



BSI Standards Publication

Safety and control devices for burners and appliances burning gaseous or liquid fuels — Control functions in electronic systems

Part 2: Fuel/air ratio control/supervision of the electronic type

National foreword

This British Standard is the UK implementation of EN 12067-2:2022. It supersedes BS EN 12067-2:2004, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GSE/22, Safety and control devices for gas and oil burners and gas burning appliances.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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burning gaseous or liquid fuels - Control functions in
electronic systems - Part 2: Fuel/air ratio
control/supervision of the electronic type

Dispositifs de commande et de sécurité pour les
brûleurs et les appareils utilisant des combustibles
gazeux ou liquides - Dispositifs électroniques de
régulation - Partie 2 : Régulation et surveillance du
rapport air/combustible de type électronique

Sicherheits- und Regeleinrichtungen für Brenner und
Brennstoffgeräte für gasförmige oder flüssige
Brennstoffe - Regel- und Steuerfunktionen in
elektronischen Systemen - Teil 2: Elektronische Gas-
Luft-Verbundregel- und Überwachungseinrichtungen

This European Standard was approved by CEN on 2 October 2022.

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

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European foreword

This document (EN 12067-2:2022) has been prepared by Technical Committee CEN/TC 58 “Safety and control devices for burners and appliances burning gaseous or liquid fuels”, 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of an identical text or by endorsement, at the latest by May 2023, and conflicting national standards shall be withdrawn at the latest by November 2025.

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 12067-2:2004.

The following significant changes compared to the previous edition have been incorporated in this document:

- a) alignment with EN 13611:2019;
- b) title change to include liquid fuel and to bring it in line with the title of EN 13611:2019;
- c) integration of the requirements for fuel/air ratio using oil as the fuel;
- d) addition of the control types ERS and ERT;
- e) update to EN 60730-1:2016;
- f) update of requirements for fault reaction time and fault tolerating time;
- g) update of the Annexes for sensors and actuators (see Annex AA);
- h) inclusion of the use of pressure and combustion products sensing devices already conforming to EN 1854:—¹, EN 60730-2-6:2016, and EN 16340:2014 respectively;
- i) new Annex Guideline for the integration of ERC, ERS or ERT into the appliances (see Annex DD);
- j) new Annex Guideline for the definition of limits for safe operation on the appliance (see Annex EE);
- k) new Annex Requirements for using alternative actuators on application level (see Annex FF).

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, Türkiye and the United Kingdom.

Introduction

This document is intended to be used in conjunction with EN 13611:2019.

This document refers to clauses of EN 13611:2019 or adapts clauses by stating “with the following modification”, “with the following addition”, “is replaced by the following” or “is not applicable” in the corresponding clause.

This document adds clauses or subclauses to the structure of EN 13611:2019 which are particular to this document. Subclauses which are additional to those in EN 13611:2019 are numbered starting from 101. Additional Annexes are designated as Annex AA, Annex BB, Annex CC, etc. It should be noted that these clauses, subclauses and Annexes are not indicated as an addition.

If by reference to EN 13611:2019 the term “control” is given, this term should be read as fuel/air ratio control/supervision system”.

EN 12067-2 compliance for electronic fuel/air ratio control/supervision system cannot be claimed based upon SIL classification according to EN 61508.

SIL classification cannot be claimed based upon compliance with this document only. A supplementary method for SIL determination is specified in EN 13611:2019, Annex J.

1 Scope

EN 13611:2019, Clause 1 is replaced by the following:

This document specifies the safety, design, construction and performance requirements, and testing for electronic fuel/air ratio control systems (ERC), electronic fuel/air ratio supervision systems (ERS) and electronic fuel/air ratio trim systems (ERT) intended for use with burners and appliances burning gaseous or liquid fuels. It also describes the procedures for evaluating these requirements and specifies information necessary for installation and use.

This document is applicable to:

- closed loop fuel/air ratio control systems, see 3.101;
- fuel/air ratio supervision systems, see 3.102;
- closed loop fuel/air ratio trim systems, see 3.103;

and does not differentiate into classification by heat input.

NOTE The documents for burners, appliances or processes which use ERC, ERS or ERT can override the requirements of this document.

