BS EN 60730-2-5:2015

BSI Standards Publication

Automatic electrical controls

Part 2-5: Particular requirements for automatic electrical burner control systems

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National foreword

This British Standard is the UK implementation of EN 60730-2-5:2015. It is derived from IEC 60730-2-5:2013. It supersedes BS EN 60730-2-5:2002+A2:2010, which will be withdrawn on 17 November 2019.

The CENELEC common modifications have been implemented at the appropriate places in the text. The start and finish of each common modification is indicated in the text by tags [C〉 〈C].

The UK participation in its preparation was entrusted to Technical Committee CPL/72, Electrical control devices for household equipment and appliances.

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

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

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Automatische elektrische Regel- und Steuergeräte für den Hausgebrauch und ähnliche Anwendungen - Teil 2-5: Besondere Anforderungen an automatische elektrische Brenner-Steuerungs- und Überwachungssysteme (IEC 60730-2-5:2013 , modifiziert)

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Foreword

This document (EN 60730-2-5:2015) consists of the text of IEC 60730-2-5:2013 prepared by IEC/TC 72 "Automatic electrical controls", together with the common modifications prepared by CLC/TC 72 "Automatic controls for household use".

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-08-27
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2017-11-17

This document supersedes EN 60730-2-5:2002.

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

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

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

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

Endorsement notice

The text of the International Standard IEC 60730-2-5:2013 was approved by CENELEC as a European Standard with agreed common modifications.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

This annex of EN 60730-1:2011 is applicable except as follows:

Addition:

Publication	Year	Title	EN/HD	Year
IEC 60068-2-6	-	Environmental testing Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	-
IEC 61643-11	-	Low-voltage surge protective devices Part 11: Surge protective devices connected to low-voltage power systems - Requirements and test methods	EN 61643-11	-

Annex ZB
(normative)

Special national conditions

This annex of EN 60730-1:2011 is applicable.

There are no special conditions (snc) causing a deviation from this European Standard other than those listed in Annex ZB to EN 60730-1:2011.

Annex ZC
(informative)

A-deviations

This annex of EN 60730-1:2011 is applicable except as follows:

Addition:

Clause	**Deviation**
Annex H	**Austria**: Bundesgesetzblatt 19. Verordnung: Luftreinhalteverordnung 1989 (LVR-K 1989, air clean keeping decree for vessel equipment), last valid modification Nov. 4, 1997 by 324. Verordnung: Änderung der Luftreinhalteverordnung für Kesselanlagen 1989 (modification of LVR-K 1989, air clean keeping decree for vessel equipment): § 8(1) Werden Dampfkesselanlagen mit Brennern ausgerüstet, die in den Anwendungsbereich nachstehender ÖNORMen fallen, so sind diese ÖNORMen verbindlich anzuwenden: (Whenever steam boilers are equipped with burners concerned by the following standards, these standards have to be applied:) - ÖNORM EN 267/1991: Atomizing oil burners of monobloc type-Testing; - ÖNORM M 7540-1/1994: Atomizing oil burners of monobloc type for the heating fuels "fuel oil light", "fuel oil medium" and "fuel oil heavy" - Terminology, requirements, testing, marking of conformty; - ÖNORM M 7445/1984: Forced-air gasburners; - ÖNORM M 7445/1990: Fan-assisted gas burners with low NOx-emission; nitrogen oxide measurement."

Annex ZZ
(informative)

Coverage of Essential Requirements of EU Directives

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers all relevant essential requirements as given in Article 1 of Annex I of the EC Directive EMC (2004/108/EC).

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive concerned.

WARNING: Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

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CONTENTS

AUTOMATIC ELECTRICAL CONTROLS –

Part 2-5: Particular requirements for automatic electrical burner control systems

1 Scope and normative references

This clause of Part 1 is applicable except as follows:

1.1 *Replacement:*

This part of IEC 60730 applies to automatic electrical burner control systems for the **automatic control** of burners for oil, gas, coal or other combustibles for household and similar use including heating, air conditioning and similar use.

This part 2-5 is applicable to a complete burner control system and to a separate **programming unit**. This part 2-5 is also applicable to a separate electronic high-voltage **ignition source** and to a separate **flame detector**.

NOTE Separate **ignition devices** (electrodes, **pilot** burners, etc.) are not covered by this part 2-5 unless they are submitted as part of a burner control system. Requirements for separate ignition transformers are contained in IEC 60989.

Throughout this part 2-5, where it can be used unambiguously, the word "system" means "burner control system" and "systems" means "burner control systems".

Systems utilizing thermoelectric flame supervision are not covered by this part 2-5.

1.1.1 This part 2-5 applies to the inherent safety, to the manufacturer's declared **operating values**, **operating times** and **operating sequences** where such are associated with burner safety and to the testing of automatic electrical burner control systems used in, on, or in association with, burners.

NOTE Requirements for specific **operating values**, **operating times** and **operating sequences** are given in the standards for appliances and equipment.

Systems for equipment not intended for normal household use, but which nevertheless may be used by the public, such as equipment intended to be used by laymen in shops, in light industry and on farms, are within the scope of this part 2-5.

This part 2-5 applies to systems using NTC or PTC thermistors, additional requirements for which are contained in Annex J.

This part 2-5 does not apply to systems designed exclusively for industrial applications.

1.1.2 This part 2-5 applies to **manual controls** when such are electrically and/or mechanically integral with **automatic controls**.

NOTE Requirements for manual switches not forming part of an **automatic control** are contained in IEC 61058-1.

Throughout this part 2-5, the word "equipment" means "appliance and equipment".

1.2 *Replacement:*

This part 2-5 applies to systems with a rated voltage not exceeding 660 V and with a rated current not exceeding 63 A.

1.3 *Replacement:*

This part 2-5 does not take into account the **response value** of an **automatic action** of a control, if such a **response value** is dependent upon the method of mounting the control in the equipment. Where a **response value** is of significant purpose for the protection of the **user**, or surroundings, the value defined in the appropriate household equipment standard or as determined by the manufacturer applies.

NOTE This part 2-5 includes systems responsive to flame properties.

1.4 *Replacement:*

This part 2-5 applies also to systems incorporating **electronic devices**, requirements for which are contained in Annex H.

1.5 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

IEC 60068-2-6, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 61643-11, *Low-voltage surge protective devices – Part 11: Surge protective devices connected to low-voltage power systems – Requirements and test methods*

2 Definitions

This clause of Part 1 is applicable except as follows:

2.2 Definitions of types of control according to purpose

Additional definitions:

2.2.101
burner control system
system which includes a **programming unit**, a **flame detector** and may include an **ignition source** and/or **ignition device** and which monitors the **operation** of fuel burners

Note 1 to entry: The various functions of the system may be in one or more housings.

2.2.102
flame detector
device which provides the **programming unit** with a signal indicating the presence or absence of flame

Note 1 to entry: It includes the **flame sensor** and may include an amplifier and a relay for signal **transmission**. The amplifier and relay may be in its own housing or combined with the **programming unit**.

2.2.103
flame sensor
device which senses the flame and provides the input signal to the **flame detector** amplifier

Note 1 to entry: Examples are optical sensors and flame electrodes (flame rods).

2.2.104
ignition source
electrical or electronic system component which provides energy to an **ignition device**

Note 1 to entry: It may be separated from or incorporated in the **programming unit**. Examples are ignition transformers and electronic high-voltage generators.

2.2.105
ignition device
device mounted on or adjacent to a burner for igniting fuel at the burner

Note 1 to entry: Examples are **pilot** burners, spark electrodes and hot surface igniters.

2.2.106
programming unit
device which controls the burner **operation** in a declared sequence from start-up to shut-down within declared timings and in response to signals from regulating, limiting and monitoring devices

2.2.107
multitry system
system that allows more than one **valve open period** during its declared **operating sequence**

2.3 Definitions relating to the function of controls

2.3.30
T_{max}
Replace "**switch head**" *by* "**burner control system**."

Additional definitions:

2.3.101
automatic recycle
automatic repetition of the start-up procedure, without manual intervention, following loss of the supervised flame and subsequent fuel supply shutoff

2.3.102
controlled shut-down
de-energization of the fuel flow means as a result of the opening of a control loop by a control device such as a **thermostat** leading the system to return to the **start position**

Note 1 to entry: **Controlled shut-down** may include additional actions by the system.

2.3.103
flame detector response time
period of time between the loss of the sensed flame and the signal indicating the absence of flame

2.3.104
flame detector operating characteristics
that function of the **flame detector** which indicates absence or presence of flame as the output signal of the **flame detector** relating to the input signal

Note 1 to entry: Normally the input signal is provided by a **flame sensor**.

2.3.104.1
signal for presence of flame
S_1
minimum signal which indicates the presence of flame when there was previously no flame

2.3.104.2
signal for absence of flame
S_2
maximum signal which indicates the loss of flame

Note 1 to entry: **S_2** is less than **S_1**.

2.3.104.3
maximum flame signal
S_{max}
maximum signal which does not affect the timings or the sequence

2.3.104.4
signal for visible light flame simulation
S_3
minimum signal which indicates the presence of flame during the visible light **flame simulation** test

Note 1 to entry: **S_3** is less than **S_2**.

