.5 Battery powered conversion device.....	25
6.6 Security devices and alarms.....	26
7 Installation requirements.....	27
7.1 General.....	27
7.2 Temperature transducer.....	27
7.3 Pressure transducer.....	27
8 Performance.....	28
8.1 Reference conditions.....	28

8.2	Rated operating conditions.....	28
8.3	Maximum permissible errors	28
8.3.1	Conversion devices type 1	28
8.3.2	Conversion devices type 2	29
8.3.3	Error of conversion.....	29
8.3.4	Specific errors for a gas-volume conversion device, type 2	29
8.4	Conditions of matching the constituent elements of a conversion device type 2	30
8.5	Influence factors	30
8.6	Disturbances.....	31
8.7	Durability	31
8.8	Repeatability	31
8.9	Reliability	31
9	Tests of conformity	31
9.1	Verification of the construction requirements.....	31
9.2	Verification of the performance requirements	31
9.2.1	Test conditions	31
9.2.2	Samples of gas volume conversion device type 1 required for testing.....	32
9.2.3	Samples of gas volume conversion devices type 2 required for testing.....	35
9.3	Test report	36
10	Marking.....	36
11	Installation and operating instructions	37
Annex A (normative)	Type test.....	38
A.1	General conditions	38
A.1.1	General	38
A.1.2	Additional conditions specific to gas volume conversion devices type 1.....	38
A.1.3	Additional conditions specific to gas-volume conversion devices type 2.....	38
A.1.4	Test procedures	39
A.1.5	Verification of the construction requirements.....	40
A.2	Accuracy tests under reference conditions.....	40
A.2.1	Objective	40
A.2.2	Reference to documents.....	41
A.2.3	Procedure	41
A.2.4	Acceptance criteria	41
A.3	Effect of ambient temperature.....	41
A.3.1	Objective	41
A.3.2	Reference to documents.....	41
A.3.3	Procedure	41
A.3.4	Acceptance criteria	41
A.4	Effect of damp heat, steady-state test.....	41
A.4.1	Objective	41
A.4.2	Reference to documents.....	41
A.4.3	Procedure	42
A.4.4	Acceptance criteria	42
A.5	Effect of damp heat, cyclic test.....	42
A.5.1	Objective	42
A.5.2	Reference to documents.....	42
A.5.3	Procedure	42
A.5.4	Acceptance criteria	42
A.6	Electrical power variation	43
A.6.1	Objective	43
A.6.2	Reference to documents.....	43
A.6.3	Procedure	43

EN 12405-1:2018 (E)

A.6.4	Acceptance criteria.....	43
A.7	Short time power reductions	43
A.7.1	Objective.....	43
A.7.2	Reference to documents	43
A.7.3	Procedure.....	43
A.7.4	Acceptance criteria.....	44
A.8	Electrical bursts.....	44
A.8.1	Objective.....	44
A.8.2	Reference to documents	44
A.8.3	Procedure.....	44
A.8.4	Acceptance criteria.....	44
A.9	Electromagnetic susceptibility.....	44
A.9.1	Objective.....	44
A.9.2	Reference to documents	44
A.9.3	Procedure.....	44
A.9.4	Acceptance criteria.....	45
A.10	Electrostatic discharges.....	45
A.10.1	Objective.....	45
A.10.2	Reference to documents	45
A.10.3	Procedure.....	45
A.10.4	Acceptance criteria.....	45
A.11	Overload of pressure (only for type 1 and pressure transducers)	45
A.11.1	Objective.....	45
A.11.2	Reference to documents	45
A.11.3	Procedure.....	45
A.11.4	Acceptance criteria.....	46
A.12	Effect of vibrations.....	46
A.12.1	Objective.....	46
A.12.2	Reference to documents	46
A.12.3	Procedure.....	46
A.12.4	Acceptance criteria.....	46
A.13	Effect of shocks.....	46
A.13.1	Objective.....	46
A.13.2	Reference to documents	46
A.13.3	Procedure.....	46
A.13.4	Acceptance criteria.....	47
A.14	Overload of pressure (mechanical)	47
A.14.1	Objective.....	47
A.14.2	Reference to documents	47
A.14.3	Procedure.....	47
A.14.4	Acceptance criteria.....	47
A.15	Durability	47
A.15.1	Objective.....	47
A.15.2	Reference to documents	47
A.15.3	Procedure.....	48
A.15.4	Acceptance criteria.....	48
A.16	Alarms operation	48
A.16.1	Objective.....	48
A.16.2	Reference to documents	48
A.16.3	Procedure.....	48
A.16.4	Acceptance criteria.....	48
A.17	Repeatability.....	49
A.17.1	Objective.....	49
A.17.2	Reference to standards	49

