



SLOVENSKI STANDARD

SIST EN 12405-2:2013

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Plinomeri - Korektorji - 2. del: Energijska korekcija

Gas meters - Conversion devices - Part 2: Energy conversion

Gaszähler - Umwerter - Teil 2: Energieumwertung

Compteurs à gaz - Dispositifs de conversion - Partie 2 : Conversion en énergie

Ta slovenski standard je istoveten z: EN 12405-2:2012

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Gas meters - Conversion devices - Part 2: Energy conversion

Compteurs à gaz - Dispositifs de conversion - Partie 2 :
Conversion en énergie

Gaszähler - Umwerter - Teil 2: Energieumwertung

This European Standard was approved by CEN on 9 June 2012.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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EN 12405-2:2012 (E)**Foreword**

This document (EN 12405-2:2012) 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of an identical text or by endorsement, at the latest by January 2013, and conflicting national standards shall be withdrawn at the latest by January 2013.

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

EN 12405 consists of the following parts:

- Part 1: Volume conversion (and its amendments EN12405-1/A1 and EN 12405-1+A2 to allow the harmonisation of the standard with the Measuring Instruments Directive 2004/22/EC);
- Part 2: Energy conversion (this European Standard);
- Part 3: Flow computers used as gas meter conversion (in preparation).

In the preparation of this European Standard, the content of OIML Publication, “Recommendation 140 — measuring systems for gaseous fuel”, has 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This introduction presents important concepts used in this standard.

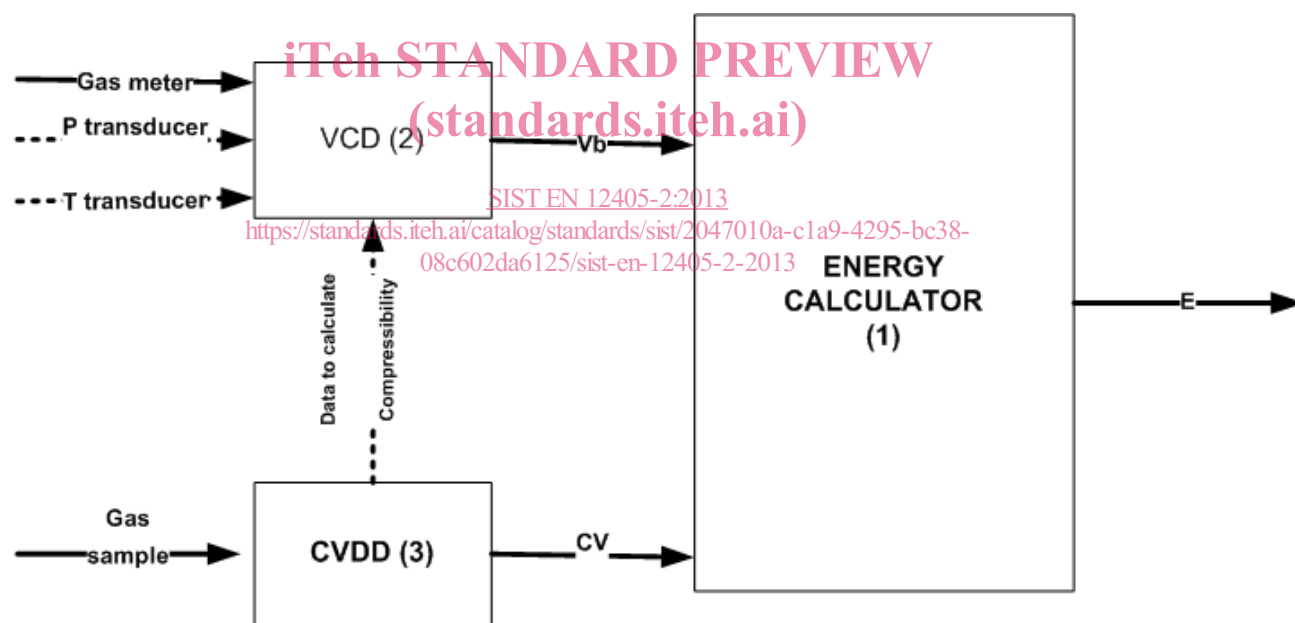
Energy conversion systems

As an energy conversion device (ECD) comprises a number of different components and functions, for the purpose of this Standard, two different systems are considered:

System 1, where

- the calorific value determination device (CVDD) is locally installed and is considered as being fully part of the ECD, and
- the energy calculator (EC) will have the ability to utilise a signal generated by this locally installed CVDD for determining energy.