2.3.105
self-checking flame detector
flame detector which checks for correct **operation** of the **flame detector** and its associated electronic circuitry while the burner is in the **running position**

2.3.106
flame detector self-checking rate
frequency of the self-checking function of the **flame detector** (in number of **operations** per unit of time)

2.3.107
flame failure lock-out time
period of time between the signal indicating absence of flame and **lock-out**

2.3.108
flame failure re-ignition time
relight time
period of time between the signal indicating absence of flame and the signal to energize the **ignition device**, during which the fuel supply is not shut off

2.3.109
flame signal
output signal of the **flame detector**

2.3.110
flame simulation
condition which occurs when the **flame detector** indicates the presence of flame when in reality no flame is present

2.3.111
ignition time
period of time during which the **ignition device** is energized

2.3.112
lock-out
process in which the system goes into one of the following **lock-out** conditions, following **safety shut-down**

2.3.112.1
non-volatile lock-out
condition such that a restart can only be accomplished by a manual **reset** of the system and by no other cause

2.3.112.2
volatile lock-out
condition such that a restart can be accomplished by either a manual **reset** of the system or by an interruption of the power supply and its subsequent restoration

2.3.113
main flame establishing period
period of time between the signal to energize the main fuel flow means and the signal indicating presence of the main burner flame

2.3.114
pilot flame establishing period
period of time between the signal to energize the **pilot** fuel flow means and the signal indicating presence of the **pilot** flame

2.3.115
post-ignition time
period of the **ignition time** between the signal indicating presence of flame and the signal to de-energize the **ignition device**

2.3.116
pre-ignition time
period of the **ignition time** between the signal to ignite and the signal to energize the fuel flow means

2.3.117
proved igniter
system in which the fuel flow means is energized only after the availability of sufficient energy to ignite the fuel has been verified

Note 1 to entry: Examples are systems using spark supervision and those using proved hot surface igniters.

2.3.117.1
proved igniter operating value
signal which indicates that the **proved igniter** has the energy to ignite the fuel

2.3.117.2
igniter proving time
period of time between the signal to energize the **proved igniter** and the signal to energize the fuel flow means

2.3.117.3
igniter failure response time
period of time between loss of the supervised **proved igniter** and the signal to de-energize the fuel flow means

2.3.118
purge time
period during which air is introduced to displace any remaining air/fuel mixtures or products of combustion from the combustion zone and flue ways

Note 1 to entry: No fuel is admitted during this period.

2.3.118.1
post-purge time
purge time that takes place immediately following the shutting off of the fuel supply

2.3.118.2
pre-purge time
purge time that takes place between **initiation** of a burner control sequence and the admission of fuel to the burner

2.3.119
re-ignition
relight
process by which, following loss of the **flame signal**, the **ignition device** will be re-energized without interruption of the fuel flow means

2.3.120
recycle time
period of time between the signal to de-energize the fuel flow means following the loss of flame and the signal to begin a new start-up procedure

2.3.121
running position
position denoting that the main burner flame is established and supervised

2.3.122
safety shut-down
de-energization of the main fuel flow means as the result of the action of a limiter, a cut-out or the detection of an internal **fault** of the system

Note 1 to entry: **Safety shut-down** may include additional actions by the system.

2.3.123
start position
position which denotes that the system is not in the **lock-out** condition and has not yet received the **start signal**, but can proceed with the start-up sequence if required

2.3.124
start signal
signal, for example, from a **thermostat**, which releases the system from its **start position**

2.3.125
start-up lock-out time
period of time between the signal to energize the fuel flow means and **lock-out**

Note 1 to entry: For systems which control two separate fuel flow means, two different **start-up lock-out times** are possible (first and second **start-up lock-out times**).

2.3.126
waiting time
period between the **start signal** and the signal to energize the **ignition device**

Note 1 to entry: For burners without fans, natural ventilation of the combustion chamber and the flue passages normally takes place during this time.

2.3.127
valve open period
for **multitry systems**, the period of time between the signal to energize the fuel flow means, and the signal to de-energize the fuel flow means, if proof of the supervised burner flame is not established

〖C〉 *deleted note* 〈C〗

2.3.128
valve sequence period
for **multitry systems**, the sum of all valve opening periods prior to **lock-out**, if proof of the supervised burner flame is not established

2.3.129
system restart
process by which, after a **safety shut-down**, a full start-up procedure is automatically repeated

2.3.130
reset from lock-out function
function that provides **reset** from **lock-out** allowing the system to attempt a restart

Note 1 to entry: The **reset** function may be performed by various electric/electronic (mobile) devices.

2.3.131
common cause failures
failures of different items, resulting from a single event, where these **failures** are not consequences of each other

Note 1 to entry: **Common cause failures** should not be confused with common mode failures.

[SOURCE: IEC 60050-191:1990,191-04-23]

2.5 Definitions of types of control according to construction

Additional definitions:

2.5.101
system for permanent operation
system which is intended to remain in the **running position** for longer than 24 h without interruption

2.5.102
system for non-permanent operation
system which is intended to remain in the **running position** for less than 24 h

Additional definitions:

2.101 Definitions relating to the type of burner (see 6.101)

2.101.1
continuous ignition
type of ignition which, once placed in **operation**, is intended to remain energized continuously until it is manually interrupted

2.101.2
continuous pilot
pilot which, once placed in **operation**, is intended to remain ignited continuously until it is manually interrupted

2.101.3
direct ignition
type of ignition which is applied directly to the main burner, without the use of a **pilot**

2.101.4
expanding pilot
form of **continuous pilot** where the **pilot** flame is increased or expanded when required to ignite the main burner and reduced either immediately after main burner ignition, or after the main flame is shut off

2.101.5
full rate start
condition in which the main burner ignition and subsequent flame supervision occur at full fuel rate

2.101.6
intermittent ignition
type of ignition which is energized when an appliance is called on to operate and which remains continuously energized during each period of main burner **operation** and where the ignition is de-energized when the main burner operating cycle is completed

2.101.7
intermittent pilot
pilot which is automatically ignited when an appliance is called on to operate and which remains continuously ignited during each period of main burner **operation** and where the **pilot** is automatically extinguished when each main burner operating cycle is completed

2.101.8
interrupted ignition
type of ignition which is energized prior to the admission of fuel to the main burner and which is de-energized when the main flame is established

2.101.9
interrupted pilot
pilot which is automatically ignited prior to the admission of fuel to the main burner and which is automatically extinguished when the main flame is established

2.101.10
low rate start
condition in which main burner ignition occurs at low fuel rate

Note 1 to entry: Once ignition at low fuel rate occurs and the flame is proved, full main burner fuel rate may be admitted.

2.101.11
pilot
flame, smaller than the main flame, which is utilized to ignite the main burner or burners

3 General requirements

This clause of Part 1 is applicable.

4 General notes on tests

This clause of Part 1 is applicable except as follows:

4.1 Conditions of test

4.1.1 *Replacement:*

Unless otherwise specified, the system and each system component are tested as delivered, having been mounted as declared in Table 1 (7.2 of the previous edition), requirement 31, in the most unfavourable position when there is more than one position.

When a separate system component is submitted, the manufacturer shall provide those other system components which may be necessary to perform the relevant tests.

4.1.7 Not applicable.

4.2 Samples required

4.2.1 *Replacement:*

Unless otherwise specified, one sample shall be used for the tests of Clauses 5 to 14 inclusive. A different sample(s) shall be used for the tests of Clauses 15 to 17. At the option of the manufacturer, the tests of Clauses 18 to 26 inclusive may be conducted on a new sample or on

the sample(s) used for the tests of Clauses 5 to 14 inclusive. The tests of Clause 27 shall be conducted on a new sample.

4.3 Instructions for test

4.3.2.1 *Modification:*

Delete "and those for a.c./d.c. at the more unfavourable supply."

4.3.2.4 Not applicable.

4.3.2.6 *Replacement:*

For systems marked or declared for more than one rated voltage or rated current, the tests of Clause 17 are made at the rated voltage and associated current (or vice versa) which produces the most unfavourable combination.

5 Rating

This clause of Part 1 is applicable.

6 Classification

This clause of Part 1 is applicable except as follows:

6.1 According to nature of supply

6.1.1 Systems for a.c. only

Replace explanatory matter by the following requirement:

Systems intended for use on a.c. only supply shall only be used on a.c. supplies.

6.1.3 Not applicable.

6.3 According to their purpose

Additional subclauses:

6.3.101 – **burner control system**;

6.3.102 – **flame detector**;

6.3.103 – **programming unit**;

6.3.104 – **ignition device**;

6.3.105 – electronic high-voltage **ignition source**;

6.3.106 – **flame sensor**.

6.4 According to features of automatic action

6.4.1 Not applicable.

6.4.3 *Addition:*

Burner control systems are classified as having **Type 2 action**.

6.4.3.12 Not applicable.

Additional subclauses:

6.4.3.101 – **non-volatile lock-out** (Type 2.V);

6.4.3.102 – **volatile lock-out** (Type 2.W);

6.4.3.103 – non-permanent **operation** (Type 2.AC);

6.4.3.104 – permanent **operation** (Type 2.AD);

6.4.3.105 – spark supervision (Type 2.AE);

6.4.3.106 – air/pressure flow supervision (Type 2.AF);

6.4.3.107 – position-checked external devices (Type 2.AG);

6.4.3.108 – visible light **flame simulation** check (Type 2.AH);

6.4.3.109 – proved hot surface igniter (Type 2.AI).

6.7 According to ambient temperature limits of the switch head

6.7.1 *Modification:*

Replace "Control with a **switch head**" *by* "**System** and **system** components".

6.7.2 *Modification:*

Replace "Control with a **switch head**" *by* "**System** and **system** components".

6.10 According to number of cycles of actuation (M) of each manual action

6.10.5 to **6.10.7** Not applicable.

6.11 According to number of automatic cycles (A) of each automatic action

Addition:

〚C〛 The minimum value is 250 000 automatic cycles. 〚C〛

6.11.4 to **6.11.12** Not applicable.

6.15 According to construction

6.15.3 Not applicable.

6.16 Not applicable.

Additional subclauses:

6.101 According to type of burner

NOTE Classification could be according to burner **operation** (for example, forced draught) and type of fuel (for example, gas). See 2.101.1 to 2.101.11.

6.102 According to type of pilot

6.103 According to type of ignition

6.104 According to starting fuel rate

7 Information

This clause of Part 1 is applicable except as follows:

7.2.6 *Replacement:*

Except as indicated in 7.4, for integrated systems all information is provided by means of declaration (X). For incorporated systems not declared under requirement 50, the marking required is as indicated in Table 1 (7.2 of the previous edition). For incorporated systems declared under requirement 50, the only marking required is the manufacturer's name or trade mark and the **unique type reference** if other required marking is provided by documentation (D).