2 Normative references

EN 13611:2019, Clause 2 applies with the following additions:

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 298:2022, *Automatic burner control systems for burners and appliances burning gaseous or liquid fuels*

EN 267:2020, *Forced draught burners for liquid fuels*

EN 676:2020, *Forced draught burners for gaseous fuels*

EN 1854:—¹, *Safety and control devices for burners and appliances burning gaseous and/or liquid fuels — Pressure sensing devices for gas burners and gas burning appliances*

EN 13611:2019², *Safety and control devices for burners and appliances burning gaseous and/or liquid fuels — General requirements*

EN 16340:2014, *Safety and control devices for burners and appliances burning gaseous or liquid fuels — Combustion product sensing devices*

EN 60204-1:2018, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2016)*

EN 60335-1:2012³, *Household and similar electrical appliances — Safety — Part 1: General requirements (IEC 60335-1:2010)*

¹ Under preparation. Stage at the time of publication: FprEN 1854:2022.

² As impacted by EN 13611:2019/AC:2021.

EN 60529:1991⁴, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

EN 60730-1:2016⁵, *Automatic electrical controls — Part 1: General requirements (IEC 60730-1:2013, modified)*

EN 60730-2-5:2015⁶, *Automatic electrical controls — Part 2-5: Particular requirements for automatic electrical burner control systems (IEC 60730-2-5:2013)*

EN 60730-2-6:2016⁷, *Automatic electrical controls — Part 2-6: Particular requirements for automatic electrical pressure sensing controls including mechanical requirements (IEC 60730-2-6:2015)*

EN IEC 60730-2-14:2019⁸, *Automatic electrical controls — Part 2-14: Particular requirements for electric actuators (IEC 60730-2-14:2017)*

EN IEC 61000-6-2:2019, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity standard for industrial environments (IEC 61000-6-2:2016)*

EN 61000-6-4:2007⁹, *Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environments (IEC 61000-6-4:2006)*

EN 61010-2-202:2017, *Safety requirements for electrical equipment for measurement, control and laboratory use — Part 2-202: Particular requirements for electrically operated valve actuators (IEC 61010-2-202:2016)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13611:2019 apply with the following modifications.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

³ As impacted by EN 60335-1:2012/AC:2014, EN 60335-1:2012/A11:2014, EN 60335-1:2012/A13:2017, EN 60335-1:2012/A1:2019, EN 60335-1:2012/A2:2019, EN 60335-1:2012/A14:2019 and EN 60335-1:2012/A15:2021.

⁴ As impacted by EN 60529:1991/corrigendum May 1993, EN 60529:1991/A1:2000, EN 60529:1991/A2:2013 and EN 60529:1991/AC:2016-12.

⁵ As impacted by EN 60730-1:2016/A1:2019 and EN 60730-1:2016/A2:2022.

⁶ As impacted by EN 60730-2-5:2015/A1:2019 and EN 60730-2-5:2015/A2:2021.

⁷ As impacted by EN 60730-2-6:2016/A1:2020.

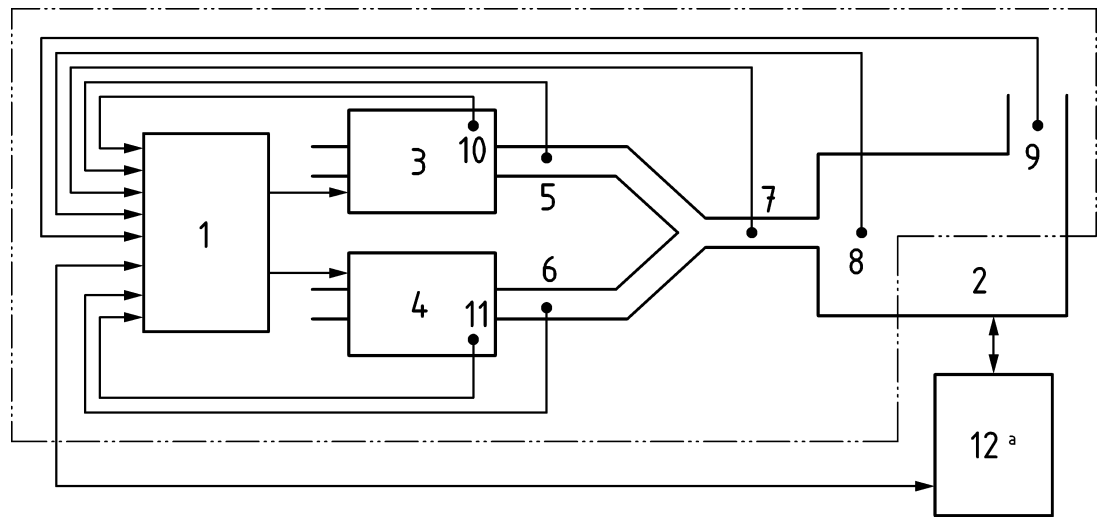
⁸ As impacted by EN IEC 60730-2-14:2019/A2:2021 and EN IEC 60730-2-14:2019/A1:2022.

