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Electrical equipment for furnaces and ancillary equipment - Part 1: Requirements for application design and installation

Elektrische Ausrüstung von Feuerungsanlagen und zugehörige Einrichtungen - Teil 1: Bestimmungen für die Anwendungsplanung und Errichtung

Equipements électriques d'installation de chaudière - Partie 1: Règles pour la conception, pour l'application et l'installation

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27.060.01	Gorilniki in grelniki vode na splošno	Burners and boilers in general
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Electrical equipment for furnaces and ancillary equipment - Part 1: Requirements for application design and installation

Equipements électriques d'installation de chaudière - Partie
1: Règles pour la conception, pour l'application et
l'installation

Elektrische Ausrüstung von Feuerungsanlagen und
zugehörige Einrichtungen - Teil 1: Bestimmungen für die
Anwendungsplanung und Errichtung

This European Standard was approved by CENELEC on 2015-01-26. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

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

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EN 50156-1:2015 (E)**European foreword**

This document (EN 50156-1:2015) has been prepared by CLC/BTTF 132-2 "Revision of EN 50156 "Electrical equipment for furnaces and ancillary equipment" in cooperation with the National Committee DKE/K 232.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2016-01-26
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2018-01-26

This document supersedes EN 50156-1:2004.

EN 50156-1:2015 includes the following significant technical changes with respect to EN 50156-1:2004:

- harmonization of the definitions to the new version of EN 61508;
- check and updating of the normative references;
- elimination of all normative references to the machinery directive 2006/42/EC;
- alignment to the requirements for safety related system to EN 12952 and EN 12953;
- modifications in Clause 10.

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

Requirements of this standard covers the essential safety requirements for limiting devices in the scope of this standard which are safety accessories in the sense of pressure equipment directive 97/23/EG, which are classified in the category II and higher.

This standard is the first part of a series of European standards which specify the requirements for equipment of safety functions for furnaces, especially safety related system to protect personnel, the furnace with ancillary equipment against hazards related to heat generation, the heated system and to operate reliably during normal conditions, and abnormal conditions which can be foreseen.

This European Standard has been prepared by the German National Committee with the participation of experts of other National Committees on the basis of CLC/BT(DE/NOT)140. It is divided into 3 parts under the generic title "*Electrical equipment for furnaces and ancillary equipment*":

- Part 1: Requirements for application design and installation;
- Part 2: Requirements for design, development and type approval of safety-relevant equipment;
- Part 3: Requirements for plant-specific tests of safety-relevant equipment.

This European Standard is based on the EN 61508:2010 "*Functional safety of electrical/electronic/programmable electronic safety-related systems*", Parts 1 to 7 as a basic safety standard.

Introduction

This part of the European Standard EN 50156 specifies the requirements and recommendations for the application design and installation of electrical and control equipment for furnaces and ancillary equipment and for the systems heated by the thermal energy released in the furnace to ensure:

- safety of personnel, property and the environment;
- consistency of proper function.

The operating conditions of the furnace, the hazards of combustion and the safety of heated systems are considered.

A safety-related system consisting of safety devices for:

- monitoring of flames and other safety conditions of the firing;
- interrupting the flow of fuel to the furnace;
- ventilating the body of the furnace and the flue gas ducts;
- monitoring of the safety condition of the heated systems (e.g. water level limiter in steam boilers);

may be necessary to ensure proper ignition and combustion of fuel and to avoid the development, existence and/or ignition of an explosive mixture of fuel and air, and also to avoid damage to the heated systems (see 3.25).

The rating of necessary safety integrity levels is based on EN 61508-1.

Figure 1 is provided as an aid to understanding the relationship between the various elements of furnaces and their ancillary equipment, the heated systems, the control system and the safety-related systems.

