



BSI Standards Publication

Electrical equipment for furnaces and ancillary equipment

Part 1: Requirements for application design and installation

This is a preview of BS EN 50156-1:2024. [Click here to purchase the full version from the ANSI store.](#)

National foreword

This British Standard is the UK implementation of EN 50156-1:2024. It supersedes BS EN 50156-1:2015, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PEL/27, Electroheating.

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

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2024
Published by BSI Standards Limited 2024

ISBN 978 0 539 21766 7

ICS 27.060.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2024.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

This is a preview of BS EN 50156-1:2024. [Click here to purchase the full version from the ANSI store.](#)

EUROPÄISCHE NORM

November 2024

ICS 27.060.01

Supersedes EN 50156-1:2015

English Version

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 2024-10-07. 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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

This is a preview of BS EN 50156-1:2024. [Click here to purchase the full version from the ANSI store.](#)

Contents	Page
European foreword.....	6
Introduction.....	7
1 Scope.....	9
2 Normative references.....	9
3 Terms and definitions.....	11
4 General requirements.....	19
4.1 Concept and scope definition.....	19
4.2 Environmental requirements.....	19
4.2.1 General.....	19
4.2.2 Environmental and operating conditions.....	19
4.2.3 Electromagnetic compatibility.....	19
4.2.4 Ambient temperature.....	20
4.2.5 Humidity.....	20
4.2.6 Contamination.....	20
4.2.7 Vibration and shock.....	21
4.2.8 Equipment used in flammable atmospheres.....	21
4.3 Power supply.....	21
4.3.1 General.....	21
4.3.2 Power stations.....	21
5 Incoming supply connections and devices for disconnecting and emergency stop.....	21
5.1 Incoming supply and equipment connections.....	21
5.1.1 Types of connection.....	21
5.1.2 Terminations.....	22
5.2 Devices for disconnecting power supplies.....	23
5.2.1 General.....	23
5.2.2 Disconnecting switch.....	24
5.2.3 Excluded circuits.....	24
5.3 Emergency stop.....	24
5.3.1 General.....	24
5.3.2 Emergency stop device for furnaces in heating installations.....	25
5.3.3 Emergency stop device for other furnaces, e.g. steam boilers.....	25
5.3.4 Application as isolating switch.....	25
6 Protection against electric shock.....	25
6.1 Protection against direct contact.....	25
6.2 Protection against indirect contact.....	25
7 Environmental protection of the equipment.....	26
7.1 Protection against ingress of solid foreign bodies.....	26
7.2 Protection against water.....	26
8 Equipotential bonding.....	26
8.1 General.....	26
8.2 Equipotential bonding as a protective measure in case of indirect contact.....	26
8.3 Equipotential bonding for the purpose of lightning protection.....	27
8.4 Functional equipotential bonding.....	27
9 Auxiliary circuits.....	27
9.1 Supply to auxiliary circuits.....	27
9.1.1 Supply from 3-phase or AC systems.....	27
9.1.2 Supply from DC mains.....	27

This is a preview of BS EN 50156-1:2024. [Click here to purchase the full version from the ANSI store.](#)

9.1.3	Auxiliary circuits connected between the line conductors.....	28
9.2	Voltage for auxiliary circuits	28
9.2.1	Operating voltage of auxiliary circuits	28
9.2.2	Preferred nominal voltages	28
9.3	Connection to the protective conductor	29
9.4	Overcurrent protection of auxiliary circuits	29
9.4.1	Rating of overcurrent protective devices	29
9.4.2	Overcurrent protection of auxiliary circuits connected to the protective conductor	29
9.4.3	Overcurrent protection of auxiliary circuit with the middle conductor connected to the protective conductor.....	29
9.4.4	Overcurrent protection of auxiliary circuits with no electrical connection to the protective conductor	29
9.4.5	Overcurrent protection of control system supply transformers	29
9.4.6	Rating and setting of overcurrent protection	29
9.5	Measures to prevent danger from short circuits to exposed conductive parts or earth	30
9.6	Influence of capacitance and leakage resistance	30
10	Additional requirements for the application of a safety-related system	30
10.1	General safety requirements	30
10.1.1	General principles of the safety life cycle.....	30
10.1.2	Objective	32
10.1.3	Requirements.....	33
10.1.4	Planning	39
10.2	Concept and scope definition	44
10.2.1	Objective	44
10.2.2	Requirements.....	44
10.2.3	Verification	45
10.3	Hazard and risk analysis	45
10.3.1	Objective	45
10.3.2	Requirements.....	46
10.3.3	Verification	46
10.4	Safety requirements allocation	48
10.4.1	Objective	48
10.4.2	Requirements.....	48
10.4.3	Measures for fault avoidance	50
10.4.4	Verification	50
10.5	Design.....	50
10.5.1	Objective	50
10.5.2	Requirements.....	51
10.5.3	Measures for fault avoidance	57
10.5.4	Consideration of times.....	57
10.5.5	Hardware design.....	58
10.5.6	Plant specific application software	62
10.5.7	Periodical test.....	65
10.5.8	Documentation	65
10.5.9	Verification	65
10.6	Installation and commissioning.....	65
10.6.1	Objective	65
10.6.2	Requirements.....	65
10.6.3	Measures for fault avoidance	66
10.6.4	Verification	67
10.7	Safety validation	68
10.7.1	Objective	68
10.7.2	Requirements.....	68
10.7.3	Measures for fault avoidance	71
10.8	Operation and maintenance	72
10.8.1	Objective	72
10.8.2	Requirements.....	72
10.9	Modification and retrofit	76
10.9.1	Causes for modification and/or retrofit.....	76