⁹ As impacted by EN 61000-6-4:2007/A1:2011.

3.101
electronic fuel/air ratio control system
ERC

closed loop system consisting of the electronic control unit, actuating elements for the fuel flow and the air flow as a minimum, and allocated feedback signal(s)

Note 1 to entry: Figure 1 shows an example of different feedback alternatives. For details, see also Table 1.



Key	
1	electronic control unit (ECU)
2	combustion process
3	actuator air
4	actuator fuel
5	sensor air
6	sensor fuel
7	sensor fuel/air mixture
8	sensor flame
9	sensor flue gas
10	actuator air feedback
11	actuator fuel feedback
12	automatic burner control system
----- scope of ERC	

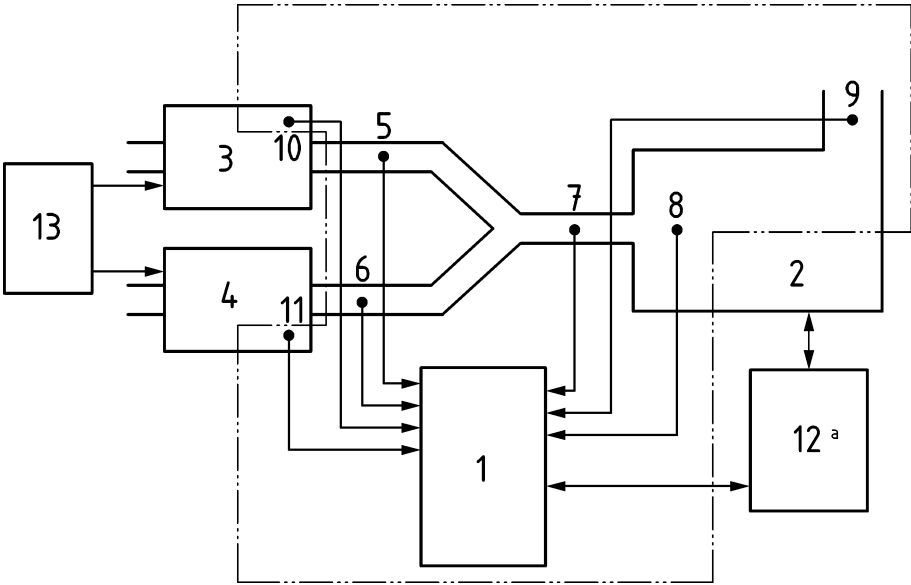
^a From the ERC point of view, 12 acts in case a safe state is requested by 1 to de-energize the safety shut-off valves.

Figure 1 — Scope of the electronic fuel/air ratio control system (ERC)

3.102
electronic fuel/air ratio supervision system
ERS

supervision system consisting of electronic control unit and sensor(s), providing at least one output signal to indicate if the fuel/air ratio is outside of the safe area of the application

Note 1 to entry: Figure 2 shows an example of different feedback alternatives. For details, see also Table 1.



Key

- | | | | |
|---|-------------------------------|----|---------------------------------|
| 1 | electronic control unit (ECU) | 8 | sensor flame |
| 2 | combustion process | 9 | sensor flue gas |
| 3 | actuator air | 10 | actuator air feedback |
| 4 | actuator fuel | 11 | actuator fuel feedback |
| 5 | sensor air | 12 | automatic burner control system |
| 6 | sensor fuel | 13 | arbitrary control |
| 7 | sensor fuel/air mixture | | ----- scope of ERS |