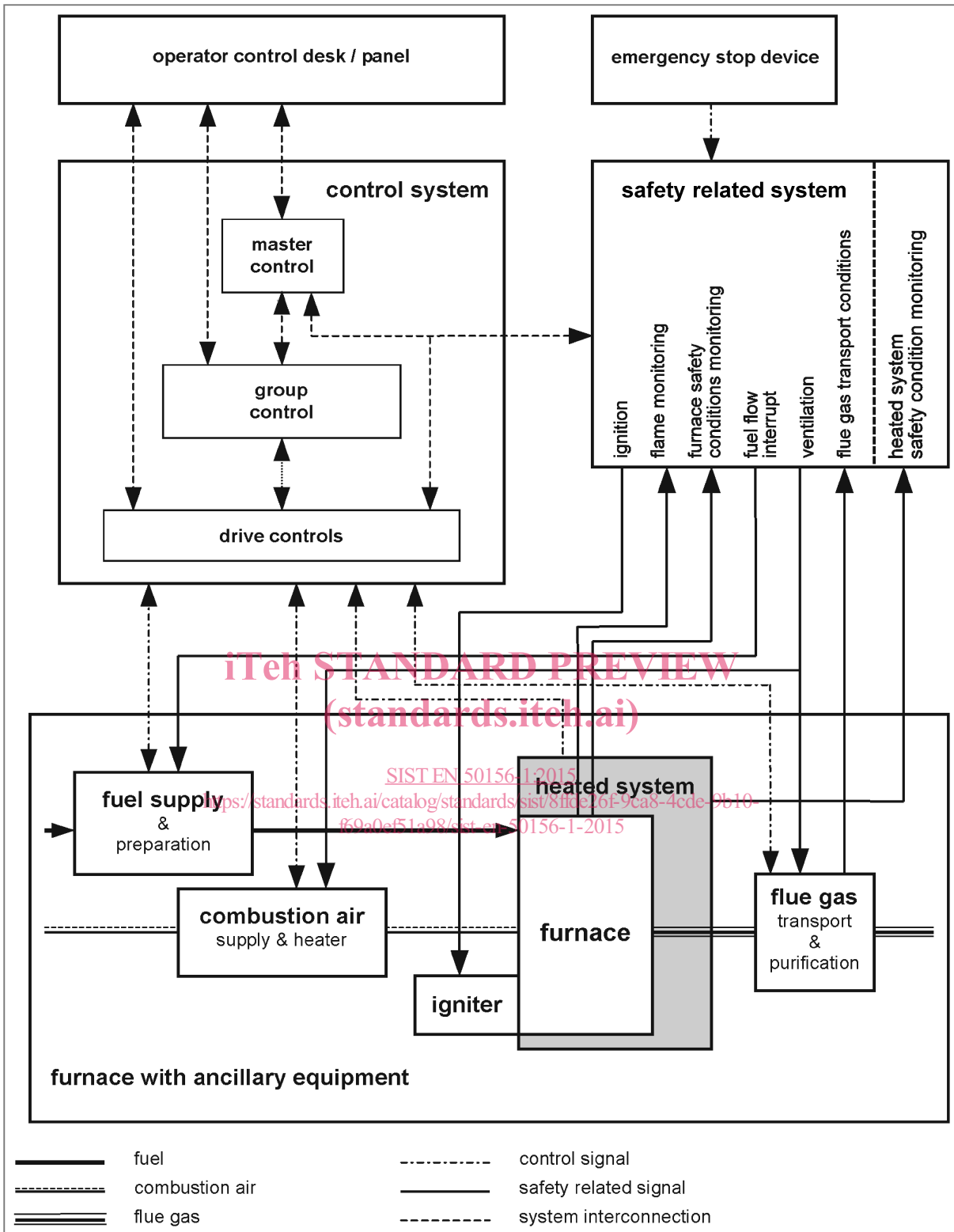


Figure 1 – Example of the functionality of a furnace with ancillary equipment, heated systems and relationship to control system and safety related system

1 Scope

This European Standard applies to the application design and installation of electrical equipment, control circuits and safety-related systems for furnaces which are operated with solid, liquid or gaseous fuels and their ancillary equipment. It specifies requirements to meet the operating conditions of furnaces, to reduce the hazards of combustion and to protect the heated systems from damage e.g. by overheating.

Such furnaces and the electrical equipment may be part by way of example of the following plant:

- a) water heating systems;
- b) steam boiler installations (steam and hot-water boilers) and heat recovery steam boilers;

NOTE 1 The requirements of this standard apply according to the electrical equipment of electrically heated steam boilers.

NOTE 2 Seagoing vessels and offshore facilities are governed by International Maritime Law and as such are not within the scope of this standard. These requirements may be used for such facilities.

