SLOVENSKI STANDARD

SIST EN 14459:2008

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Krmilne in nadzorne funkcije v elektronskih sistemih za plinske gorilnike in plinske aparate - Metode za klasifikacijo in ocenjevanje

Control functions in electronic systems for gas burners and gas burning appliances - Methods for classification and assessment

Regel- und Steuerfunktionen in elektronischen Systemen für Gasbrenner und Gasgeräte - Verfahren für die Klassifizierung und Bewertung

Fonctions de commande des systemes électroniques pour les bruleurs a gaz et les appareils a gaz - Méthode de classification et d'évaluation

Ta slovenski standard je istoveten z: **EN 14459:2007**

ICS:

91.140.40	Sistemi za oskrbo s plinom	Gas supply systems
97.100.20	Plinski grelniki	Gas heaters

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Control functions in electronic systems for gas burners and gas burning appliances - Methods for classification and assessment

Fonctions de commande des systèmes électroniques pour les brûleurs à gaz et les appareils à gaz - Méthode de classification et d'évaluation

Regel- und Steuerfunktionen in elektronischen Systemen für Gasbrenner und Gasgeräte - Verfahren für die Klassifizierung und Bewertung

This European Standard was approved by CEN on 26 March 2007.

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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 Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Contents

Foreword

This document (EN 14459:2007) has been prepared by Technical Committee CEN/TC 58 "Safety and control devices for gas-burners and gas-burning appliances", 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of an identical text or by endorsement, at the latest by May 2008, and conflicting national standards shall be withdrawn at the latest by May 2008.

This document supersedes ENV 14459:2002.

Changes to ENV 14459:2002 are:

— General requirements have been transferred into EN 13611.

— Addition of specific requirements for electronic temperature-control-functions and gas shut off functions.

Control systems are designed to control and protect gas appliances and combustion process. All functions are performed depending on their safety relevance within a specific tolerance of measures and time and with a specific certainty under external influences and internal failures.

Existing control standards are based on fault recognition up to two faults deep. It was concluded in controls committees that it is not always necessary to protect against the consequences of any hazardous event with uniform measures, as hazards differ in severity and the probability of unwanted occurrences may differ. As there exists large interpretational differences on what level of protection is necessary against certain hazards, there is a need for guidance to bring the safety philosophy for gas appliances and controls in line. The discussions of different committees regarding safety related control functions and the application of controls in the appliances illustrate that it is worthwhile to refine the basic safety philosophy of gas appliances into different risk levels.

To evaluate preventative measures concerning fault tolerance and avoid hazards it is essential to classify control functions with regard to their fault behaviour. To classify control functions, their integration into the complete safety concept of the appliance should be accounted for.

For electronic controls covered by CEN/TC 58 a consensus was reached by assuming two faults, including hardware and software, that should result in a safe situation. Class C software is regarded as equivalent to this two fault assessment.

In the appliance standards, only specific fault conditions are considered when controls complying with CEN/TC 58 standards are used, e.g. flame simulation and air proving before each new start. In some cases (e.g. switch contacts) shorting is excluded when certain tests have proven that the probability for fault occurrence is low. For gas valves it is considered that a single valve is not sufficient.

Regarding protection against overheating of gas appliances reference is made to EN 60730-2-9. For electronic temperature controls, the safety philosophy is not on the same level as for controls covered by CEN/TC 58 (see e. g. EN 483:1999, 5.6.7.6 where only fault conditions of the sensor are considered, however, other hardware or software faults are not considered). Actually the proper safety level for the control is not specified by appliance committees.

This Standard gives the manufacturer and the test authority methods for assessing products in the field of gas controls for which no specific product standards are actually available.

The assessment is focused on the controlled parameters (high/low temperature, pressure, flow) in the combustion process and in the functionality of the controls (open/closed; lock/unlock; start/stop). Each control function needs to be classified according to the required safety aspects (class A, class B and class C).

To analyse the effect of fault conditions it is essential to know the specific application and the related risk.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, 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.

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1 Scope

This European Standard specifies methods for classification and assessment of function blocks designed to operate gas burners and gas burning appliances, particularly regarding their fault behaviour and preventative measures.

This European Standard is applicable to control function blocks that are not covered by a dedicated control standard as specified in Annex F.

This European Standard is intended for type testing.

2 Normative references

The following referenced documents are indispensable for the application 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 126, *Multifunctional controls for gas burning appliances*

EN 161:2007, *Automatic shut-off valves for gas burners and gas appliances*

EN 297:1994, *Gas-fired central heating boilers - Type B11 and B11BS boilers fitted with atmospheric burners of nominal heat input not exceeding 70 kW*

EN 298, *Automatic gas burner control systems for gas burners and gas burning appliances with or without fans*

EN 13611:2007, *Safety and control devices for gas burners and gas-burning appliances — General requirements*

EN 50159-2:2001, *Railway applications — Communication, signalling and processing systems —Part 2: Safety-related communication in open transmission systems*

EN 60730-1:2000, *Automatic electrical controls for household and similar use — Part 1: General requirements (IEC 60730-1:1999, modified)*

EN 60730-2-9, *Automatic electrical controls for household and similar use — Part 2-9: Particular requirements for temperature sensing controls (IEC 60730-2-9:2000, modified)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13611:2007 and the following apply.