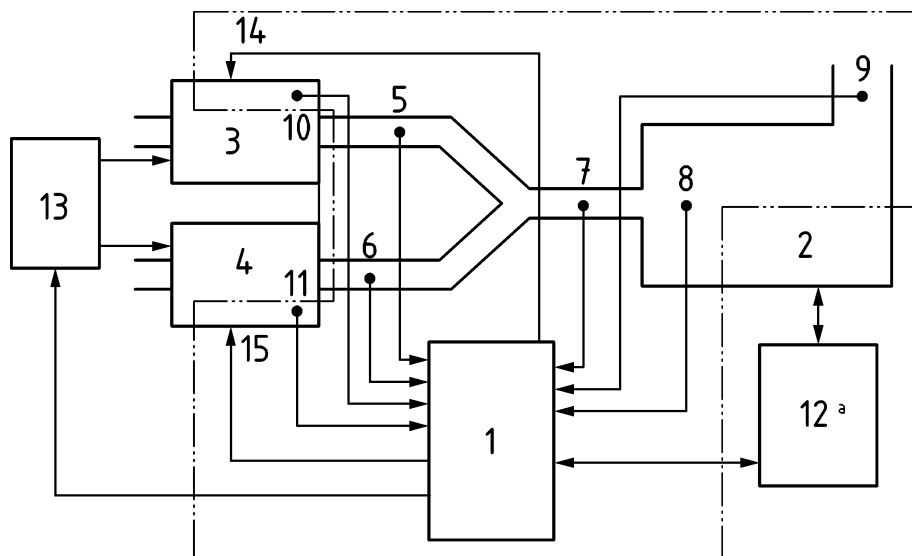
^a From the ERS point of view, 12 acts in case a safe state is requested by 1 to de-energize the safety shut-off valves.

Figure 2 — Scope of the electronic fuel/air ratio supervision system (ERS)

3.103
electronic fuel/air ratio trim system

ERT
closed loop system consisting of the electronic control unit, actuating element(s) or control output(s) to influence the fuel/air ratio controlled by other means, and the allocated feedback signal(s)

Note 1 to entry: Figure 3 shows an example of different feedback alternatives. For details, see also Table 1.



Key

1	electronic control unit (ECU)	9	sensor flue gas
2	combustion process	10	actuator air feedback
3	actuator air	11	actuator fuel feedback
4	actuator fuel	12	automatic burner control system
5	sensor air	13	arbitrary control
6	sensor fuel	14	trimsignal air
7	sensor fuel/air mixture	15	trimsignal fuel
8	sensor flame		----- scope of ERT

^a From the ERT point of view, 12 acts in case a safe state is requested by 1 to de-energize the safety shut-off valves.

Figure 3 — Scope of the electronic fuel/air ratio trim system (ERT)

3.104

electronic control unit

ECU

electronic main control module incorporating all inputs and outputs for the ERC, ERS or ERT function

3.105

actuator

device for controlling the amount of fuel and/or air

3.106

sensor

device which gives a signal related to a physical property to which it responds

3.107

combustion process

chemical reaction between fuel and air to produce heat

3.108
safe state

state of the system with the following characteristics:

- a) the system passively assumes a state in which the output signal(s) ensure a safe situation under all circumstances or;
- b) the system actively executes a protective action causing it to shutdown and lock-out, or;
- c) the system remains in operation, continuing to satisfy all safety related functional requirements

3.109
fault tolerating time

FTT
time between the occurrence of a fault and reaching a safe state, which is tolerated by the application without resulting in a hazardous situation

Note 1 to entry: For illustration of the fault tolerating time, see Figure 4 or Figure 5.

3.110
fault reaction time control

FRTc
time that the ERC, ERS or ERT needs from the moment the fault condition reaches the sensor to the moment of an initialization to reach a safe state

Note 1 to entry: For illustration of the fault reaction time control for ERC and ERS, see Figure 4.