- c) warm air heaters;
- d) hot-gas heaters;
- e) heat exchanger systems;
- f) combustion chambers of stationary turbines;
- g) as long as no other standard is applicable for combined heat and power stations, we recommend the use of the requirements of this standard;
- h) This standard may also be used as reference for electrical equipment requirements for thermo-processing equipment;

The requirements in this standard are not applicable to electrical equipment for:

- i) non-electrically heated appliances and burner control systems for household and similar purposes;
- j) furnaces using technologies for the direct conversion of heat into electrical energy;
- k) combustion chambers of non-stationary prime movers and turbines;
- l) central oil supply systems for individual heating appliances;
- m) furnaces using solid fuels for heating purposes for household use with a nominal thermal output up to 1 MW;
- n) furnaces which are used to heat process fluids and gasses in chemical plant.

This European Standard may be used as a basis for the requirements placed on electrical equipment for furnaces, which are excluded from its field of application.

EN 50156-1:2015 (E)**2 Normative references**

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12952-7:2012, *Water-tube boilers and auxiliary installations - Part 7: Requirements for equipment for the boiler*

EN 12952-8:2002, *Water-tube boilers and auxiliary installations - Part 8: Requirements for firing systems for liquid and gaseous fuels for the boiler*

EN 12952-9:2002, *Water-tube boilers and auxiliary installations - Part 9: Requirements for firing systems for pulverized solid fuels for the boiler*

EN 12952-16:2002, *Water-tube boilers and auxiliary installations - Part 16: Requirements for grate and fluidized-bed firing systems for solid fuels for the boiler*

EN 12953-6:2011, *Shell Boilers - Part 6: Requirements for equipment for the boiler*

EN 12953-7:2002, *Shell boilers - Part 7: Requirements for firing systems for liquid and gaseous fuels for the boilers*

EN 12953-12:2003, *Shell boilers - Part 12: Requirements for grate firing systems for solid fuels for the boiler*

EN 55011:2009, *Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement (CISPR 11:2009, mod.)*

EN 55022:2010, *Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement (CISPR 22:2008, mod.)*

EN 60034 all parts, *Rotating electrical machines (IEC 60034-1, all parts)*

EN 60309-1:1999, *Plugs, socket-outlets and couplers for industrial purposes - Part 1: General requirements (IEC 60309-1:1999)*

EN 60332-1-1, *Tests on electric and optical fibre cables under fire conditions - Part 1-1: Test for vertical flame propagation for a single insulated wire or cable - Apparatus*

EN 60332-2-1, *Tests on electric and optical fibre cables under fire conditions - Part 2-1: Test for vertical flame propagation for a single small insulated wire or cable - Apparatus*

EN 60445:2010, *Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals, conductor terminations and conductors (IEC 60445:2010)*

EN 60529:1991, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

EN 60654-3:1997, *Operating conditions for industrial-process measurement and control equipment - Part 3: Mechanical influences (IEC 60654-3:1983)*

EN 60664-1:2007, *Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests (IEC 60664-1:2007)*

EN 60947-2:2006, *Low-voltage switch gear and control gear – Part 2: Circuit-breakers (IEC 60947-2:2006)*

EN 60947-3:2009, *Low-voltage switchgear and controlgear - Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units (IEC 60947-3:2008)*

EN 60947-4-1:2010, *Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters (IEC 60947-4-1:2009)*

EN 60947-5-1:2004, *Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices (IEC 60947-5-1:2003)*

EN 61000-4, all parts, *Electromagnetic compatibility (EMC) (IEC 61000-4, all parts)*

FprEN 61000-6-7:2014, *Electromagnetic compatibility (EMC) - Part 6-7: Generic standards - Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations (IEC 61000-4-7:201X)*

EN 61082-1:2006, *Preparation of documents used in electrotechnology - Part 1: Rules (IEC 61082-1:2006)*

EN 61508-1:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 1: General requirements (IEC 61508-1:2010)*

EN 61508-2:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems (IEC 61508-2:2010)*

EN 61508-6:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3 (IEC 61508-6:2010)*

EN 61558-1:2005, *Safety of power transformers, power supplies, reactors and similar products - Part 1: General requirements and tests (IEC 61558-1:2005)*

EN 61810-1:2008, *Electromechanical elementary relays - Part 1: General requirements (IEC 61810-1:2008)*

HD 60364-4 (all parts), *Low-voltage electrical installations – Part 4: Protection for safety (IEC 60364-4, all parts)*

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HD 60364-4-41:2007, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock (IEC 60364-4-41:2005, modified)*

EN 81346-1, *Industrial systems, installations and equipment and industrial products - Structuring principles and reference designations - Part 1: Basic rules (IEC 81346-1)*