NOTE See the explanation of documentation (D) contained in 7.2.1.

7.2.9 *Modification:*

Replace "$\boldsymbol{T_{max}}$ other than 55 °C" *by* "$\boldsymbol{T_{max}}$ other than 60 °C" *in the line for symbol for* "Ambient temperature limits of **switch head**".

Table 1 (7.2 of the previous edition) *(1 of 2)*

	Information	Clause or subclause	Method
	Modification:		
	Replace the following requirements by:		
4	Nature of supply (a.c. or d.c.)	4.3.2, 6.1	C
6	Purpose of system or system component	4.3.5, 6.3	D
7	The type of load controlled by each circuit[7)]	14, 17.3.1, 6.2, H.27.1.2	D
15	Degree of protection provided by enclosure[8)]	6.5.1, 6.5.2, 11.5	D
17	Which of the terminals are suitable for the connection of external conductors, and if they are suitable for line or neutral conductors, or both	6.6, 7.4.2, 7.4.3	D
22	Temperature limits of the system and system components if T_{min} is lower than 0 °C, or $\boldsymbol{T_{max}}$ other than 60 °C	6.7, 14.5, 14.7, 17.3	D
23	Temperature limits of mounting surfaces (T_s)	6.12.2, 14.1, 17.3	D
26	Number of cycles of **actuation** (M) for each **manual action**[101)]	6.10	X
28	Not applicable		
31	Method of mounting the system and each system component[5)]	4.1.1, 11.6	D
34	Details of any limitation of **operating time**	6.4.3.103, 6.4.3.104, 14, 17	D
37	Not applicable		
38	Not applicable		
40	Additional features of **Type 2 actions**	6.4.3	D
41	Not applicable		
42	Not applicable		
44	Not applicable		
46	**Operating sequence**	2.3.13, 11.3.108, 15	D
48	Not applicable		
50	System or system components intended to be delivered exclusively to the **equipment manufacturer**	7.2.1, 7.2.6	X
	Add the following additional requirements:		
101	Maximum **flame detector response time** (if applicable)	2.3.103, 15	D
102	Minimum **flame detector self-checking rate** (if applicable)	2.3.106, 11.3.107, 15	D
103	Maximum **flame failure lock-out time** (if applicable)	2.3.107, 15	D
104	Maximum **flame-failure re-ignition time** (if applicable)	2.3.108, 15	D
105	Maximum **ignition time** (if applicable)	2.3.111, 15	D
106	Maximum **main flame establishing period** (if applicable)	2.3.113, 15	D
107	Maximum pilot flame establishing period (if applicable)	2.3.114, 15	D
108	Maximum **post-ignition time** (if applicable)	2.3.115, 15	D
109	Maximum **pre-ignition time** (if applicable)	2.3.116, 15	D
110	Void		
111	Minimum **post-purge time** (if applicable)	2.3.118.1, 15	D
112	Minimum **pre-purge time** (if applicable)	2.3.118.2, 15	D
113	Minimum **recycle time** (if applicable)	2.3.120, 15	D
114	Maximum **start-up lock-out time** (if applicable)	2.3.125, 15	D

Table 1 *(2 of 2)*

	Information	Clause or subclause	Method
115	Minimum **waiting time** (if applicable)	2.3.126, 15	D
116	Type of burner	6.101	D
117	Type of **pilot**	6.102, 2.101.2, 2.101.4, 2.101.7, 2.101.9, 2.101.11	D
118	Type of ignition	2.101.1, 2.101.3, 2.101.6, 2.101.8, 6.103	D
119	See Annex H		
120	Means for protecting **setting** of timings	11.3.4	X
121	See Annex H		
122	Resistance to vibration	17.1.3, 17.16.103	D
123	**S_1 (signal for presence of flame)**	2.3.104.1, 15.5, 15.6, 15.7	D
124	**S_2 (signal for absence of flame)**	2.3.104.2, 15.5, 15.6, 15.7	D
125	**S_{max}** (**maximum flame signal**, if applicable)[103)]	2.3.104.3, 15.5, 15.6, 15.7	D
126	Electronic high-voltage ignition spark gap [102)]	13.2.101	D
127	Other system components for use with the submitted components to provide a complete system	2.2.101, 2.2.102, 2.2.104, 2.2.106	D
128	For each valve opening period, the maximum time (if applicable)	2.3.127, 11.3.113, 15.5 p)	D
129	Maximum **valve sequence period** (if applicable)	2.3.128, 11.3.112, 15.5 q)	D
130	**S_3** (**signal for visible light flame simulation**)	2.3.104.4, 11.3.110	X
131	For **proved igniters**, the characteristics (energy, current, voltage, resistance, temperature, etc.) which establish that the **proved igniter** has the energy to ignite the fuel	2.3.117	D
132	**Proved igniter operating value** (Minimum and/or maximum, as applicable)	2.3.117.1, 15.7, 17.16.108, H.27.1.1.3	D
133	Maximum **igniter proving time** (If applicable)	2.3.117.2, 15.5	D
134	Maximum **igniter failure response time** (If applicable)	2.3.117.3, 15.5	D
135	Type of **lock-out**	2.3.112, 11.3.108	D
136	See Annex H		
137	External overcurrent device (if applicable)	11.3.5.2.1a)	D
138	Maximum short circuit current as declared	11.3.5.2.1b)	D

NOTES

Additional notes:

[101)] For 17.16.105, the number of **manual actions** for **lock-out** re-set is a minimum of 6 000.

[102)] If a range is declared, the maximum value is used for the test of 13.2.102 and 13.2.103.

[103)] **S_{max}** shall be declared for those systems in which the **maximum flame signal** affects timings or sequence.

8 Protection against electric shock

This clause of Part 1 is applicable except as follows:

8.1 General requirements

Additional subclause:

8.1.101 High-voltage ignition sources

Provision shall be made for protection against contact with high-voltage **ignition sources** having any of the following characteristics:

a) for continuous spark ignition (pulses within the mains frequency range):
   – the maximum voltage is higher than 10 kV (peak), and/or
   – the maximum current is higher than 0,7 mA (peak);
b) for pulse spark ignition: (see Figure 101)
   – the charge of an individual ignition pulse exceeds 100 μC, and
   – the duration (*d*) is greater than 0,1 s, and
   – the interval (*i*) between individual ignition pulses is less than 0,25 s.

Either the system manufacturer shall provide a warning that is visible when the high-voltage **ignition source** is mounted as in **normal use**, or the equipment manufacturer shall be advised of the need to provide such protection or a warning.

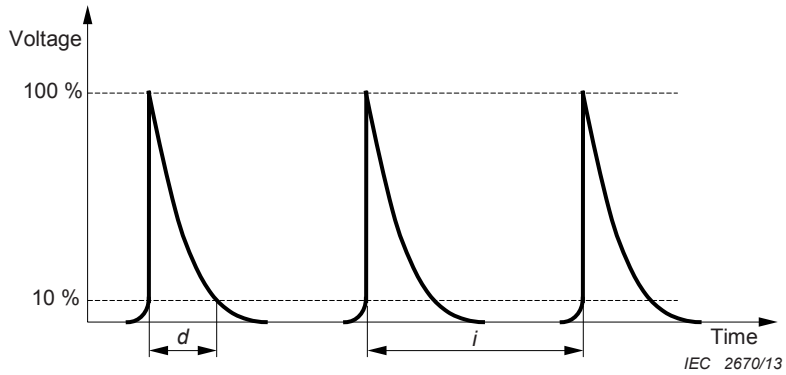

Figure 101 – Pulse spark generation

8.3 Capacitors

Not applicable.

9 Provision for protective earthing

This clause of Part 1 is applicable.

10 Terminals and terminations

This clause of Part 1 is applicable except as follows:

10.2.4 Flat push-on connectors

Additional subclause:

10.2.4.101 Direct plug-in connections

Systems designed for direct plug-in connection to a sub-base shall be so constructed that they withstand the forces of normal insertion and withdrawal in such a manner that compliance with this part 2-5 is not impaired.

Compliance is checked by performing 10 insertions and withdrawals according to the manufacturer's instructions.

After this test, no significant displacement or damage shall occur.

NOTE The terminals used for direct plug-in connections between the system and/or system components and their sub-bases are not considered flat push-on connectors.

11 Constructional requirements

This clause of Part 1 is applicable except as follows:

11.1 Materials

11.1.2 Not applicable.

11.3 Actuation and operation

11.3.4 Setting by the manufacturer

Replacement:

Adjustment means used for the **setting** of timings shall be secured by means providing protection against access by uninstructed persons or shall be declared as requiring such protection in the application.

NOTE For example, such adjustment means can

1) be sealed with a material suitable for the temperature range of the system and/or system components such that tampering is apparent, or
2) consist of special parts only available from the manufacturer, or
3) be accessible only with the use of **special-purpose tools** or access codes.

Compliance is checked by inspection. Where sealing is used, inspection is done before and after the tests of Clause 17.

11.3.5 Contacts – General

11.3.5.2 *Replacement:*

The system shall include at least two switching elements to directly de-energize the safety relevant valve terminals.

NOTE A single relay operating two independent contacts is considered to be only one switching element.

11.3.5.2.1 Measures to protect against common cause failures

Replacement:

Designs where relays are used as switching elements, a non-replaceable fuse (see Table H.21 Note 7) in series with two independent relay contacts with I_N fuse $< 0,6 * I_e$ relay, are considered to comply with the following requirements for prevention of common cause failure, without performing the following tests.

NOTE I_N: values for the fuse (see IEC 60127-1:2006, 3.16);

I_e: rated operational current of the contact (see IEC 60947-1:2007, 4.3.2.3).

Measures shall be taken to protect against **failure** of two (or more) switching elements, due to a common cause, by an external short circuit that would prevent the **burner control system** from performing a **safety shut-down**.

Acceptable methods are

– overcurrent protection device,

– current limitation or

– internal **fault** detecting means.