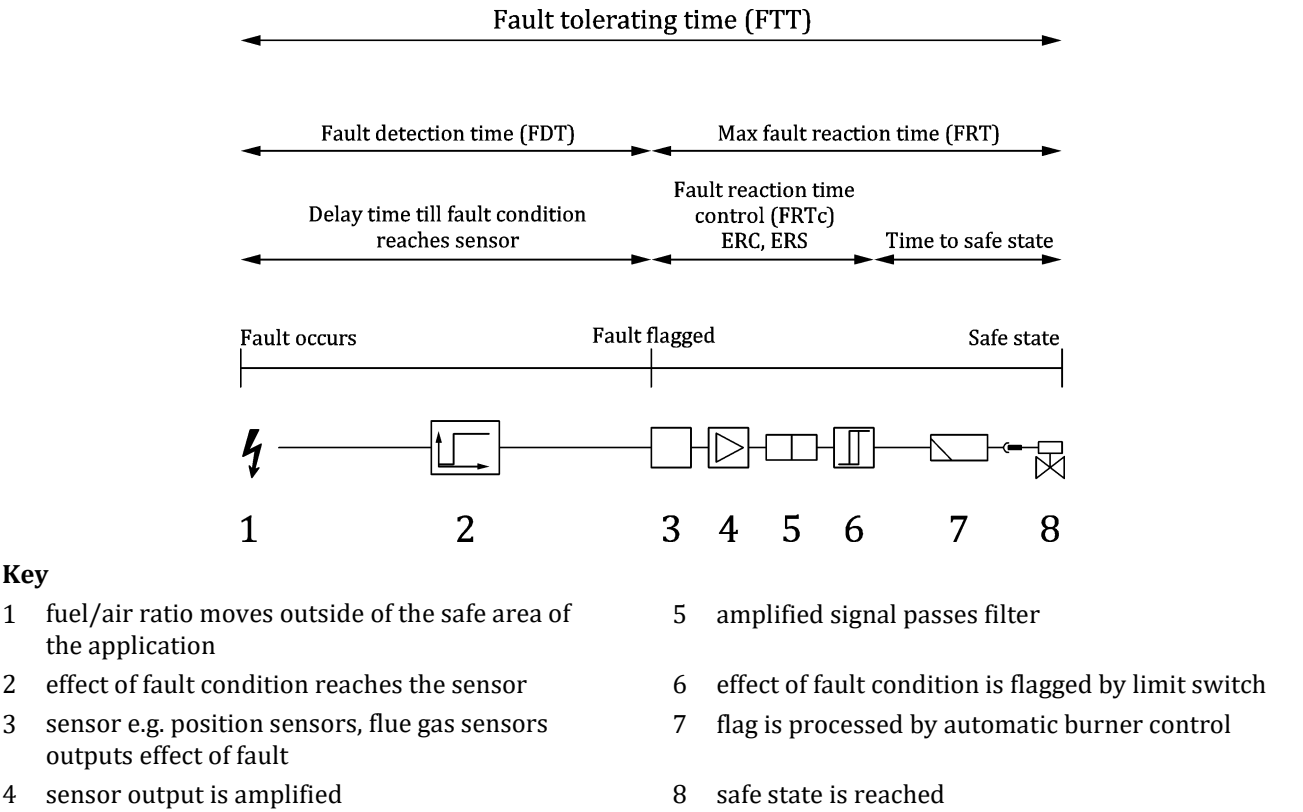
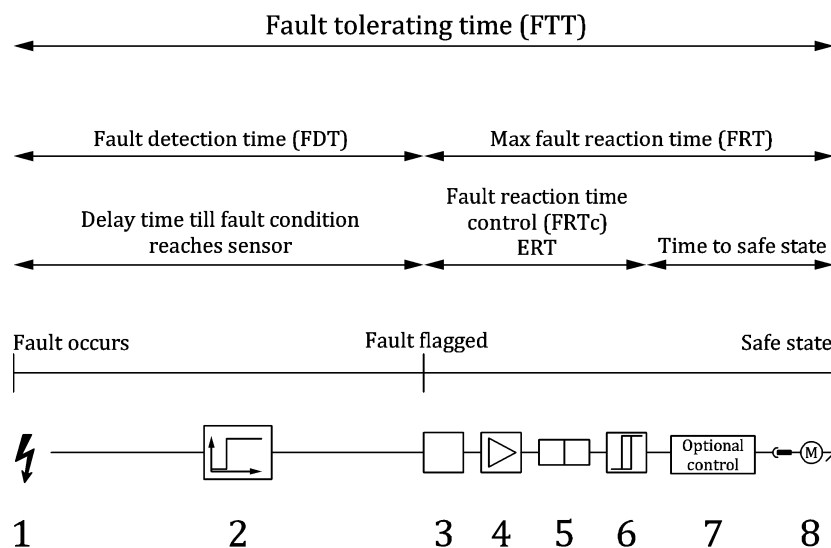


Figure 4 — Relationship between fault tolerating time and fault reaction time control for ERC and ERS

Note 2 to entry: For illustration of the fault reaction time control for ERT, see Figure 5.