Figure 1 shows the various components of ECD system 1.



- (1) Standardised in EN12405-2
 (2) Standardised in EN12405-1 or EN 12405-3 for class 0.5
 (3) Standardised in EN 12405-2

Dotted line = optional

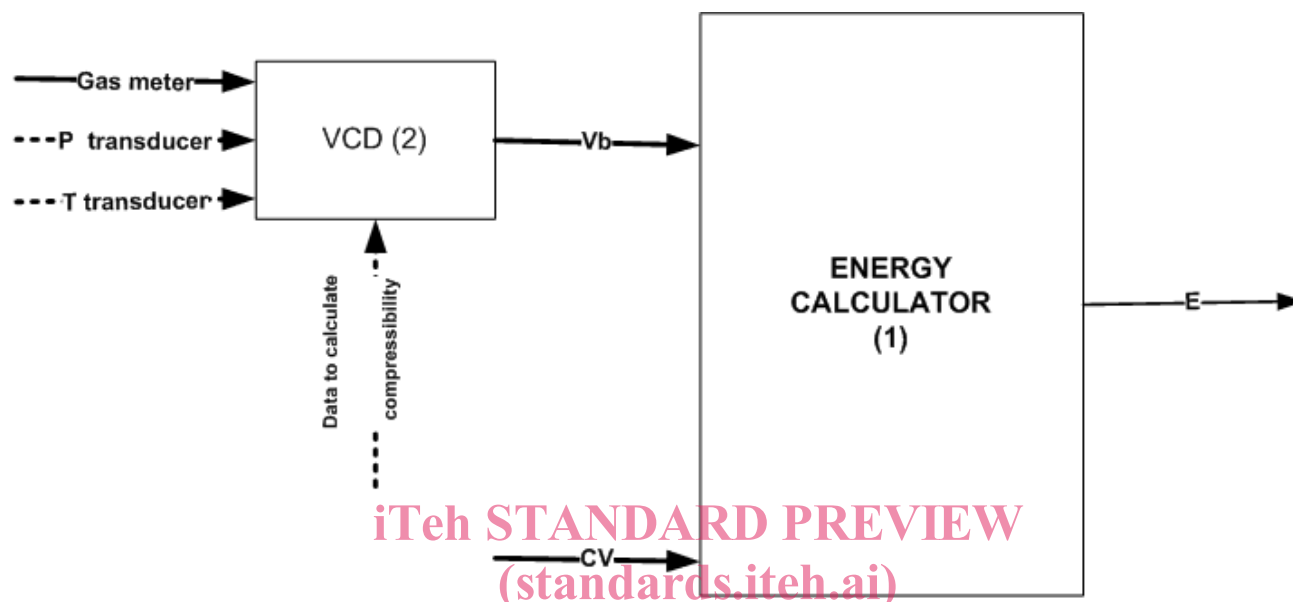
Figure 1 — Description of ECD system 1

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System 2, where

- the CVDD may not be locally installed and is considered as an external transducer of the system, and
- the calculator will have the ability to accept fixed or periodically updated signals for the calorific value for determining energy.

Figure 2 shows the various components of ECD system 2.



(1) Standardised in EN12405-2

(2) Standardised in EN12405-1 or EN 12405-3 (for class 0,5%)

Dotted line = optional

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Figure 2 — Description of ECD system 2

NOTE The various components of the ECD need to be supplied as a matched, ready-for-use, set of devices; this applies to System 1 and System 2, and mechanically integrated or separated devices (see modular and global approaches below).