The suitability of measures to maintain the capability to interrupt the energization of the shut-off valve terminals by means of at least one switching element or the interruption of a non-replaceable overcurrent protection device shall be verified by the following test.

The shut-off valve terminals of the **burner control system** are connected to a switch that is intended to switch the short circuit current. With this switch opened, the **burner control system** is connected as described in H.27.1.1.2 with the outputs energized to simulate normal **operation** (contacts of the internal switching elements closed).

The test equipment shall have the following characteristics:

a) when overcurrent protection device are used as the protective measure, the power supply to the **burner control system** shall have the capability of supplying a short-circuit current of at least 500 A.

b) when current limitation techniques are used as the protective measure (e.g. transformer) the power supply to the **burner control system** shall not limit the declared (Table 1, requirement 138) short-circuit current.

A short-circuit is applied between the shut-off valve terminals of the **burner control system** by closing the switch.

The test is terminated if there is no current flow through the switch, or after 1 h.

If an overcurrent protection device is replaceable and has operated during the test, it shall be replaced and the test is repeated two more times by attempting to restart the **burner control system** keeping the switch closed.

The test is repeated using either the same or a separate sample with the switch maintained in the closed position prior to the first start-up sequence.

If an internal **fault** detecting function of the **burner control system** either opens the switching elements or initiates a **safety shut-down** the test is repeated two times by attempting to restart the **burner control system** while maintaining the external short circuit.

Compliance is checked in accordance with H.27.1.1.3 and Clause 15.

After the test, at least one switching element of the **burner control system** shall be able to de-energize the shut-off valve terminals, or a non-replaceable overcurrent protection device has permanently interrupted the supply to the shut-off valve terminals.

11.3.9 Pull-cord actuated control

Not applicable.

Additional subclauses:

11.3.101 Burner control circuits

Circuits employing **burner control systems** used in earthed supply systems shall be two-wire, one-side nominally earthed. Devices intended to open such a circuit shall be connected to the unearthed side of the supply circuit.

11.3.102 Circuits employing **burner control systems** used in unearthed supply systems shall be two-wire. All devices intended to open such circuits shall be connected to the same side of the supply circuit.

11.3.103 Circuits employing **burner control systems** used in earthed three-phase supply systems shall be four-wire. Devices intended to open such circuits shall be connected to all three phases.

11.3.104 Circuits employing **burner control systems** used in unearthed three-phase supply systems shall be three-wire. Devices intended to open such circuits shall be connected to two or three phases.

11.3.105 If the system initiates a signal to energize the fuel flow means at less than 85 % rated voltage for a.c. and less than 80 % rated voltage for d.c., the system shall comply with the following:

a) in the **running position**, the system shall proceed to **safety shut-down** or operate with the timings measured at declared ambient temperatures as declared in Table 1 (7.2 of the previous edition), requirements 101 to 104, inclusive;

b) in any other position, the **operating sequence** shall comply with the declarations of Table 1 (7.2 of the previous edition), requirement 46. The **start-up lock-out time** shall not exceed twice the value declared in Table 1 (7.2 of the previous edition), requirement 114.

Compliance is checked by H.26.5.4.

11.3.106 The system shall provide a safe start check that will cause a), b) or c) to occur if the **failure** results in a flame before the fuel flow means are energized:

a) the system shall fail to start the **operating sequence**;

b) the system shall lock out within the time declared in Table 1 (7.2 of the previous edition), requirement 103;

c) the system shall remain in pre-purge.

NOTE The system can remain in conditions a) or c) until the **fault** clears.

*For systems which incorporate **electronic devices**, compliance is determined by the tests of Clause H.27.*

*For systems not subject to the tests of Clause H.27, a **flame signal** shall be simulated and introduced at the start of the flame establishing period until a), b) or c) occurs.*

11.3.107 Systems declared as Type 2.AD shall perform a self-check at least once every hour, when the system is in the **running position**.

Systems declared in Table 1 (7.2 of the previous edition), requirement 102, have the self-checking rate evaluated as part of the declared sequence and timings. This requirement shall be evaluated in Clauses 15, 17 and H.27.1.2.

11.3.108 Systems shall perform the declared **operating sequence**.

11.3.108.1 The electric circuit of the **actuating means** of the **lock-out** device shall be checked during each start-up sequence.

11.3.108.2 The fuel flow means shall not be energized before the **ignition device**.

11.3.108.3 **Re-ignition** is only permitted when the system is in the **running position**.

11.3.108.4 **Automatic recycle** is only permitted when the system is in the **running position**.

11.3.108.5 If no flame is detected at the end of the first or second **start-up lock-out time** the system shall perform **lock-out**. However, if the declared **operating sequence** includes recycle or re-ignition, the system may recycle or allow re-ignition.

Compliance with 11.3.108 is checked by inspection and by test.

11.3.108.6 If no flame is detected at the end of the **flame failure lock-out time**, the system shall perform **lock-out**. However, if the declared **operating sequence** includes recycle or re-ignition, the system may recycle or allow re-ignition.

11.3.108.7 After a **safety shut-down** or after a **volatile lock-out reset**, the **operating sequence** may proceed only with a **system restart**.

11.3.109 If the wiring diagram provided by the manufacturer indicates an input to the system from an external limiter or cut-out, then **operation** of this external device shall lead to at least **safety shut-down**.

Compliance is checked by examination of the circuit design.

11.3.110 Visible light flame simulation test

Flame detectors classified as Type 2.AH shall have a check to discriminate between **flame simulation** and **flame signals** originating from real flame. Examples of suitable checks are:

a) prior to the signal to energize the fuel flow means during each start-up sequence, the system shall check for the presence of a **flame signal** that is greater than or equal to $\mathbf{S_3}$. If such a signal is detected, the system shall proceed to **lock-out** or shall interrupt the start-up sequence;

   for the above test, $\mathbf{S_3}$ shall be less than $\mathbf{S_2}$;

   or

b) after performing a **controlled shut-down**, the system shall check for the presence of a **flame signal** which is less than or equal to $\mathbf{S_2}$. If such a signal is detected, the system shall proceed to **lock-out** or shall prevent the next start-up sequence.

11.3.111 For **multitry systems**, the system shall go to **lock-out** at the end of the **valve sequence period**.

11.3.112 For **multitry systems**, further **valve open periods** may be initiated either as a result of loss of supervised flame during the **running position** or **failure** to prove supervised flame during the declared **valve sequence period**.

NOTE **Re-ignition** (see 11.3.108.5) is also allowed if declared.

11.3.113 For **multitry systems**, the **valve open periods** may have different values during the **valve sequence period**.

11.4 Actions

11.4.3 Type 2 action

Replacement:

Any **Type 2 action** shall be so designed that the **manufacturing deviation** and **drift** of its **operating value**, **operating time** or **operating sequence** is within the limits declared in Table 1 (7.2 of the previous edition), requirements 46, 101 to 115 inclusive, and 123 to 125 inclusive.

11.4.15 Not applicable.

Additional subclauses:

11.4.101 Type 2.V action

A Type 2.V action shall be so designed that a restart can only be accomplished by a manual **reset** of the system.

Systems classified as Type 2.V shall have a **reset** mechanism classified as Type 2.J.

Compliance is checked by inspection and by test.

11.4.102 Type 2.W action

A Type 2.W action shall be so designed that a restart can only be accomplished by either a manual **reset** or an interruption of the power supply and its subsequent restoration.

Compliance is checked by inspection and by test.

11.4.103 For systems with remotely mounted **reset** buttons, a short circuit between the connecting cables or between the connecting cables and earth shall not result in a **reset**.

11.4.104 Systems classified as Type 2.AE shall perform spark supervision prior to energization of the fuel flow means.

11.4.105 Systems classified as Type 2.AF shall check for correct function of external air pressure/flow control.

The system shall perform **safety shut-down** or **lock-out** or shall fail to start if a positive external air pressure/flow control signal is detected prior to start-up.

The system shall perform **safety shut-down** or **lock-out** if insufficient external air pressure/flow is detected during the **purge time** or when the system is in the **running position**.

11.4.106 Systems classified as Type 2.AG which perform position checks during or prior to the start-up sequence shall continue with the **operating sequence** only after these position checks have been successfully performed.

Compliance with 11.4.103 to 11.4.106 inclusive is checked by inspection and by test.

11.4.107 Systems classified as Type 2.AI shall perform hot surface igniter supervision prior to energization of the fuel flow means.

11.10 Equipment inlets and socket-outlets

11.10.2 Not applicable.

11.11 Requirements during mounting, maintenance and servicing

11.11.6 Not applicable.

11.13 Not applicable.

Additional subclauses:

11.101 Flame detector constructional requirements

11.101.1 **Flame detector** devices using infrared sensors shall only react to the flicker property of the flame.

11.101.2 **Flame detector** devices using ionization sensors (flame rods) shall only make use of the rectification property of the flame.

11.101.3 **Flame detector** devices using UV-tubes shall have sufficient checks for ageing of the UV-tubes.

NOTE Examples of suitable checks are

– automatic periodic supervision of the sensor function;

– a check of the UV-tube during the **purge time** with a voltage 15 % higher than that applied to the UV-tube during the remainder of the **operating sequence**;

– a check that the flame relay has dropped out after each **controlled shut-down** with the amplifier continually energized.

11.101.4 An open circuit of the **flame sensor** or its connecting cables shall cause loss of the **flame signal**.

11.101.5 **Flame detectors** using UV sensors other than UV tubes shall not react to infrared light. Such **flame detectors** shall not indicate a signal for the presence of flame when the sensor is illuminated with 10 lx or less at a colour temperature of 2 856 K with the spectrum being cut off below the wavelength of 400 nm by means of a filter.

11.101.6 Sensors for visible light are not allowed if the illumination intensity is lower than 0,5 lx during **operation**. Systems using sensors for visible light shall not give a detect-of-**flame signal** during **operation** below an illumination intensity of 0,5 lx.

Compliance with 11.101.1 to 11.101.6 inclusive is checked by inspection, test and/or measurement.