A.17.3	Procedure	49
A.17.4	Acceptance criteria	49
A.18	Short time DC power variations	49
A.18.1	Objective	49
A.18.2	Reference to standards.....	49
A.18.3	Procedure	49
A.18.4	Acceptance criteria	49
A.19	Surges on supply lines and/or signal lines.....	50
A.19.1	Objective	50
A.19.2	Reference to standards.....	50
A.19.3	Procedure	50
A.19.4	Acceptance criteria	50
A.20	Power frequency magnetic field	50
A.20.1	Objective	50
A.20.2	Reference to standards.....	50
A.20.3	Procedure	50
A.20.4	Acceptance criteria	50
Annex B (normative)	Pressure transducers	51
B.1	Scope	51
B.2	Rated operating conditions.....	51
B.2.1	Specified measurement range for pressure.....	51
B.2.2	Environmental class	51
B.2.3	Power supply.....	51
B.3	Construction requirements.....	51
B.3.1	General	51
B.3.2	Casings.....	51
B.3.3	Indications	51
B.4	Performances.....	52
B.4.1	Reference conditions.....	52
B.4.2	Rated operating conditions.....	52
B.4.3	Maximum permissible errors	52
B.4.4	Influence factors	52
B.4.5	Disturbances.....	52
B.4.6	Durability	52
B.5	Tests of conformity	53
B.5.1	Test conditions	53
B.5.2	Tests	53
B.5.3	Sample of pressure transducers required for testing	53
B.6	Marking.....	53
Annex C (normative)	Platinum resistance thermometer sensors	54
C.1	Scope	54
C.2	Operating rated conditions.....	54
C.2.1	Specified measurement range for temperature.....	54
C.2.2	Environmental class	54
C.3	Construction requirements.....	54
C.4	Performances.....	54
C.5	Marking.....	55
C.5.1	Required markings	55
C.5.2	Verification mark.....	55
C.6	Metrological verifications.....	55
C.6.1	Type approval.....	55
C.6.2	Initial verification.....	56
C.7	Verification procedure	56

EN 12405-1:2018 (E)

C.7.1	Visual inspection	56
C.7.2	Type testing (type approval)	56
C.7.3	Samples of PRT required for testing	56
C.7.4	Initial verification	56
Annex D	(normative) Temperature transducers	58
D.1	Scope	58
D.2	Rated operating conditions	58
D.2.1	Specified measurement range for temperature	58
D.2.2	Environmental class.....	58
D.2.3	Power supply	58
D.3	Construction requirements	58
D.3.1	General.....	58
D.3.2	Casings	58
D.3.3	Indications.....	58
D.4	Performances	59
D.4.1	Reference conditions	59
D.4.2	Rated operating conditions	59
D.4.3	Maximum permissible errors	59
D.4.4	Influence factors.....	59
D.4.5	Disturbances.....	59
D.4.6	Durability	59
D.5	Tests of conformity.....	60
D.5.1	Test conditions.....	60
D.5.2	Tests.....	60
D.5.3	Sample of temperature transducers required for testing.....	60
D.6	Marking.....	60
Annex E	(informative) Model type test report for conversion devices.....	61
E.1	General.....	61
E.1.1	General remarks.....	61
E.1.2	Number of pages.....	61
E.1.3	Laboratory's identification.....	61
E.1.4	Applicant	61
E.1.5	Identification of device(s) submitted for testing.....	61
E.2	Accuracy tests under reference conditions	61
E.2.1	Ambient temperature during the test	61
E.2.2	Test equipment used.....	62
E.2.3	Test results	62
E.3	Ambient temperature.....	63
E.3.1	Effect of dry heat.....	63
E.3.2	Effect of cold	64
E.4	Effect of damp heat, steady-state test	65
E.4.1	Ambient temperature during the test	65
E.4.2	Test equipment used.....	65
E.4.3	Test results	66
E.5	Effect of damp heat, cyclic test.....	67
E.5.1	Ambient temperature during the test	67
E.5.2	Test equipment used.....	67
E.5.3	Test results	68
E.6	Electrical power variation	68
E.6.1	AC power supply.....	68
E.6.2	DC power supply or battery supply	70
E.7	Short time power reductions	71
E.7.1	Test equipment used.....	71