Modular and global approaches

In the modular approach, the ECD is an assembly of separate associated measuring instruments (VCD and CVDD) and an energy calculator (EC), which are verified separately. Each instrument is verified according to its testing procedure, using the indication available on the energy calculator or on the associated measuring instrument itself. In this case, the indication shall correspond to the one which is directly processed in energy conversion. The verification of calculation consists in verifying the calculation concerning each characteristic quantity of the gas and/or the calculation for the energy conversion.

The associated measuring instruments are approved for a type or some types of conversion device(s) in order to ensure the compatibility of the association. If the associated measuring instruments deliver a digital signal, they may be considered as interchangeable, provided the type examination certificate provides all the necessary conditions of compatibility with the calculator of the conversion device.

In the global approach, the ECD is tested as a package, performing tests of the following functions: energy calculation, volume conversion and CV determination.

The testing procedures are given in Clause 9.

For the purpose of this standard, the following configurations of devices are accepted:

Table 1 — Description of systems 1 and 2

	Global approach	modular approach
System 1	VCD/CVDD/EC	VCD + CVDD/EC
		VCD/EC + CVDD
		VCD + EC + CVDD
System 2	VCD/EC (signal CV)	VCD + EC (signal CV)

Key: VCD: volume conversion device
 CVDD: calorific value determination device
 EC: energy calculator
 X/Y: devices X and Y mechanically integrated, able to perform their functions separately
 X+Y: devices X and Y exchanging signals between them, verified separately

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1 Scope

This European Standard specifies the requirements and tests for the construction, performance, safety and conformity of conversion devices used to determine the energy of fuel gases described in the Table 1, including those of the 1st and 2nd families according to EN 437.

The energy conversion device (ECD) considered in this standard consists of an energy calculator (EC) and is associated with the following devices and/or functions:

- a volume conversion device (VCD) or a flow computer used as gas meter conversion, either conforming to EN 12405-1:2005+A2:2010, or to prEN 12405-3, for high accuracy measurements;
- a calorific value determination device (CVDD).

Requirements for type approval tests of the devices, not included in the above-mentioned standards are described in appropriate annexes specified in Table 6.

For the purpose of this European Standard, the term “volume conversion devices” (VCDs) includes flow computers (FCs).

A single calculator may undertake the volume conversion functions for different metering lines.

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 437, *Test gases - Test pressures - Appliance categories*.

EN 12405-1:2005+A2:2010, *Gas meters — Conversion devices — Part 1: Volume conversion*

prEN 12405-3, *Gas meters — Conversion devices — Part 3: Flow computers*¹⁾

EN 55011, *Industrial, scientific and medical equipment — Radio-frequency disturbance characteristics — Limits and methods of measurement*

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*

EN 60068-2-30, *Environmental testing — Part 2-30: Tests — Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

EN 60068-2-31, *Environmental testing — Part 2-31: Tests — Test Ec: Rough handling shocks, primarily for equipment-type specimens*

EN 60068-2-47, *Environmental testing — Part 2-47: Tests — Mounting of specimens for vibration, impact and similar dynamic tests*

EN 60068-2-64, *Environmental testing — Part 2-64: Tests — Test Fh: Vibration, broadband random and guidance*

1) In preparation.

EN 60068-2-78, *Environmental testing — Part 2-78: Tests — Test Cab: Damp heat, steady state*

EN 60068-3-1, *Environmental testing — Part 3-1: Supporting documentation and guidance — Cold and dry heat tests*

EN 60068-3-4, *Environmental testing — Part 3-4: Supporting documentation and guidance — Damp heat tests*

EN 60068-3-8, *Environmental testing - Part 3-8: Supporting documentation and guidance – Selecting amongst vibration tests*

EN 60079 (all parts), *Explosive atmospheres*

EN 60529, *Degrees of protection provided by enclosures (IP Code)*

EN 60654-2, *Operating conditions for industrial-process measurement and control equipment — Part 2: Power*