11.102 Reset from lock-out function

11.102.1 General

For **automatic controls**, provisions are present to ensure that the appliance can be **reset** from a **lock-out** condition (e. g. caused by overheating of the appliance or no flame establishment).

Traditional methods for resetting heating appliances are:

– conventional mechanical **reset** switch (no or minor simple electronic components present);
– removing the power supply to the control unit (only accepted in case of **volatile lock-out** applications).

New technologies provide more complex **reset** devices, such as:

a) remote **reset** devices (e.g. through communication lines/protocols);
b) intelligent complex **reset** devices (e.g. by means of additional hardware and/or software);
c) infrared or radio frequency controlled **reset** devices;
d) combinations of a) and b) and c) (e.g. through Internet by means of an interface and a portable telephone).

11.102.2 Performance requirements

The **reset from lock-out function** is a **class B control function** according H.27.1.2.2.

A **reset** action from **lock-out** shall be a **manual action**. An automatic **reset** (e.g. **resets** generated by automatic devices, like **timers**, etc.) shall not be possible unless it is accepted by specific application standards.

The **reset** device shall be capable of resetting the **system** in a proper way. Unintended or spontaneous **resets** from lockout shall not occur.

Whenever the **reset** function is performed by a mobile device, at least two **manual actions** are required to activate a **reset**.

Any **fault** within the **reset** function shall not cause the appliance to operate outside the applicable requirements. It shall be detected before the next start-up or shall not prevent the appliance from going to shut-down or **lock-out**.

For **reset** functions where the **manual action** is initiated without being within the visible sight of the appliance, the following additional requirements apply:

– actual status and relevant information of the process under control shall be visible to the **user** before, during and after the **reset** action;
– maximum number of **resets** shall be limited. Where it is not specified in the specific application standard, the number of **resets** shall be limited to five actions within a time span of 15 min or less. Following this, any further **resets** shall be denied unless the appliance is checked.

If the **reset** is activated by manual switching a **thermostat** or device with a similar function, this shall be declared by the manufacturer for approval with the final appliance.

12 Moisture and dust resistance

This clause of Part 1 is applicable.

13 Electric strength and insulation resistance

This clause of Part 1 is applicable except as follows:

13.1 Insulation resistance

Not applicable.

13.2 Electric strength

Additional subclauses:

13.2.101 The electric strength of the high-voltage side of an electronic high-voltage **ignition source** is not checked by the test of 13.2 to 13.2.4 inclusive, but by the tests of 13.2.102 to 13.2.103, which are conducted immediately after the humidity treatment of 12.2.7 and 12.2.8.

NOTE For electronic high-voltage **ignition sources** which are built into the printed circuit board, additional details of the test methods can be agreed between the manufacturer and the test house.

13.2.102 The input supply terminals of the electronic high-voltage **ignition source** are to be connected to a variable voltage supply at rated input mains frequency. The output voltage is measured at 1,0 V_R and 1,1 V_R with the spark gap as declared in requirement 126 of Table 1 (7.2 of the previous edition). Then the electronic high-voltage **ignition source** is subjected to the following tests:

a) all connections to the output terminals are removed. Initially, a voltage not exceeding the rated voltage is applied. Then the input voltage is gradually increased until 150 % of output voltage measured in 13.2.102 (at 1,0 V_R) is achieved. The output voltage is maintained at that value for 1 min; or

b) with the input voltage at 1,1 V_R, the electrode gap is increased from that declared in requirement 126 of Table 1 (7.2 of the previous edition) until either 150 % of the output voltage measured in 13.2.102 (at 1,0 V_R) is achieved or until the output voltage no longer increases, whichever occurs first. This output voltage is maintained for 1 min; or

c) if test methods a) and b) cannot be applied, a test method shall be agreed between manufacturer and test authority in order to achieve 150 % of the output voltage measured in 13.2.102 at 1,0 V_R or the highest possible output voltage for the device. This output voltage is maintained for 1 min.

13.2.103 *Compliance is determined by measuring the output voltage with 1,1 V_R applied to the input terminal and with the spark gap restored to that declared in requirement 126 of Table 1 (7.2 of the previous edition), if applicable. The measured output voltage shall be within ± 10 % of the value measured in 13.2.102 at 1,1 V_R.*

For 13.2.102 a), b) and c), flashovers which occur at an air gap provided to protect the circuitry are ignored. Glow discharges at the output terminal are neglected.

14 Heating

This clause of Part 1 is applicable except as follows:

14.3 Not applicable.

14.4.2 Not applicable.

14.4.3.1 to **14.4.3.3** Not applicable.

14.4.3.4 *Modification:*

*Replace "other **automatic controls**," by "**systems**".*

14.4.4 Not applicable.

14.5.1 *Modification:*

*Replace "**switch head**" by "**system**".*

14.6 *Modification:*

*Replace "**switch head**" by "**system**".*

14.6.2 Not applicable.

14.7 *Modification:*

*Replace "**switch head**" by "**system**".*

Modification to Table 13 (14.1 of the previous edition):

The section entitled "Accessible surfaces of handles, knobs, grips and the like used for carrying and transporting the control" is not applicable.

15 Manufacturing deviation and drift

This clause of Part 1 is replaced by the following:

15.1 **Systems** shall have adequate consistency of manufacture with regard to their declared **operating times**, **operating sequences**, **flame detector operating characteristics**, and **proved igniter operating value**.

15.2 *Compliance is checked by the tests of 15.5, 15.6 ad 15.7.*

15.3 The appropriate **operating time**, **operating sequence**, **flame detector operating characteristics** and **proved igniter operating value** shall be recorded for the sample.

15.4 Three tests shall be conducted for each **operating time**, each **operating sequence**, **flame detector operating characteristics** and each **proved igniter operating value** declared.

15.5 Operating times

Each of the following **operating times** which are declared applicable in Table 1 (7.2 of the previous edition) shall be measured at a voltage of 0,85 V_R a.c. or 0,80 V_R for d.c. and at a temperature of T_{min}.

Measurements shall also be taken at a voltage of 1,1 V_R and a temperature of $\boldsymbol{T_{max}}$.

None of the times recorded shall exceed the manufacturer's declared maximum times nor be less than the manufacturer's declared minimum times, whichever is applicable.

a) **flame detector response time**;

b) **flame detector self-checking rate**;

c) **flame failure lock-out time**;

d) **flame failure re-ignition time (relight time)**;

e) **ignition time**;

f) **main flame establishing period**;

g) **pilot flame establishing period;**

h) **post-ignition time**;

i) **pre-ignition time**;

j) Void;

k) **post-purge time**;

l) **pre-purge time**;

m) **recycle time**;

n) **start-up lock-out time**;

o) **waiting time**;

p) valve opening period;

q) **valve sequence period**;

r) **igniter proving time**;

s) **igniter failure response time**.

NOTE For test purposes, the **flame detector operating characteristics** ($\mathbf{S_1}$ and/or $\mathbf{S_2}$ and/or $\mathbf{S_{max}}$) can be artificially simulated.

15.5.4 Not applicable.

15.6 Operating sequence

The **operating sequence** shall be tested at a voltage of 0,85 V_R a.c. or 0,80 V_R for d.c. and at a temperature of T_{min}. A test shall also be conducted at a voltage of 1,1 V_R and a temperature of $\boldsymbol{T_{max}}$.

The **operating sequence** shall be as declared.

NOTE For test purposes, the **flame detector operating characteristics** ($\mathbf{S_1}$ and/or $\mathbf{S_2}$ and/or $\mathbf{S_{max}}$) can be artificially simulated.

15.7 Flame detector operating characteristics and proved igniter operating value

The operating characteristics of **flame detectors** and **proved igniter operating value** shall be measured under the following conditions:

a) at V_R and (20 ± 5) °C;

b) at 0,85 V_R and 0 °C or T_{min}, whichever is lower, and

c) at 1,1 V_R and 60 °C or $\boldsymbol{T_{max}}$, whichever is higher.

The measured values shall be as declared in Table 1 (7.2 of the previous edition) requirements 123, 124, 125, and 132, as applicable.

The details of the measuring equipment shall be arranged between the manufacturer and the test house.

If a lamp is used for response to the visible range of light, it shall have a colour temperature of 2 856 K.

〖C〉 *deleted note* 〈C〗

16 Environmental stress

This clause of Part 1 is applicable, except as follows:

16.2.4 *Replacement:*

In addition, the appropriate tests of Clause 15 shall be repeated, only at room temperature, after each of the above tests. The values in these tests shall not differ from the values declared in Table 1 (7.2 of the previous edition).

17 Endurance

This clause of Part 1 is applicable, except as follows:

17.1 General requirements

Replacement:

17.1.1 **Systems** including those submitted in or with an appliance shall withstand, without excessive wear or other harmful effect, the mechanical, electrical and thermal stresses that occur in **normal use**.

17.1.2 *Compliance is checked by the tests indicated in 17.1.3.*

17.1.3 Test sequence and conditions

In general, the sequence of tests is:

– *for electronic **systems**, the thermal cycling test specified in 17.16.101;*
– *endurance test of automatic and **manual action** at normal operating rate specified in 17.16.102;*
– *vibration test of 17.16.103, if declared;*
– *endurance test of **automatic action** at accelerated rate specified in 17.16.104.*

NOTE For test conditions, see 17.2 and the relevant tests of 17.16.

*The number of **operations** performed during 17.16.101, 17.16.102 and 17.16.104 is recorded. When the actual number of automatic cycles completed is equal to the number declared in Table 1 (7.2 of the previous edition) requirement 27, this test sequence is concluded and the following sequence is performed:*

– ***lock-out reset** test of 17.16.105;*
– *endurance test of 17.16.106.1, if applicable;*
– *electrical strength requirements specified in 17.16.107;*
– *evaluation of compliance specified in 17.16.108.*

Whenever possible the tests of 17.16.101 to 17.16.105 may be combined.

17.3 (except 17.3.1) to **17.15** Not applicable.