Key

- | | |
|--|--|
| 1 fuel/air ratio moves outside the safe area of the application | 5 amplified signal passes filter |
| 2 effect of fault condition reaches the sensor | 6 effect of fault condition is flagged by limit switch |
| 3 sensor e.g. position sensors, flue gas outputs effect of fault | 7 flag may be processed by optional control* system to initiate a safe state |
| 4 sensor output is amplified | 8 shut-off element or actuating element influences the fuel/air ratio to reach a safe state. |

*Examples for optional control are key 12 or key 13 in Figure 3. An optional control can only be used to reach a safe state if the control has the required safety class for this function. If an ERT doesn't use optional control to reach a safe state, key 14 and key 15 in Figure 3 are examples.

Figure 5 — Relationship between fault tolerating time and fault reaction time control for ERT

3.111

non-volatile lock-out

safety-shutdown condition of the system, where a restart can only be accomplished by a manual reset of the system and by no other means

[SOURCE: EN 298:2022, 3.121.1]

3.112

volatile lock-out

safety-shutdown condition of the system, where a restart can only be accomplished by either a manual reset of the system or an interruption of the mains power and its subsequent restoration

[SOURCE: EN 298:2022, 3.121.2]

3.113

normal operation

operation of the ERC, ERS or ERT control system within its specification including the effect of influences which may occur during intended operation

Note 1 to entry: Examples of influences on sensors are given in Table AA.1.

3.114

abnormal operation

operation under the effect of internal failures of the ERC, ERS or ERT control system

3.115

form closure construction

construction ensuring non-slippage of a connection between at least two mechanical components

3.116

accuracy

ability to provide an indicated value close to the true value

3.117

adaptive control function

ACF

control function, intended to maintain λ constant in a range $\Delta\lambda$ by adapting the flow of fuel, and/or the flow of air and/or other physical quantity to compensate changes in input parameters relevant for the combustion process

Note 1 to entry: Changes in input parameters could be for example the composition of the fuel or the combustion air temperature.

4 Classification

4.1 Classes of control

EN 13611:2019, 4.1 is not applicable.

4.2 Groups of control

Shall be according to EN 13611:2019, 4.2.

4.3 Classes of control functions

Shall be according to EN 13611:2019, 4.3 with the following addition:

- ERC is a class C control function;
- ERS is a class C control function;
- ERT is a class C control function.

If the control functions as given above are combined with each other or with other fuel/air ratio control systems technologies, e.g. pneumatic, mechanical, then they may have a lower class of control function if the entire ERC, ERS or ERT complies with class C control function, see 6.6.

4.4 Types of DC supplied controls

Shall be according to EN 13611:2019, 4.4.

5 Test conditions and uncertainty of measurements

Shall be according to EN 13611:2019, Clause 5.

6 Design and construction

6.1 General

Shall be according to EN 13611:2019, 6.1 with the following addition:

6.1.101 General structure and feedback types

The ERC shall consist of at least two actuators and at least one sensor; see Figure 1 and Table 1 which shall be considered together.

The ERS shall consist of at least one sensor and one output to initiate reaching a safe state; see Figure 2 and Table 1 which shall be considered together.

The ERT shall consist of at least one output to trim the fuel/air ratio and at least one sensor; see Figure 3 and Table 1 which shall be considered together.

The ERC, ERS or ERT shall have continuous self-checking functions. In periods of time where the ERC, ERS or ERT is not active, e.g. in stand-by, any fault in its control function shall move to or remain in a safe state.

An ERC, ERS or ERT shall use a feedback system which ensures the fuel/air ratio meets the requirements of 7.101.6.

For the analysis of the system safety, the complete system shall be taken into account. This shall include the peripheral elements, e.g. servo motors, actuators, positional devices, sensors, variable speed controls for combustion air fans and combustion analysis feedback systems.