This is a preview of BS EN 50156-1:2024. [Click here to purchase the full version from the ANSI store.](#)

10.9.2	Objectives	76
10.9.3	Requirements	76
10.9.4	Measures against unauthorised changes or overriding	77
10.9.5	Verification	77
10.10	Decommissioning	77
10.10.1	Objectives	77
10.10.2	Requirements	77
10.10.3	Verification	78
10.11	Assessment	78
10.11.1	Objectives	78
10.11.2	Verification	78
11	Electrical equipment	78
11.1	General requirements	78
11.2	Creepage distances and clearances	78
11.3	Motors	79
11.4	Transformers	79
11.5	Switching devices	79
11.6	Operator control devices	79
11.7	Immersion electrodes	79
11.8	Trace heating systems	80
12	Cables and cords	80
12.1	General requirements	80
12.2	Insulation	80
12.3	Current-carrying capacity	80
12.4	Conductors of separate circuits	81
13	Warning signs and item designation	81
13.1	Warning signs	81
13.2	Functional identification	81
13.3	Item designations	81
14	Technical documentation	82
14.1	General	82
14.2	Documentation describing functions and connections	82
14.2.1	General	82
14.2.2	Documentation describing functions	82
14.2.3	Requirements for periodical tests	82
14.2.4	Documentation describing connections	82
14.2.5	Documentation describing the process	83
14.2.6	Documentation of the risk assessment	83
14.3	Documents for type approved components	83
14.4	Documentation of the application software	83
Annex A (informative)	Configurations of programmable safety devices (PSD) with reference to EN 61508	85
A.1	General	85
A.2	Configuration 1oo2	86
A.3	Configuration 1oo2D	87
A.4	Configuration 2oo3	88
A.5	Configuration 2oo3D	89
Annex B (informative)	Lifecycle of programmable safety device	91
Annex C (informative)	Management of functional safety	92
Annex D (informative)	Examples of determining the safety integrity level SIL using the risk graph method	93
D.1	General	93

This is a preview of BS EN 50156-1:2024. [Click here to purchase the full version from the ANSI store.](#)

D.2	RISK parameter C (Consequences of the hazardous event)	93
D.3	Risk parameter F (Frequency and duration of the time spent in the hazard area)	93
D.4	Risk parameter P (Possibility of preventing the hazardous event)	93
D.5	Risk parameter W (Likelihood of occurrence of the hazardous event)	93
	Bibliography	95

This is a preview of BS EN 50156-1:2024. [Click here to purchase the full version from the ANSI store.](#)

European foreword

This document (EN 50156-1:2024) has been prepared by CLC/BTTF 132-2 “Revision of EN 50156 ‘Electrical equipment for furnaces and ancillary equipment’”.

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) 2025-10-07
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2027-10-07

This document supersedes EN 50156-1:2015 and all of its amendments and corrigenda (if any).

EN 50156-1:2024 includes the following significant technical changes with respect to EN 50156-1:2015:

- harmonization of the definitions to the new version of EN 61508:2010;
- check and updating of the normative references;
- significant changes in subclause 4.1 and Clause 10;
- EN 50156-3 will not be created.

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

This document has been prepared under a standardization request addressed to CENELEC by the European Commission.

This document covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits 2014/35/EU [2014 OJ L96].

This document 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 its 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 document has been prepared by the German National Committee with the participation of experts of other National Committees. It is currently divided into 2 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 devices and subsystems.

Any feedback and questions on this document should be directed to the users’ national committee. A complete listing of these bodies can be found on the CENELEC website.