17.16 Tests for particular purpose systems

Additional subclauses:

17.16.101 Thermal cycling test for electronic systems

*The purpose of the test is to cycle components of an electronic circuit between the extremes of temperature likely to occur during **normal use** and which may result from ambient temperature variation, mounting surface temperature variation, supply voltage variation or the change from an operating condition to a non-operating condition and vice versa.*

The following conditions shall form the basis of the test.

a) *Duration of test: 14 days*

b) *Electrical conditions*

*The **system** is loaded according to the ratings declared by the manufacturer, the voltage then being increased to 1,1 V_R except that for 30 min during each 24 h period of the test the voltage is reduced to 0,9 V_R. The change of voltage shall not be synchronized with the change of temperature. Each 24 h period shall also include at least one period in the order of 30 s during which the supply voltage is switched off.*

c) *Thermal conditions*

The ambient temperature and/or the mounting surface temperature are varied between T_{max} and T_{min} to cause the temperature of the components of the electronic circuit to be cycled between their resulting extremes. The rate of ambient and/or mounting surface temperature change shall be in the order of 1 °C/min and the extremes of temperature maintained for approximately 1 h. Care shall be taken to avoid the occurrence of condensation during this test.

d) *Rate of **operation***

*During the test, the **system** shall be cycled through its operational modes at the fastest rate possible up to a maximum of six cycles/min subject to the need to cycle components of the electronic circuit between their temperature extremes.*

17.16.102 Endurance test of automatic and manual action at normal operating rate

17.16.102.1 Test sequence and conditions

The test is carried out with the terminals loaded with the maximum current and the minimum power factor declared by the manufacturer.

*The **system** and its **flame detector** are tested under the following conditions:*

a) *45 000 **operations** at V_R and (20 ± 5) °C;*

〖C〗 *deleted note* 〖C〗

b) *2 500 **operations** at T_{max} and 1,1 V_R or 1,1 times the upper limit of the rated voltage range;*

c) *2 500 **operations** at T_{min} and 0,85 V_R or 0,85 times the lower limit of the rated voltage range for a.c. and 0,80 V_R or 0,80 times the lower limit of the rated voltage range for d.c.*

17.16.103 Vibration test

***Systems** declared in Table 1 (7.2 of the previous edition), requirement 122 are subjected to the vibration test of IEC 60068-2-6 as follows:*

Cycling rate:	*as declared*
Loaded at:	*1,1 V_R*
Frequency range:	*10 Hz to 150 Hz*
Acceleration amplitude:	*1 g or higher if declared by the manufacturer*
Sweep rate:	*1 octave/min*
No. of sweep cycles:	*10*
No. of axes:	*3, mutually perpendicular*

17.16.104 Endurance test of automatic action at accelerated rate

This test shall be conducted at V_R, I_R and T_{max}.

*The following means may be used to accelerate the test time of the **systems**:*

– *substitution of the components of the electronic circuit previously found acceptable under the abnormal **operation** test of Clause H.27;*
– *modification of control circuits to eliminate the portions of control programming that do not affect the **operating time** of the **system** or **system** component being tested;*
– *applying additional heating or external cooling to the thermal **timers** in the manner that does not alter the normal operating characteristics of the **timer** other than its timing.*

NOTE The electromechanical components can be tested separately under the operating conditions to which they are subjected when incorporated into the **system** circuit, including the electrical loading of the contacts.

An additional sample may be required for this test.

17.16.105 Lock-out reset test

*The **system** is also tested under the following **lock-out** conditions, mounted as declared in Table 1 (7.2 of the previous edition), requirement 31:*

– *the first half of the declared cycles (see requirement 26 and note 101 to Table 1 (7.2 of the previous edition)), without flame presence;*
– *the second half of the declared cycles, the flame disappearing during **operation**.*

*During the tests described above, the **system** is operated in such a way that the normal start-up sequence is performed.*

The repetitions of the sequence shall be compatible with the method of **operation** of the **system** and shall be dependent on the cycling rate, if any, declared by the manufacturer.

17.16.106 Components of systems which are declared for operation in an ambient temperature above 125 °C

17.16.106.1 Endurance test

*For **system** components which are declared in Table 1 (7.2 of the previous edition) requirement 22, for **operation** in an ambient temperature above 125 °C, but not subjected to this temperature during the tests of 17.16.101 to 17.16.104, the **system** components are mounted as declared in Table 1 (7.2 of the previous edition), requirement 31. The **system** components are placed in a test chamber and cycled for the declared number of cycles.*

*During the "ON" cycle, the temperature of the **system** components is raised to within + 5 % of the maximum operating temperature declared by the manufacturer.*

*During the "OFF" cycle, the test chamber heat source is interrupted and the **system** components cooled naturally or by passing room temperature air over the components as specified by the manufacturer, until the temperature is reduced to 125 °C or less as necessary to permit the **system** to complete the current cycle.*

17.16.107 Electric strength requirements

After all the tests of 17.16.101 to 17.16.107 inclusive, the requirements of 13.2 shall apply, with the exception that the samples are not subjected to the humidity treatment before the application of the test voltage.

17.16.108 Evaluation of compliance

*After completion of all applicable tests of 17.16.101 to 17.16.107 inclusive, the sample shall be retested according to Clause 15. The **operating times**, **operating sequence**, **flame detector operating characteristics**, and **proved igniter operating value** shall be as declared in Table 1 (7.2 of the previous edition).*

*For **systems** providing **electronic disconnection** (Type 1.Y or 2.Y), the requirements of H.11.4.16 are still met.*

18 Mechanical strength

This clause of Part 1 is applicable except as follows:

18.2 Impact resistance

18.2.4.1 Not applicable.

18.5 to **18.8** Not applicable.

19 Threaded parts and connections

This clause of Part 1 is applicable.

20 Creepage distances, clearances and distances through solid insulation

This clause of Part 1 is applicable except as follows:

Addition:

For the high-voltage side of electronic high-voltage **ignition sources**, the requirements of Clause 20 are not applicable.

21 Resistance to heat, fire and tracking

This clause of Part 1 is applicable.

22 Resistance to corrosion

This clause of Part 1 is applicable.

23 Electromagnetic compatibility (EMC) requirements – emission

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable.

25 Normal operation

This clause of Part 1 is applicable.

26 Electromagnetic compatibility (EMC) requirements – immunity

See Annex H.

27 Abnormal operation

This clause of Part 1 is applicable except as follows:

27.3 Over-voltage and under-voltage test

Not applicable.

28 Guidance on the use of electronic disconnection

This clause of Part 1 is applicable.

Figures

The figures of Part 1 are applicable

Annexes

The annexes of Part 1 are applicable except as follows:

Annex H
(normative)

Requirements for electronic controls

H.7 Information

This clause of Part 1 is applicable except as follows:

Table H.1 (7.2 of the previous edition)

Modification:

Information		Clause or subclause	Method
52	Not applicable		
58a	Not applicable		
58b	Not applicable		
60	Not applicable		
Modify the existing requirement:			
71	Not applicable		
Add the following additional requirement:			
119	Defined state ”out of operation”	H.26.8.2	X
Add the following additional requirement:			
121	The effect on solid-state outputs for motors, transformers, valves, etc. as a result of the tests of Clause H.26	H.26.2	X
Add the following additional requirement:			
136	Software fault/error detection time(s) for controls of software class C [12), 104)]	H.27.1.2.3	X
NOTES:			
Additional notes:			
104)	The fault/error detection time is the period between the execution (after the fault has occurred), of the relevant software segment, either for function or for checking purposes and the completion of the declared control response.		

H.17 Endurance

This clause of Part 1 is not applicable.

See 17.16.101.

H.26 Electromagnetic compatibility (EMC) requirements – Immunity

This clause of Part 1 is applicable except as follows:

H.26.1 *Modification:*

The third paragraph is not applicable.

H.26.2 *Replacement:*

Compliance is checked according to the criteria described in each of the Subclauses H.26.5 to H.26.12 inclusive.

H.26.5 Voltage dips and voltage interruptions in the power supply network

H.26.5.2 Test values

Replacement:

The **system** shall tolerate voltage dips, short interruptions and voltage variations in the electricity supply so that, when tested in accordance with H.26.5.3,

a) for assessment a): it shall continue to function in accordance with the requirements of this standard. It shall neither proceed to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;

b) for assessment b): either it shall perform as in a) or it may proceed to **safety shut-down** followed by a **system restart**, or if in **volatile lock-out** it may proceed to a **system restart**.

NOTE **Non-volatile lock-out** excludes the use of **system restart**.

When the power supply is restored, the **system restart** shall comply with the requirements for a start-up sequence.

Requirement b) can be ignored, provided that the power **failure** is less than 60 s and occurs within 60 s after call for heat. On restoration of the power, the programme may be continued from the point at which it was interrupted.

A shortened start-up sequence, for example, a start-up sequence without pre-purge or **waiting time**, is allowed, provided that the power **failure** occurs within 60 s after the end of the start-up sequence and is shorter than 60 s.

Table H.101 – Voltage dips, short interruptions and voltage variations

Assessment criteria	Duration	Δ*U*		
		30 %	60 %	100 %
a)	Half-cycle of supply waveform			X
	One cycle of supply waveform			X
b)	2,5 cycles	X	X	X
	25 cycles	X	X	X
	50 cycles	X	X	X

The test shall be performed in accordance with H.26.5.3.

H.26.5.3 Test procedure

Replacement:

The **system** is tested in accordance with IEC 61000-4-11.

The supply voltage to the **system** shall be reduced according to the values shown in Table H.101. The voltage dips, short interruptions and voltage variations shall be performed at random phase with respect to mains frequency three times in each of the following operating conditions:

a) during pre-purge or **waiting time**;

b) during **start-up lock-out time(s)**;

c) in the **running position**;

d) in the **lock-out** position.

Between the voltage dips, short interruptions and voltage variations, a **waiting time** of at least 10 s shall be observed.