Table 1 — Acceptable feedback types

		Actuator feedback		Actuator output feedback		Process feedback		
		Position _b	Speed	Flow/ Δp	p	Fuel/ air ratio	Flame	Flue gas
Actuator Air	Valve / damper	X		X	X	X	X	X
	fan		X ^{a, d}	X	X			
Actuator Fuel	Valve / damper	X		X	X			
	pump		X ^{d, e}	X	X			
	pressure / flow regulator			X	X			
		At least 2 feedbacks (1 fuel, 1 air) required ^c				At least 1 feedback required ^c		
^a If a fan speed signal is used as means to control the air flow, proof of air flow cannot rely on fan rotation only. A possible additional signal can be derived from an independent air proving device at least checked during start up.								
^b A feedback signal which is directly related to the mechanical part of the actuator.								
^c The two actuator feedbacks and the process feedback are alternatives.								
^d A feedback signal from a variable speed control, e.g. a frequency converter, cannot be used as long as this feedback signal is not derived through a class C control function representing the actual speed.								
^e for pumps used on oil burners								

6.2 Mechanical parts of the control

Shall be according to EN 13611:2019, 6.2 with the following addition:

6.2.101 Special requirements for electromechanical actuators with position feed-back sensors

The mechanical connection between the actuator and the actuator feed-back sensor, which represents e.g. the position as a representative value of the flow, shall be of form closure construction or of adequate design. This requirement shall include the complete connection up to the shaft of the control element (e.g. butterfly valve, air damper).

Screws, pins and other components which are necessary to ensure form closure shall be secured, e.g. by glue.

6.3 Materials

Shall be according to EN 13611:2019, 6.3 with the following addition in 6.3.1:

6.3.1 General material requirements

Shall be according to EN 13611:2019, 6.3.1 with the following addition:

The following aspects shall be considered for fuel/air ratio components constructed of non-metallic material under the conditions of their intended use:

- dimensional stability;
- flow characteristics of the material;
- possible heat shrinkage;
- durability.

6.4 Gas connections

EN 13611:2019, 6.4 is not applicable.

6.5 Electronic parts of the control

6.5.1 General

6.5.1.101 Requirements

Shall be according to EN 13611:2019, 6.5.1 with the following modification:

Replace the third paragraph.

The ERC, ERS or ERT shall be designed such that changes in critical component values (such as those affecting timing, sequence, accuracy) within the worst case specifications of the components, including the long-term stability, shall result in the control continuing to function in accordance with this document.

6.5.1.102 Test

Compliance shall be checked by worst case analysis.

6.5.2 Switching elements

6.5.2.1 Requirements

Shall be according to EN 13611:2019, 6.5.2.1 with the following addition after the NOTE:

The requirement to include at least two operating elements does not apply to ERC, ERS, ERT which are not intended to energize shut-off valves directly. This applies also for ERC, ERS or ERT providing a hard-wired safety interlock with the automatic burner control system (refer to Figures 1, 2, and 3, arrow 1↔12).

6.5.2.2 Test of protecting measures against failure of switching elements

Shall be according to EN 13611:2019, 6.5.2.2.

6.5.3 Electrical components

Shall be according to EN 13611:2019, 6.5.3.

6.6 Protection against internal faults for the purpose of functional safety

6.6.1 Design and construction requirements

Shall be according to EN 13611:2019, 6.6.1 with the following addition:

Whenever the terms lock-out or safety-shutdown are used within EN 13611:2019, 6.6.3 and 6.6.4 they shall be replaced by the term safe state.

6.6.2 Class A

Shall be according to EN 13611:2019, 6.6.2.

6.6.3 Class B

6.6.3.1 Design and construction requirements

Shall be according to EN 13611:2019, 6.6.3.1 with the following addition:

Class B control functions for ERC, ERS or ERT are only to be used in combinations as given in 4.3.

ERC, ERS or ERT with class B control functions shall be designed such that under single fault conditions they conform to 6.6.3.2 and – if applicable – 6.6.3.3, when tested under the test conditions and criteria of 6.6.5.

For the purpose of the fault assessment the effect of internal failures in accordance with Annex AA shall also be considered.

6.6.3.2 First fault

EN 13611:2019, 6.6.3.2 is replaced by the following:

Any first fault (see Annex E) in any one component or any one fault together with any other fault arising from that first fault shall result in either:

- a) the ERC, ERS or ERT passively assuming a safe state (3.108, a));
- b) within the fault reaction time control (FRTc) the ERC, ERS or ERT actively executing a protective action causing it to proceed to a safe state (3.108, b)). If in lock-out, a subsequent reset from lock-out under the same fault condition shall result in the ERC, ERS or ERT returning to lock-out;

- c) for ERS where its control signal processing (Figure 2, Keys 5 – 11) is independent from the process control (Figure 2, Key 13) or not used, the ERS continuing to operate, the fault being identified during the next start-up sequence, or any other measure that is capable of detecting the fault during actual burner operation or shut down within 24h, whichever occurs first, the result being a) or b);
- d) the ERC, ERS or ERT remaining operational in accordance with the safety related functional requirements of this document (3.108, c)).