E.7.2	Test results.....	72
E.8	Electrical bursts	72
E.8.1	Test equipment used.....	72
E.8.2	Test results.....	72
E.9	Electromagnetic immunity.....	73
E.9.1	Test equipment used.....	73
E.9.2	Test results.....	74
E.10	Electrostatic discharges	74
E.10.1	Test equipment used.....	74
E.10.2	Test results.....	75
E.11	Effect of an overload of static pressure.....	75
E.11.1	Ambient temperature during the test.....	75
E.11.2	Test equipment used	75
E.11.3	Test results.....	76
E.12	Effect of vibrations	76
E.12.1	Ambient temperature during the test.....	76
E.12.2	Test equipment used	77
E.12.3	Test results.....	77
E.13	Effect of shocks	78
E.13.1	Ambient temperature during the test.....	78
E.13.2	Test equipment used	78
E.13.3	Test results.....	78
E.14	Mechanical resistance to overload of static pressure	78
E.14.1	Ambient temperature during the test.....	78
E.14.2	Test equipment used	78
E.14.3	Test results.....	79
E.15	Durability	79
E.15.1	Ambient temperature during the test.....	79
E.15.2	Test equipment used	79
E.15.3	Test equipment used	79
E.16	Alarms operation.....	82
E.16.1	Ambient temperature during the test.....	82
E.16.2	Test equipment used	82
E.16.3	Test results.....	82
E.17	Repeatability	82
E.18	Short time DC power variations	83
E.18.1	Test equipment used	83
E.18.2	Test results.....	83
E.19	Surges on supply lines and/or signal lines.....	83
E.19.1	Test equipment used	83
E.19.2	Test results.....	84
E.20	Power frequency magnetic field	84
E.20.1	Test equipment used	84
E.20.2	Test results.....	84
Annex F (informative)	Model type test report for associated transducers	86
F.1	General	86
F.1.1	General remarks	86
F.1.2	Number of pages	86
F.1.3	Laboratory's identification	86
F.1.4	Applicant.....	86
F.1.5	Identification of device(s) submitted for testing	86
F.2	Accuracy tests under reference conditions.....	86
F.2.1	Ambient temperature during the test.....	86
F.2.2	Test equipment used.....	87

EN 12405-1:2018 (E)