H.26.5.4.1 Purpose of the test

Replacement:

The purpose of the test is to verify the immunity of the control against voltage change taking place over a short period which may occur due to a change of load or stored energy in local power networks. The control shall operate according to the functional specification (see 11.3.105) at least within the voltage tolerance band of the rated voltage $^{+10}_{-15}$ %, and below –15 % of the rated voltage, the control shall stay safe.

H.26.5.4.2 The duration and procedure

Replacement:

The duration of the voltage changes and the time for which the reduced voltages are to be maintained are given in Table H.13 (Table H.26.5.4.2 of the previous edition) and illustrated in Figure H.2 (Figure H.26.5.4.2 of the previous edition). The rate of change of voltage shall be constant; however, the voltage is allowed to be stepped. The steps shall be positioned at zero crossing and shall be not larger than 10 % of V_R. Steps under 1 % of V_R are evaluated as constant rate of change of voltage.

The control, in the **running position**, is supplied at rated voltage, or at the lowest rated voltage of a rated voltage range. After approximately 1 min, the power supply voltage is reduced to a level such that the control ceases to respond to safety related inputs and/or drive safety related outputs (e.g. **flame signal**, fuel valve).

This value of the supply voltage is recorded.

Table H.13 (Table H.26.5.4.2 of the previous edition) **–**
Timing of short-term supply voltage variations

Voltage test level	Time for decreasing voltage	Time at reduced voltage	Time for increasing voltage
Recorded value – 10 %	60 s ± 20 %	10 s ± 20 %	60 s ± 20 %
0 V	60 s ± 20 %	10 s ± 20 %	60 s ± 20 %

In the voltage range of **operation**, from rated voltage to 1,05 times of the recorded value, the control shall conform to 11.3.105 a). In the voltage range of **operation**, between 85 % of the rated voltage and 1,05 times of the recorded value, the control shall conform to 11.3.105 b).

For test purposes, precautions shall be taken to ensure that signals e.g. from sensors or switches that can initiate a safety action and the presence of which normally may be independent of the supply voltage, are present at any level of the supply voltage. The signal may be simulated to prevent the control de-energizing the safety relevant output(s) as a result of disappearance of such input signals.

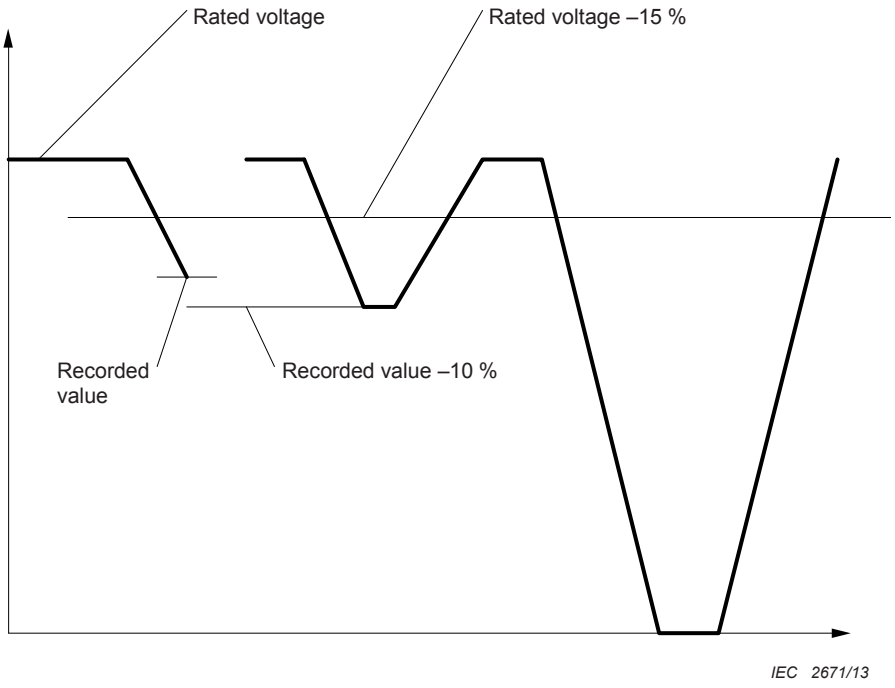

Figure H.2 (H.26.5.4.2 of the previous version) **– Voltage variation test**

H.26.5.4.3 *Addition:*

Each of the above tests is repeated three times in each of the operating conditions indicated in H.26.5.3.

After the tests, the **system**:

a) shall continue to function in accordance with the requirements of this standard. It shall neither proceed to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**, or

b) shall either perform as in a) or it may proceed to **safety shut-down** followed by a **system restart**, or if in **volatile lock-out**, it may proceed to a **system restart**.

NOTE **Non-volatile lock-out** excludes the use of **system restart**.

H.26.6 Test of influence of voltage unbalance

Not applicable.

H.26.8 Surge immunity test

H.26.8.2 Test values

Addition:

The **system** shall tolerate voltage surges on the mains supply and relevant signal terminals, so that, when tested in accordance with H.26.8.3,

a) for the values of Table H.14 (Table H.26.8.2 of the previous edition) installation class 2, it shall continue to function in accordance with the requirements of this standard. It shall neither proceed to **safety shut-down** or **lock-out** nor shall it **reset** from **lock-out**;

b) for the values of Table H.14 installation class 3 for all listed tests, either it shall perform as in a) or it may proceed to **safety shut-down**, which may be followed by a **system restart**, or if in **volatile lock-out** it may proceed to a **system restart**.

NOTE **Non-volatile lock-out** excludes the use of **system restart**.

c) for the values of Table H.14 installation class 4 with line to earth on power supply only, either it shall perform as in a) or b) or it shall go into the defined state “out of **operation**” as declared by the manufacturer in accordance with Table 1 (7.2 of the previous edition) requirement 119.

For compliance criteria a) and b), after the tests as detailed in Table H.14 (H.26.8.2 of the previous edition), the surge protective components shall not be destroyed.

H.26.8.3 Test procedure

Replacement of the second paragraph:

*The test shall be carried out by subjecting the **system** to five pulses and with the voltage and current values listed in Table H.14 at intervals of not less than 60 s.*

The five pulses of each polarity (+, –) and each phase angle as described in IEC 61000-4-5 are delivered in the following order:

*a) 2 pulses with the **system** in the **lock-out** position;*

*b) 1 pulse with the **system** in the **running position**;*

c) 2 pulses randomly applied during the start-up sequence.

The tests on interface cables are not carried out if the manufacturer explicitly specifies that the length of that cable shall not exceed 10 m.

If “VDR” are used as surge protective devices, they shall comply with IEC 61643-11. Additionally, they shall be selected to withstand the impulses corresponding to the installation class level.

For controls having surge protective device arresters incorporating spark gaps, the test is repeated at a level that is 95 % of the flashover voltage.

H.26.9 Electrical fast transient/burst test

H.26.9.2 Test levels

Replacement of "Table H.15" by "Table H.102" in the first paragraph.

Replacement of Table H.15 by Table H.102.

Table H.102 – Test level for electrical fast transient burst

		L1, L2, PE		I/O	
Assessment criteria	**Severity level in accordance with IEC 61000-4-4**	**Voltage peak** kV	**Repetition rate** KHz	**Voltage peak** kV	**Repetition rate** kHz
a)	2	1	5	0,5	5
b)	3	2	5	1	5
c)	4	4	5	-	-

H.26.9.3 Test procedure

Replacement:

The **system** shall tolerate electrical fast/transient bursts on the mains supply and signal lines, so that, when tested in accordance with H.26.9.2,

a) for assessment criteria a): it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, not shall it **reset** from **lock-out**;

b) for assessment criteria b): either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart**, or if in **volatile lock-out**, it may proceed to a **system restart**;

NOTE **Non-volatile lock-out** excludes the use of **system restart**.

c) for assessment criteria c), either it shall perform as in a) or b) or it shall be set out of **operation** into a defined state as declared by the manufacturer in accordance with Table 1 (7.2 of the previous edition) requirement 119.

The test shall be performed for 20 cycles with the **system** having reached the **running position**, remaining in the **running position** for a minimum of 30 s within each cycle. The test shall also be performed for a minimum of 2 min with the **system** in the **lock-out** position and with the **system** in the stand-by position.

〖C〉 Void 〈C〗

H.26.11 Electrostatic discharge test

Additional subclauses:

H.26.11.101 Test and operating conditions

This test is carried out in accordance with IEC 61000-4-2.

H.26.11.102 Test conditions

Table H.104 – Test levels for electrostatic discharge

Assessment criteria	Severity level	Contact discharge	Air discharge
a)	2	4 kV	4 kV
b)	4	8 kV	15 kV

The **system** has to be tested in each of the following conditions:

– **start position**;
– **running position**;
– **lock-out** position.

H.26.11.103 Operating conditions/compliance

*The **system** shall tolerate electrostatic discharges so that, when tested in accordance with H.26.11,*

*a) for assessment criteria a): it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;*

*b) for assessment criteria b): either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart**, or if in **volatile lock-out** it may proceed to a **system restart**.*

NOTE 1 **Non-volatile lock-out** excludes the use of **system restart**.

〖C〉 *deleted note* 〈C〗

H.26.12 Radio-frequency electromagnetic field immunity

H.26.12.2.1 Test levels for conducted disturbances

Replacement:

Table H.105 – Test levels for conducted disturbances on mains and I/O lines

		Frequency range 150 kHz to 80 MHz	
Assessment criteria	Severity level	Voltage level (e.m.f) U_o V	
		150 kHz to 80 MHz	ISM and CB bands
a)	2	3	6
b)	3	10	20
The levels in the ISM, CB bands are chosen to be 6 dB higher.			
ISM: Industrial, scientific and medical radio frequency equipment 13,56 ± 0,007 MHz, 40,68 ± 0,02 MHz.			
CB: Citizen band: 27,125 ± 1,5 MHz.			

The tests on interface cables are not carried out if the manufacturer explicitly specifies that the length of that cable shall not exceed 1 m.