The fault reaction time control (FRTc) shall be as specified in the instructions, considering 7.101.4.

6.6.3.3 Faults introduced during lock-out or safety-shutdown

EN 13611:2019, 6.6.3.3 is replaced by the following:

Whenever the ERC, ERS or ERT is in an inoperative safe state without an internal fault, with all safety related output terminals being de-energized, or safety related output signals representing a safe situation, the following requirements apply.

Any first fault (together with any other fault arising from that fault) in any one component (see Annex E), induced while the ERC, ERS or ERT in an inoperative safe state, shall result in either:

- a) the ERC, ERS or ERT remaining in this safe state;
- b) the ERC, ERS or ERT proceeding to another inoperative safe state;
- c) the ERC, ERS or ERT returning to operation again resulting in 6.6.3.3 a) or b);
- d) the ERC, ERS or ERT returning to operation in accordance with the safety related functional requirements of this document.

The fault reaction time control (FRTc) shall be as specified in the instructions, considering 7.101.4.

6.6.4 Class C

6.6.4.1 Design and construction requirements

EN 13611:2019, 6.6.4.1 is replaced by the following:

The ERC, ERS or ERT shall be fail-safe. ERC, ERS or ERT which meet the requirements of 6.6.4 and, if applicable, 6.6.1, are considered to be inherently fail-safe.

For the purpose of the fault assessment the effect of internal failures in accordance with Annex AA shall also be considered.

The circuitry and the construction of the ERC, ERS or ERT shall meet the requirements of 7.101. They shall be appraised in accordance with the requirements to 6.6.4.2, 6.6.4.3 and 6.6.4.4, and tested under the test conditions and criteria of 6.6.5.

Any interface or interlock between the ERC, ERS or ERT and the automatic burner control system shall not degrade the safety of the complete system.

Software shall conform to software Class C of EN 60730-1:2016.

6.6.4.2 First fault

EN 13611:2019, 6.6.4.2 is replaced by the following:

Any first fault (see Annex E) in any one component or any one fault together with any other fault arising from that first fault shall result in either:

- a) the ERC, ERS or ERT passively assuming a safe state (3.108, a));
- b) within the fault reaction time control (FRTc) the ERC, ERS or ERT actively executing a protective action causing it to proceed to a safe state (3.108, b)). If in lock-out, a subsequent reset from lock-out under the same fault condition shall result in the ERC, ERS or ERT returning to lock-out;
- c) for ERS where its control signal processing (Figure 2, Keys 5 – 11) is independent from the process control (Figure 2, Key 13) or not used, the ERS continuing to operate, the fault being identified during the next start-up sequence, or any other measure that is capable of detecting the fault during actual burner operation or shut down within 24h, whichever occurs first, the result being a) or b);
- d) the ERC, ERS or ERT remaining operational in accordance with the safety related functional requirements of this document (3.108, c)).

The fault reaction time control (FRTc) shall be as specified in the instructions, considering 7.101.4.

6.6.4.3 Second fault

EN 13611:2019, 6.6.4.3 is replaced by the following:

If the first fault results in the ERC, ERS or ERT remaining operational in accordance with the safety related functional requirements of this document (see 6.6.4.2 d)), any further independent fault considered together with the first fault shall result in either 6.6.4.2 a), b), c), or d).

For ERC, ERS or ERT, which make use of a cyclic operation of the appliance not exceeding 24 h in operation, the second fault shall only be considered to occur when a start-up sequence of the appliance has been performed between the first and the second fault.

For all other ERC, ERS or ERT the second fault shall only be considered to occur 24 hours after the first fault.

NOTE While conducting this test, the fault can be applied at any time. It is not necessary to wait 24 h before applying the fault. If the fault was applied before 24 h and unacceptable results were obtained, the fault is applied 24 h after the first fault.

6.6.4.4 Faults during lock-out or safety-shutdown

6.6.4.4.1 General

EN 13611:2019, 6.6.4.4.1 is replaced by the following:

Whenever the ERC, ERS or ERT is in an inoperative safe state without an internal fault, 6.6.4.4.2 and 6.6.4.4.3 apply.

Whenever the ERC, ERS or ERT is in an inoperative safe state with an internal fault, 6.6.4.4.3 applies.