3.1
function block
part of an electric or electronic system that realises at least one control function with one input and one output signal

3.2
combustion products discharge function
TTB
control function that initiates (at least) shut down of the main burner when there is an unacceptable spillage of combustion products at the draught diverter

[EN 297:1994, 1.3.3.2.4]

3.3
reset function
function that provides reset from lock-out allowing the system to attempt a restart

NOTE   The reset function may be performed by various electric/electronic (mobile) devices.

3.4
reasonably foreseeable misuse
use of a product, process or service in a way not intended by the supplier, but which may result from readily predictable human behaviour

[ISO/IEC Guide 51:1999, 3.14]

3.5
functional safety
freedom from unacceptable risk of harm due to the equipment or system malfunction that results from reasonably foreseeable misuse

3.6
safety integrity
probability that electric or electronic equipment will perform satisfactorily regarding the safety functions under all the stated conditions within a stated period of time

[IEC 61508-4:1998]

3.7
gas shut-off function
function which switches the gas flow off

NOTE   The assembly to provide this function may consist of a combination of the following parts: closure members, actuators, sensors and the control electronics.

3.8
automatic shut-off valve
valve which opens when energized and closes automatically when de-energized

[EN 161: 2007, 3.1]

3.9
shut-off valve
valve that opens and closes the gas flow but does not fulfil all requirements of EN 161

3.10
stored closing energy
SCE
energy available (even after interruption of the power supply) to move the closure member into the closed position and keep it closed

3.11
non-permanent operation
operation in the running position for less than 24 h

4   Classification

EN 13611:2007, Clause 4 shall apply.

In addition, the class of the control function shall be identified by manufacturer's declaration.

5   Units of measurement and test conditions

EN 13611:2007, Clause 5 shall apply.

6 Construction requirements

6.1 General

EN 13611:2007, 6.1 shall apply.

6.2 Mechanical parts of the control

EN 13611:2007, 6.2 shall apply.

6.3 Materials

EN 13611:2007, 6.3 shall apply.

6.4 Gas connections

EN 13611:2007, 6.4 shall apply.

6.5 Electronic parts of the control

EN 13611:2007, 6.5 shall apply.

6.6 Protection against internal faults for the purpose of functional safety

6.6.1 Design and construction requirements

EN 13611:2007, 6.6.1 shall apply.

6.6.2 Class A

EN 13611:2007, 6.6.2 shall apply.

6.6.3 Class B

EN 13611:2007, 6.6.3 shall apply.

6.6.4 Class C

EN 13611:2007, 6.6.4 shall apply.

6.6.5 Circuit and construction evaluation

EN 13611:2007, 6.6.5 shall apply.

6.6.6 Assessment for control functions in gas appliances

6.6.6.1 General

Potential hazards arising from the use of gas appliances are among others covered by means of control functions.

Examples are:

— hazard of fire caused by overheating, prevented by the temperature control function;

— hazard imposed by the discharge of unburned gas, prevented by the gas shut-off function.

Safety classes for control functions required by the relevant appliance standards are the basis for assessing electronic control functions.

At the classification of control functions, their integration into the complete safety concept of the appliance shall be taken into account.

6.6.6.2 Fault tolerating time

Fault tolerating time is determined by the ability of the appliance to tolerate a fault for a certain time.

In this standard, the fault tolerating time determines the fault reaction time of the Control Function, which shall be equal or less than the fault tolerating time.

For new Control Functions, of which the fault tolerating time is not yet described, the fault tolerating time shall be declared by the manufacturer based on a clear description of an assessment of the appliance, with choices that have been made to come to the declared fault tolerating time.

NOTE   The relevant appliance standard should describe the fault tolerating time.

6.6.6.3 Fault modes

Fault modes on the appliance level shall be considered for assessing a certain control function.

If not defined by the appliance standard, fault modes that are specific for the appliance with relation to the control function, shall be declared by the manufacturer, based on a clear description.

7 Performance

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7.1 General

EN 13611:2007, 7.1 shall apply.

7.2 Leak-tightness

EN 13611:2007, 7.2 shall apply.

7.3 Test for leak-tightness

EN 13611:2007, 7.3 shall apply.

7.4 Torsion and bending

EN 13611:2007, 7.4 shall apply.

7.5 Torsion and bending test

EN 13611:2007, 7.5 shall apply.

7.6 Rated flow rate

EN 13611:2007, 7.6 shall apply.

7.7 Test for rated flow rate

EN 13611:2007, 7.7 shall apply.

7.8 Durability

EN 13611:2007, 7.8 shall apply.

7.9   Performance test for electronic controls

EN 13611:2007, 7.9 shall apply.