H.26.12.2.2 Test procedure

Addition:

*The **system** shall be swept through the complete frequency range at least once with the **system** in each of the following positions:*

- ***start position**;*
- ***running position**;*
- ***lock-out** position.*

*The **system** is subjected to two sweeps of the frequency range from minimum to maximum at the indicated severity level. One sweep is performed with the **system** in the **lock-out** condition. The other sweep is performed during the remainder of the **operating sequence**.*

Additional subclause:

H.26.12.2.101 Compliance

*The **system** shall tolerate conducted electromagnetic fields so that, when tested in accordance with H.26.12.2.1,*

*a) for test level 2a: it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;*

*b) for test level 3: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart**, or if in **volatile lock-out** it may proceed to a **system restart**.*

NOTE **Non-volatile lock-out** excludes the use of **system restart**.

H.26.12.3 Radiated electromagnetic fields immunity evaluation

H.26.12.3.1 Test level for radiated electromagnetic fields

Replacement:

Table H.18 (Table H.26.12.3.1 of the previous edition) **–**
Immunity to radiated electromagnetic fields

		Frequency range 80 MHz to 1 000 MHz	
Assessment criteria	**Severity level**	**Test field strength** V/m	
		80 MHz to 1 000 MHz	**ISM and GSM bands**
a)	2	3	6
b)	3	10	20
The levels in the ISM and GSM bands are chosen to be 6 dB higher.			
ISM: Industrial, scientific and medical radio-frequency equipment 433,92 ± 0,87 MHz.			
GSM: Group special mobile: 900 MHz ± 5,0 MHz, modulated by 200 Hz ±1 % pulses of equal mark/space ratio (2,5 ms on and 2,5 ms off).			

H.26.12.3.2 Test procedure

Addition:

*The **system** has to be swept through the complete frequency range at least once with the **system** in each of the following positions:*

– ***start position**;*
– ***running position**;*
– ***lock-out** position.*

Additional subclause:

H.26.12.3.101 Compliance

*The **system** shall tolerate radiated electromagnetic fields so that, when tested in accordance with H 26.12.3.2,*

*a) for the values of Table H.18 (Table H.26.12.3.1 of the previous edition), assessment criteria a): it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**;*

*b) for the values of Table H.18 (Table H.26.12.3.1 of the previous edition), assessment criteria b): either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart**, or if in **volatile lock-out** it may proceed to a **system restart**.*

NOTE **Non-volatile lock-out** excludes the use of **system restart**.

H.26.13 Test of influence of supply frequency variations

H.26.13.2 Test levels

Addition, after Table H.19:

The **system** shall tolerate supply frequency variations such that, when tested in accordance with H.26.13.3,

a) for the values of Table H.19, test level 2: it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**. Variation in programme timings shall not exceed the percentage of applied frequency variations;
b) for the values of Table H.19, test level 3: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart**, or if in **volatile lock-out** it may proceed to a **system restart**.

NOTE **Non-volatile lock-out** excludes the use of **system restart**.

H.26.13.3 Test procedure

Addition:

*The test shall be performed at least once with the **system** in each of the following positions:*

– **start position**;
– **running position**;
– **lock-out** position.

H.26.14 Power frequency magnetic field immunity test

H.26.14.2 Test levels

Addition, after Table H.20:

The **system** shall tolerate power frequency magnetic fields so that, when tested in accordance with H.26.14.3,

a) for the values of Table H.20, severity level 2: it shall continue to function in accordance with the requirements of this standard. It shall neither go to **safety shut-down** or **lock-out**, nor shall it **reset** from **lock-out**.
b) for the values of Table H.20, severity level 3: either it shall perform as in a) or it may proceed to **safety shut-down** which may be followed by a **system restart**, or if in **volatile lock-out** it may proceed to a **system restart**.

NOTE **Non-volatile lock-out** excludes the use of **system restart**.

H.26.14.3 Test procedure

Addition:

The test shall be done at least once with the **system** in each of the following positions:

– **start position**;
– **running position**;
– **lock-out** position.

H.26.15 Evaluation of compliance

This subclause of Part 1 is not applicable.

H.27 Abnormal operation

This clause of Part 1 is applicable except as follows:

H.27.1.1.3

The third paragraph of a) is not applicable.

Add the following new item:

h) For **proved igniter systems**, the **proved igniter operating value** shall not exceed or be less than, as applicable, the values declared by the manufacturer (Table 1 (7.2 of the previous edition), requirement 132).

H.27.1.1.5 Electronic circuit fault conditions

Table H.21 (Table H.27.1 of the previous edition) **– Electrical/electronic component fault modes table**

Modification:

Add to item 3 in note 7 in Table H.21 the following:

The nominal cycles are 250 000.

〖C〗 *deleted note* 〖C〗

Replace note 12 as follows:

[12] For the assessment according H.27.1.1.3, the short-circuit **failure** mode is excluded if the requirements of Clause 20 are met. For the assessment according H.27.1.2, the short-circuit **failure** mode is excluded if the requirements of Clause 20 for **overvoltage category** III are met.

H.27.1.2 Protection against internal faults to ensure functional safety

H.27.1.2.2 Class B control function

This subclause of Part 1 is applicable for the **reset** from **lock-out** control function.

H.27.1.2.3 Class C control function

〖C〗 *deleted text* 〖C〗

H.27.1.2.3.1 Design and construction requirements

Replacement of the last paragraph by the following:

The circuitry and the construction of the **system** shall be such that they meet the requirements of 11.3.101 to 11.3.113 inclusive, 11.4.101 to 11.4.107 and 11.101 and shall be appraised according to the requirements to H.27.1.2.3.2, H.27.1.2.3.3 and H.27.1.2.4 and under the test conditions and criteria of H.27.1.2.5.

H.27.1.2.3.2 First fault

Replacement:

Any **fault** (see Table H.21) in any one electronic component or any one **fault** together with any other **fault** arising from the first **fault** shall result in either

a) the **system** proceeding to **safety shut-down** within the **fault**/error detection time as declared by the manufacturer in accordance with Table 1, requirement 136 (terminals for fuel flow means are de-energized) and it remains in this condition as long as the **fault** appears; or

b) the **system** proceeding to **lock-out** within the **fault**/error detection time as declared by the manufacturer in accordance with Table 1, requirement 136 provided that the subsequent **reset** from **lock-out** under the same **fault** condition results in **lock-out**; or

c) the **system** continuing to operate, the **fault** being identified during the next start-up sequence, the result being a) or b); or

d) the **system** remaining operational in accordance with Clause 15.

For automatic **burner control systems** design for non-permanent **operation**, c) is applicable whereas c) is not applicable for automatic **burner control systems** designed for permanent **operation**.

H.27.1.2.3.3 Second fault

Replacement of the third paragraph by the following:

For automatic **burner control systems** design for non-permanent **operation** the second **fault** shall be considered according to option a) whereas option b) is applicable for automatic **burner control systems** designed for permanent **operation**.

H.27.1.2.4.2 Second faults introduced during lock-out or safety shut-down

Addition:

During assessment, the first **fault** shall not be considered to occur within 24 h after **lock-out** or **safety shut-down** is reached without an internal **fault**.

NOTE 101 While conducting this test, the **fault** can be applied at any time during the **lock-out** or **safety shut-down** condition. 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** can be applied 24 h after reaching **lock-out** or **safety shut-down**.

The “safe situation” as mentioned in H.27.1.2.4.1 is defined:

– as valve terminals remaining de-energized;

– as valve terminals are energized not longer than the safety time.

NOTE 102 For independent **flame detector** devices the de-energization of the **flame signal** output resulting in a “flame off” signal is equivalent to these definitions.

H.27.1.2.4.3 Second fault introduced during lock-out or safety shut-down

Addition:

While conducting this test, the second **fault** can be applied at any time during the **lock-out** or **safety shut-down** condition. It is not necessary to wait 24 h before applying the second **fault**. If the second **fault** was applied before 24 h and unacceptable results were obtained, the initial **fault** shall be applied and then wait 24 h before applying the second **fault**.

Annex J
(normative)

Requirements for controls using thermistors

J.1 Scope

This clause of Part 1 is applicable except as follows:

J.1.1.1 *Addition:*

NOTE 101 A hot surface igniter is not considered to be a thermistor.

Annex BB
(informative)

Functional characteristics of burner control systems to be specified by the relevant appliance standards, as applicable

Table BB.1 – Functional characteristics of burner control systems to be specified by the relevant appliance standards, as applicable

Item	Subclause	Remarks
Multitry system	2.2.107	Allowed or not
Automatic recycle	2.3.101	Allowed or not
Flame detector response time	2.3.103	Maximum time
Self-checking flame detector	2.3.105	Required or not
Flame detector self-checking rate	2.3.106	Minimum rate
Flame failure lock-out time	2.3.107	Maximum time
Flame failure re-ignition time	2.3.108	Maximum time
Ignition time	2.3.111	Maximum time
Non-volatile lock-out	2.3.112.1	Required or not
Volatile lock-out	2.3.112.2	Allowed or not
Main flame establishing period	2.3.113	Maximum time
Pilot flame establishing period	2.3.114	Maximum time
Post-ignition time	2.3.115	Maximum time
Pre-ignition time	2.3.116	Maximum time
Proved igniter	2.3.117	Required or not
Purge time	2.3.118	Minimum time
Post-purge time	2.3.118.1	Minimum time
Pre-purge time	2.3.118.2	Minimum time
Re-ignition	2.3.119	Allowed or not
Recycle time	2.3.120	Minimum time
Start-up lock-out time	2.3.125	Maximum time
Waiting time	2.3.126	Minimum time
Valve open period	2.3.127	Maximum time
Valve sequence period	2.3.128	Maximum time
System for permanent operation	2.5.101	Required or not
System for non-permanent operation	2.5.102	Allowed or not

Bibliography

Bibliography of Part 1 is applicable except as follows:

Addition:

IEC 60989:1991, *Separating transformers, autotransformers, variable transformers and reactors*

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