F.2.3	Test results	87
F.3	Ambient temperature.....	87
F.3.1	Effect of dry heat.....	87
F.3.2	Effect of cold	88
F.4	Effect of damp heat, steady-state test	89
F.4.1	Ambient temperature during the test	89
F.4.2	Test equipment used.....	89
F.4.3	Test results	89
F.5	Effect of damp heat, cyclic test.....	90
F.5.1	Ambient temperature during the test	90
F.5.2	Test equipment used.....	90
F.5.3	Test results	90
F.6	Electrical power variation	91
F.6.1	AC power supply.....	91
F.6.2	DC power supply or battery supply	92
F.7	Short time power reductions	92
F.7.1	Ambient temperature during the test	92
F.7.2	Test equipment used.....	93
F.7.3	Test results	93
F.8	Electrical bursts.....	93
F.8.1	Ambient temperature during the test	93
F.8.2	Test equipment used.....	93
F.8.3	Test results	93
F.9	Electromagnetic immunity	94
F.9.1	Ambient temperature during the test	94
F.9.2	Test equipment used.....	94
F.9.3	Test results	95
F.10	Electrostatic discharges.....	95
F.10.1	Ambient temperature during the test	95
F.10.2	Test equipment used.....	95
F.10.3	Test results	95
F.11	Effect of an overload of static pressure	96
F.11.1	General.....	96
F.11.2	Ambient temperature during the test	96
F.11.3	Test equipment used.....	96
F.11.4	Test results	96
F.12	Effect of vibrations.....	97
F.12.1	Ambient temperature during the test	97
F.12.2	Test equipment used.....	97
F.12.3	Test results	97
F.13	Effect of shocks.....	98
F.13.1	Ambient temperature during the test	98
F.13.2	Test equipment used.....	98
F.13.3	Test results	98
F.14	Mechanical resistance to overload of static pressure.....	98
F.14.1	General.....	98
F.14.2	Ambient temperature during the test	98
F.14.3	Test equipment used.....	98
F.14.4	Test results	99
F.15	Durability	99
F.15.1	Ambient temperature during the test	99
F.15.2	Test equipment used.....	99
F.15.3	Test results	99
F.16	Repeatability.....	100

Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2014/32/EU Measuring Instruments Directive	101
Bibliography	106

EN 12405-1:2018 (E)

European foreword

This document (EN 12405-1:2018) 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 April 2019, and conflicting national standards shall be withdrawn at the latest by April 2019.

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 12405-1:2005+A2:2010.

This document has been prepared under the mandate M/541 given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2014/32/EU Measuring Instruments Directive (MID).

For relationship with EU Directive 2014/32/EU, see informative Annex ZA, which is an integral part of this document.

EN 12405 consists of the following parts:

- Part 1: Volume conversion (this European Standard),
- Part 2: Energy conversion,
- Part 3: Flow computer.

In the preparation of this European Standard, the content of OIML Publication, “International Document 11”, and “International Recommendations 140” and the content of member bodies' national standards on gas-volume electronic conversion devices have been taken into account.

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 conformity of gas-volume electronic conversion devices associated to gas meters, used to measure volumes of fuel gases of the 1st and 2nd families according to EN 437.

This European Standard is intended for type testing, the detailed relevant provisions of which are given in Annex A.

Only three kinds of conversion are treated in this European Standard:

- conversion as a function of temperature only (called T conversion);
- conversion as a function of the pressure and of the temperature with constant compression factor (called PT conversion);
- conversion as a function of the pressure, the temperature and taking into account the compression factor (called PTZ conversion).

This document is not relevant to temperature conversion integrated into gas meters which only indicate the converted volume.

EN 12405-2 applies for energy conversion.

Gas-volume conversion devices consist of a calculator and a temperature transducer or a calculator, a temperature transducer and a pressure transducer locally installed.

For application of this European Standard, a conversion device may be, as a choice of the manufacturer, considered as a complete instrument (Type 1) or made of separate elements (Type 2), according to the definitions given in 3.1.18.1 and 3.1.18.2.

In this last case, the provisions concerning pressure transducers, temperature sensors and temperature transducers are given in Annexes B, C and D respectively.

Any conversion device can provide an error curve correction for a gas meter.

NOTE When rendering an account to an end user the readings from the conversion device can be used in conjunction with the readings from a gas meter conforming to EN 1359, EN 12480, or EN 12261, as appropriate, or to any other appropriate and relevant international or national standard for gas meters, without prejudice of national regulations.

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, *Test gases — Test pressures — Appliance categories*

EN 1776, *Gas infrastructure - Gas measuring systems - Functional requirements*

EN 55011, *Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement (CISPR 11)*

EN 60068-2-1, *Environmental testing - Part 2-1: Tests - Test A: Cold*

EN 60068-2-2, *Environmental testing - Part 2-2: Tests - Test B: Dry heat*

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

-
- [Looking for additional Standards? Visit Intertek Inform Infostore](#)
 - [Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation](#)
-