This is a preview of BS EN 50156-1:2024. [Click here to purchase the full version from the ANSI store.](#)

Introduction

This Part of 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

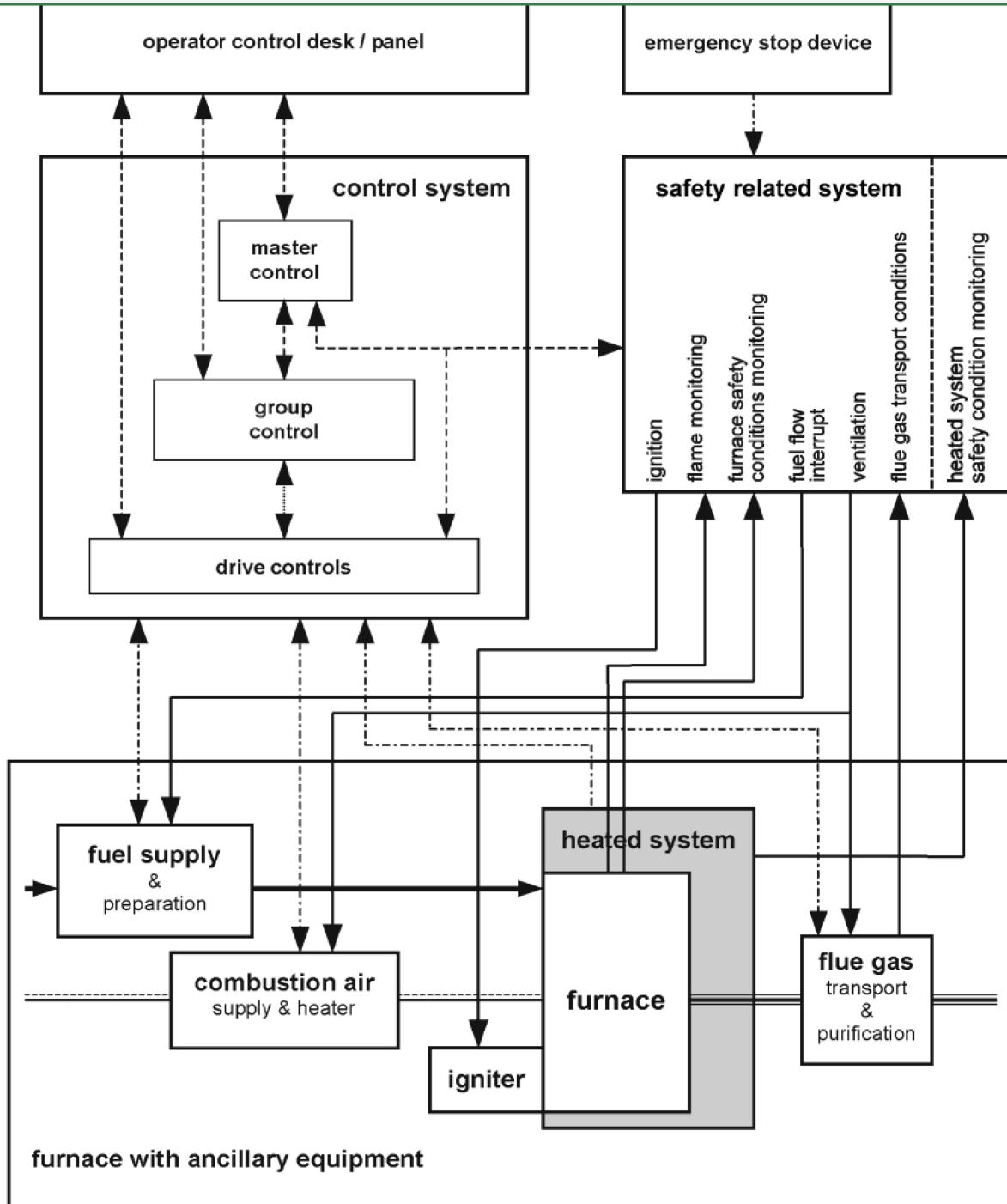
- monitoring of flames and other safety conditions of the firing,
- interrupting the flow of fuel to the furnace,
- ventilating the body of the furnace and the flue gas ducts,
- monitoring of the safety condition of the heated systems (e.g. water level limiter in steam boilers),

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 3.22).

The rating of necessary safety integrity levels is based on EN 61508-1:2010.

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.

This is a preview of BS EN 50156-1:2024. Click here to purchase the full version from the ANSI store.



Key

- | | | | |
|--|----------------|--|------------------------|
| | fuel | | control signal |
| | combustion air | | safety-related signal |
| | flue gas | | system interconnection |

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

This is a preview of BS EN 50156-1:2024. [Click here to purchase the full version from the ANSI store.](#)

1 Scope

This document 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 can 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 document 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 document. These requirements can 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 document;

This document can also be used as reference for electrical equipment requirements for thermo-processing equipment.

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

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

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

This document specifies special requirements for the management of functional safety.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1854:2022+A1:2023, *Safety and control devices for burners and appliances burning gaseous and/or liquid fuels — Pressure sensing devices for gas burners and gas burning appliances*