IEC 60417, *Graphical symbols for use on equipment (IEC 60417 all parts)*

IEC 60536-2:1992, *Classification of electrical and electronic equipment with regard to protection against electric shock – Part 2: Guide to requirements for protection against electric shock*

IEC 60617, *Graphical symbols for diagrams*

ISO 3864, *Safety colours and safety signs*

3 Terms and definitions

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

3.1

actuating element

component which produces changes in other electrical circuits or volume flows (e.g. fuel, air) as a result of the effect of changes in signal

Note 1 to entry: Examples are valves, switches and motors including their common auxiliaries, also for example solenoid valve with magnetic actuation and final control element for direct process control

EN 50156-1:2015 (E)**3.2****auxiliary circuit**

electrical circuit for ancillary functions, e.g. control circuits (command initiation, interlocking operation), signalling and measuring circuits

3.3**certificate of conformity**

declarations that the equipment is in accordance with the relevant standard (see 10.7.3)

Note 1 to entry: In some legislation these declarations are only accepted from independent assessors depending on the required safety integrity level.

3.4**component**

constituent part of electrical devices or subsystems, usually specified by function, but used in various applications. These are elements or components in the sense of EN 61508-4. Examples include resistors, capacitors, transistors, integrated circuits, printed-circuit boards

Note 1 to entry: A component is the smallest element a circuit can be subdivided into. If a component has to be broken down it loses its physical characteristics and/or does not conform to specifications.

Note 2 to entry: An element may comprise hardware and/or software.

3.5**proven in use**

demonstration, based on an analysis of operational experience for specific configuration, an element that likelihood of dangerous systematic faults is low enough so that every safety function that uses the element achieves its required safety integrity level

3.6**continuous operation**

operation can be maintained for longer than 24 h without interruption

3.7**control circuit**

electrical circuit used for the operational control and the protection of the furnace and of the power circuits

3.8**control device**

device connected into the control circuit and used for controlling the operation of the furnace. For example, a manually operated switch, a limit transducer, or a valve

3.9**current limiting**

limiting of electric current to a predetermined maximum value for the defined operation by means of a suitable arrangement of components in the circuit

3.10**Diagnostic Coverage****DC**

proportion of all hardware faults which are detected by the online diagnostics embedded in the safety-related system

Note 1 to entry: To determine the DC a fault model should be used which is sufficient for the concerned technology.

3.11**diverse programs (software)**

programs or program sections which represent different solutions to an identical task which were either written (independently) by various persons or take different approaches to problems from the outset to achieve the same result (design diversity)

3.12**electrical equipment**

equipment for furnaces includes all electrical equipment for the fields of application mentioned in Clause 1

3.13**emergency stop device**

manually operated switch which can be used to shut down the furnace and its associated equipment in the event of danger. The emergency stop device shall prevent fuel flow and electrical preheating

Note 1 to entry: In EN 12952–8 and EN 12952–9 the emergency stop is defined as master fuel trip (MFT).

3.14**external diagnostic****ED**

measures to detect failures, particularly passive failures, where additional devices, which do not form part of the programmable controller or one of its channels, are used to test the function of particular sections or the entire programmable controller. The external diagnostic may be performed by another channel in the case of a multi-channel configuration

3.15**external influences**

influences from the environment which could bring about a failure or malfunction of the function

Note 1 to entry: The following are examples of external influences on electrical systems:

- a) Power failure and return of power, over-voltage and under-voltage, short-power interruptions (<0,5 s).
- b) Electromagnetic and electrical disturbances, such as inductive or capacitive interference or leakage currents through resistive connections.
- c) For microelectronic components, ionising radiation.

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3.16**Failure****F**

termination of the ability of an item to perform required function

Note 1 to entry: After failure, the item has a fault.

Note 2 to entry: „Failure“ is an event, as distinguished from „fault“ which is a state.

Note 3 to entry: This concept as defined does not apply to items consisting of software only.

[SOURCE: IEC 60050-191:1990, definition 191-04-01]

3.17**failure mechanism**

physical or chemical process which causes an assembly to fail. It may also define how the assembly fails, e.g. fail to safety. In doing so it may be possible to detect a failure tendency direction

3.18**fault**

state of an item characterised by inability to perform a required function, excluding the inability during preventative maintenance or other planned actions, or due to lack of external resources e.g. loss of power supplied (see Figures 2 and 3)

Note 1 to entry: A fault is often the result of a failure of the item itself, but may exist without prior failure (191–05–01 of IEC 60050–191:1990).