7.10   Long-term performance for electronic controls

EN 13611:2007, 7.10 shall apply.

7.11   Combined apparatus

If a system consists of two or more combined apparatus with different control functions, the interconnection and interference of the involved apparatus shall be considered during fault assessment.

Safety of a control function shall not be impaired when it is integrated into a gas appliance or gas system.

Responsibilities and safety critical interface parameters shall be declared to incorporate control in an overall system.

7.12   Multifunctional systems

If a control system consists of one apparatus and provides two or more different control functions, the system shall provide the same overall safety level as the independent control functions provide for the complete application.

Any interference between individual control functions shall be assessed with respect to both the functional condition and any fault conditions.

Failures in any function shall not affect safe operation of the control function. Each individual function shall be assessed in accordance with the requirements of this Standard.

With regard to a specific component or a group of components, use or application of a multifunctional system shall be classified as one of the following.

a)   no additional loading on a multifunctional component (for example a sensing element, the signal of which is multiply analysed):

   no additional requirement;

b)   higher load is to be expected (e. g. on relays):

   components shall withstand and are to be properly specified for this higher load;

c)   monitoring or controlling elements associated with two or more function blocks:

   each control function shall be able to detect any failure of such elements and process them in a safe way according to their fault behaviour class.

Control functions, integrated into a multifunctional system, shall be able to withstand the same long-term performance requirements as required for independent controls.

7.13   Data exchange

7.13.1   General

Systems or apparatus with control functions may be connected to separate, independent apparatus or systems (which may themselves contain control functions or provide other information). Any data exchange between these systems or apparatus shall be taken into consideration regarding safety.

7.13.2 Type of data

Regarding safety relevance and influence, message types for data exchange in a control function or functions shall be defined according to Table 1 as:

—   safety related;

—   non-safety related.

NOTE   Data exchange may be the transfer of single signals as well as complex information (see Table 1).

Table 1 — Data exchange

Data	Safety related (not exhaustive list)	Non-safety related (not exhaustive list)
Operating data	Messages such as "RESET from LOCKOUT"	Messages such as on/off instructions, room temperature information
Configuration parameters	Messages modifying parameters that determine safety related functions	Messages modifying parameters that determine performance related functions
Software modules	Modules downloaded into a system, that determine safety related functions	Modules downloaded into a system, that determine performance related functions

7.13.3 Communication of safety related data

7.13.3.1   Transmission

Safety related data shall be transmitted authentically concerning:

—   quantity of data (i.e. all data expected to and from respective addresses);

—   quality of data (i.e. in a correct and precise manner);

—   appropriate transmission time.

Data variation or corrupted data shall not lead to an unsafe state. This shall be illustrated by assessment according to EN 60730-1:2000, Annex H.

In addition to the EN 60730-1 requirements, the following failure modes shall be met:

–   permanent "auto-sending" or repetition;

–   interruption of data transfer.

Acceptable measures are specified in EN 60730-1:2000, Annex H.

Further examples of measures are given in Table 2.

NOTE   Special attention is drawn to EN 60730-1:2000, Table H.11.12.7, Clause 6, which mentions data deformation, address deformation or wrong timing or sequences, that can be detailed further, as follows:

—   data deletion from the original message;

—   data insertion into the original message;

—   corruption of the data in the original message;

—   change in sequence of data in the original message;

— make a non-authentic message look like an authentic message;

— incomplete address;

— corruption of the address of the original message;

— wrong address;

— more addresses;

— receive message more than once;

— delay in transmitting or receiving the message;

— wrong sequence of sending/receiving.

7.13.3.2 Access to data exchange

All types of access to a safety related data exchange system shall be clearly restricted.

Safety related operating data, configuration parameters and/or software modules may be transmitted to control functions via communication, providing adequate hardware/software measures are taken to ensure that no unwanted access to the control function is possible.

Adequate measures against unauthorised access can be passwords or cryptographic techniques, as further detailed in Table 2.

Table 2 — Examples of defences against unauthorized access

Threats	Defences							
	Sequence number	Time stamp	Time-out	Feed-back message	Source and destination identifier	Identification procedure	Safety code	Crypto-graphic techniques
Repetition of a message	x	x						
Deletion of data in a message	x							
Insertion of data in a message	x			x	x	x		
changed sequence of data in a message	x	x						
Corrupted data in message							x	x
Delay in sending / receiving the message		x	x					
Masquerade, making an inauthentic message look like an authentic message				x		x		x
For further details see EN 50159-2.								
NOTE This table has been taken from EN 50159-2:2001.								

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7.14 Specific requirements for other control functions

See Annex I, Combustion products discharge function (TTB)

See Annex J, Reset Functions

See Annex K, Temperature Control Functions (TCF)

See Annex L, Gas shut-off Functions

NOTE   These annexes show the implementation of risk assessment on new functions and/or technologies. Instead of introducing these functions in specific product standards, it was decided to include them in an annex. In time, when there is a better idea of where to implement these functions, they will be moved into specific product standards or stay in this standard.