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

EN 60950-1, *Information technology equipment - Safety - Part 1: General requirements*

IEC 61000-2-1, *Electromagnetic compatibility (EMC) Part 2: Environment Section 1: Description of the environment — electromagnetic environment for low-frequency conducted disturbances and signalling in public power supply systems*

EN 61000-2-2, *Electromagnetic compatibility (EMC) — Part 2-2: Environment — Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems*

EN 61000-4-1, *Electromagnetic compatibility (EMC) - Part 4-1: Testing and measurement techniques — Overview of IEC 61000-4 series*

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

EN 61000-4-3, *Electromagnetic compatibility (EMC) — Part 4-3: Testing and measurement techniques — Radiated, Radio frequency, electromagnetic field immunity test*

EN 61000-4-4, *Electromagnetic compatibility (EMC) — Part 4-4: Testing and measurement techniques — Electrical fast transient/burst immunity test*

EN 61000-4-5, *Electromagnetic compatibility (EMC) — Part 4-5: Testing and measurement techniques — Surge immunity test*

EN 61000-4-6, *Electromagnetic compatibility (EMC) — Part 4-6: Testing and measurement techniques — Immunity to conducted disturbances, induced by radio-frequency fields*

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

EN 61000-4-11, *Electromagnetic compatibility (EMC) — Part 4-11: Testing and measurement techniques — Voltage dips, short interruptions and voltage variations immunity tests*

EN 61000-4-29, *Electromagnetic compatibility (EMC) — Part 4-29: Testing and measurement techniques — Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests*

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

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

EN ISO 6974-1, *Determination of composition and associated uncertainty by gas chromatography — Part 1: General guidelines and calculation of composition (ISO 6974-1)*

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

EN ISO 12213-3, *Natural gas — Calculation of compression factor — Part 3: Calculation using physical properties (ISO 12213-3)*

EN ISO 13443: 2005, *Natural gas — Standard reference conditions (ISO 13443:1996 including Corrigendum 1:1997)*

ISO 6141, *Gas analysis — Requirements for certificates for calibration gases and gas mixtures*

ISO 6142, *Gas analysis — Preparation of calibration gas mixtures — Gravimetric method*

ISO 6143, *Gas analysis — Comparison methods for determining and checking the composition of calibration gas mixtures*

ISO 6976, *Natural gas — Calculation of calorific value, density, relative density and Wobbe index from composition*

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3 Terms, definitions and symbols

3.1 Terms and definitions

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

3.1.1

adjustment interval

time interval or number of measurements between two necessary adjustments of a calorific value determining device

3.1.2

associated measuring instruments

instruments for measuring certain quantities which are characteristic of the gas (temperature, pressure, calorific value etc.), whose indications are used by the calculator with a view to making a correction and/or a conversion

Note 1 to entry: For the purpose of this standard, when dealing with the ECD in modular approach, the VCD and CVDD are considered as associated measuring instruments.

3.1.3

base conditions

fixed conditions used to express the volume of gas independently of the metering conditions and the superior calorific value

Note 1 to entry: The pressure base for both volumetric metering and combustion is always 101,325 kPa. The temperature needs to be specified

EXAMPLE Temperature of 273,15 K and absolute pressure of 1,013 25 bar or temperature of 288,15 K and absolute pressure of 1,013 25 bar.

3.1.4**calorific value determining device****CVDD**

associated measuring instrument for determining the calorific value of gas

3.1.5**compression factor**

parameter which indicates the deviation from the ideal gas

Note 1 to entry: The compression factor calculation needs to be carried out according to ISO 12213 part 2 or 3.

3.1.6**display**

element or assembly of elements of the indicating device on which the results of measurement and memorised values are displayed

3.1.7**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.

3.1.8**energy conversion device****ECD**

device which calculates, integrates and displays energy using volume at base conditions and the calorific value or the gas composition

3.1.9**global approach**

approach through which the performances of the energy conversion device (ECD) are verified and approved with a completely integrated package, including the energy calculation, the associated measuring instruments and other functions

3.1.10**influence factor**

influence quantity having a value within the specified rated operating conditions of the measuring instrument

3.1.11**influence quantity**

quantity that is not a measurand but that affects the result of the measurement

EXAMPLE Ambient temperature.

3.1.12**maximum permissible error**

extreme value of the **measurement error**, with respect to a known **reference quantity value**, permitted by specifications or regulations for a given **measurement, measuring instrument or measuring system**

Note 1 to entry: Generally, the two extreme values are taken together and are termed "maximum permissible errors" or "limit of error".

3.1.13**measurand**

particular quantity subject to measurement

EN 12405-2:2012 (E)**3.1.14****measurement repeatability****repeatability**

measurement precision under a set of repeatable conditions of measurement

3.1.15**metering conditions**

conditions of the gas at which the volume is measured at the point of measurement

Note 1 to entry: Metering conditions include the temperature and pressure of the measured gas.

3.1.16**modular approach**

approach combining associated measuring instruments (VCD and CVDD) and an energy calculator (EC) of the energy conversion device (ECD) which are verified and approved separately and conditions for the matching of the associated measurement instruments which are verified appropriately

3.1.17**precision**

closeness of agreement between indication obtained by replicate measurements on the same or similar objects under specified conditions

3.1.18**rated operating conditions**

values for the measurement and influence quantities making up the normal working conditions of an instrument

3.1.19**reference conditions**

set of reference values or reference ranges of influence factors prescribed for testing the performances of a measuring system or a device or for inter comparisons of the results of measurements

3.1.20**repeatability condition of measurement****repeatability condition**

condition of measurement in a set of conditions that includes the same measurement procedure, same operators, same measuring system, same operating conditions and same location, and replicated measurement on the same or similar objects over a short period of time

3.1.21**repeatability error**

difference between the largest and the smallest results of successive measurements of the same quantity carried out under the same conditions

3.1.22**representative calorific value**

individual calorific value or a combination of calorific values that is considered to be, according to the constitution of the measuring system, the most appropriate calorific value to be associated with the metered quantity in order to calculate the energy

3.1.23**secured communication**

communication, physical or non-physical, between elements of a measuring system ensuring that information transferred from one of these elements to an other one may not be tampered with by the user, by external influences or by fault of the system

Note 1 to entry: Secured communication is ensured by providing sealing devices and/or checking facilities.

Note 2 to entry: WELMEC Guide 7.2 provides guidance with application of MID for software-equipped measuring instruments [7].

3.1.24

signal

message made up of data or information, which can take many forms broadly classed as analogue or digital, that enables the data or information to be conveyed from one apparatus to another

Note 1 to entry: Examples of signals are shown in Table 2.

Table 2 — Electronic interface descriptions

Measurand representation as:	Example	Transmission between devices	Conversion
Proportional quantity, analogue signals Analogue value	Voltage Current Frequency	Analogue	Analogue-to-digital conversion
Proportional quantity, digital signals Pulses	NAMUR-Sensor Reed-Contact	Digital	Counting
Coded (Binary) Data protocol	HART Protocol Modbus - Protocol	Coded (e.g. digital)	Decoding

3.1.25

superior calorific value

gross calorific value

the amount of heat which would be released by the complete combustion in air of a specified quantity of gas, in such a way that the pressure at which the reaction takes place remains constant, and all the products of combustion are returned to the same specified temperature as that of the reactants, all of these products being in the gaseous state except for water formed by combustion, which is condensed to the liquid state at this specified temperature

Note 1 to entry: In the following parts of this standard, the term calorific value (CV) is used to mean superior calorific value. The symbol H_s is used for the formulae.

3.1.26

System 1

energy conversion device (ECD) with calorific value determination device (CVDD) locally installed and considered as being fully part of the ECD

3.1.27

System 2

energy conversion device (ECD) not included in calorific value determination device (CVDD) where the energy calculation uses ECV fixed or periodically updated with signals representative of the calorific value