

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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**Low-voltage electrical installations –
Part 4-42: Protection for safety – Protection against thermal effects**

**Installations électriques à basse tension –
Partie 4-42: Protection pour assurer la sécurité – Protection contre les effets
thermiques**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

Part 4-42: Protection for safety – Protection against thermal effects

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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IEC 60364-4-42 has been prepared by IEC technical committee 64: Electrical installations and protection against electrical shock. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2010 and Amendment 1:2014. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) the Scope now includes a new paragraph stating that IEC 60364-4-42 has become a group safety publication (GSP) following the Advisory Committee on Safety (ACOS) recommendation for approval of the group safety function "protection against thermal effects for any kind of low-voltage electrical installations" to TC 64; this GSP is primarily intended to be used as a product safety standard for the installations mentioned in the scope, but also to be used by TCs in the preparation of publications for installations similar to those mentioned in the scope of this GSP;
- b) new terms and definitions have been added, for:
 - arcing;
 - arc fault;
 - assembly internal arc fault;
 - burn;
 - combustion;
 - escape route;
 - final circuit arc fault;
 - flame;
 - flammable;
 - flaming combustion;
 - low-voltage switchgear and controlgear assembly;
- c) a new Subclause 421.6 regarding measures for preventing fires originating from the use of an electrical stove or cooker or hob has been added;
- d) the previous Subclause 421.7 was expanded and moved to a new Clause 426: Additional protective measures against thermal effect for locations where consequences of fire are severe;
- e) requirements for escape routes have been expanded and modified;
- f) requirements for final circuits in BE2 locations have been expanded and modified;
- g) requirements for locations with irreplaceable goods or with business critical facilities have been expanded and modified;
- h) a new Clause 425 for protection against fire due to fault currents has been added;
- i) a new Clause 427 for protection against assembly internal arc faults has been added.

The text of this International Standard is based on the following documents:

Draft	Report on voting
64/2686/FDIS	64/2697/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document has the status of a group safety publication in accordance with IEC Guide 104.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60364 series, published under the general title *Low-voltage electrical installations*, can be found on the IEC website.

The reader's attention is drawn to the fact that Annex A lists all of the "in-some-country" clauses on differing practices of a less permanent nature relating to the subject of this document.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

IEC 60364-1 gives the rules for the design, erection, and verification of electrical installations. The rules are intended to provide for the safety of persons, livestock and property against dangers and damage which can arise in the reasonable use of electrical installations and to provide for the proper functioning of those installations.

According to IEC 60364-1:2005, 11.5, electrical equipment is dealt with only so far as its selection and application in the electrical installation are concerned.

According to IEC 60364-1:2005, 131.3 (Protection against thermal effects), "the electrical installation shall be so arranged to minimize the risk of damage or the risk of ignition of flammable materials due to high temperature or electric arc. In addition, during normal operation of the electrical equipment, there shall be no risk of persons or livestock suffering burns." These general requirements are specified in this document.

However, there are several types of electrical installations which are not covered by the IEC 60364 series, such as those indicated in IEC 60364-1:2005, 11.3.

The safety aspects specified in this document are also applicable to installations not covered by the IEC 60364 series.

LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

Part 4-42: Protection for safety – Protection against thermal effects

420 Protection against thermal effects

420.1 Scope

This part of IEC 60364 applies to electrical installations with regard to measures for the protection of persons, livestock and property against:

- thermal effects, risk of combustion or degradation of materials, and risk of burns caused by electrical equipment,
- flames in case of a fire hazard being propagated from electrical installations to other fire compartments segregated by barriers which are in the vicinity, and
- the impairment of the safe functioning of electrical equipment, including safety services due to thermal effects.

NOTE For explosion risks, see IEC 60079-14.

This group safety publication (GSP) focusing on safety essential requirements is primarily intended to be used as a product safety standard for the installations mentioned in the scope, but is also intended to be used by TCs in the preparation of publications for installations similar to those mentioned in the scope of this GSP, in accordance with the principles laid down in IEC Guide 104 and ISO/IEC Guide 51.

One of the responsibilities of a TC is, wherever applicable, to make use of basic safety publications and/or group safety publications in the preparation of its publications.

420.2 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.

IEC 60332 (all parts), *Tests on electric and optical fibre cables under fire conditions*

IEC 60364-4-43:2023, *Low-voltage electrical installations – Part 4-43: Protection for safety – Protection against overcurrent*

IEC 60364-5-53:2019, *Low-voltage electrical installations – Part 5-53: Selection and erection of electrical equipment – Devices for protection for safety, isolation, switching, control and monitoring*

IEC 61084 (all parts), *Cable trunking systems and cable ducting systems for electrical installations*

IEC 61386 (all parts), *Conduit systems for cable management*

IEC 61439-6, *Low-voltage switchgear and controlgear assemblies – Part 6: Busbar trunking systems (busways)*

IEC 61534 (all parts), *Powertrack systems*

IEC 61537, *Cable management – Cable tray systems and cable ladder systems*

IEC 60598-2-24, *Luminaires – Part 2-24: Particular requirements – Luminaires with limited surface temperatures*

IEC 62606, *General requirements for arc fault detection devices*

IEC TS 63107:2020, *Integration of internal arc-fault mitigation systems in power switchgear and controlgear assemblies (PSC-assemblies) according to IEC 61439-2*

IEC TR 61641, *Enclosed low-voltage switchgear and controlgear assemblies – Guide for testing under conditions of arcing due to internal fault*

420.3 Terms and definitions

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

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

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

420.3.1

combustible

capable of being ignited and burned

[SOURCE: ISO 13943:2023, 3.59]

420.3.2

fire

<general> process of combustion characterized by the emission of heat and fire effluent and usually accompanied by smoke, flame or glowing or a combination thereof

[SOURCE: ISO 13943:2023, 3.138, modified – Note 1 to entry has been deleted.]

420.3.3

fire

<uncontrolled> self-supporting combustion that has not been deliberately arranged to provide useful effects and is not limited in its extent in time and space

[SOURCE: ISO 13943:2023, 3.140]

420.3.4

ignition

initiation of combustion

Note 1 to entry: For more information see IEC 60695-4.

[SOURCE: ISO 13943:2023, 3.242, modified – The domain and deprecated term have been deleted and Note 1 to entry has been added.]

420.3.5**non-flame propagating**

liable to ignite, as a result of an applied flame, but in which the flame does not propagate, and which extinguishes itself within a limited time after the flame is removed

[SOURCE: IEC 60050-442:1998, 442-01-12, modified – "component" has been deleted from the term and "a component which is" has been deleted from the start of the definition.]

420.3.6**arcing**

luminous discharge of electricity across an insulating medium, usually accompanied by the partial volatilization of the electrodes

Note 1 to entry: A complete sinusoidal current half-cycle is not considered to be an arcing half-cycle.

[SOURCE: IEC 60050-442:2019, 442-05-65]

420.3.7**arc fault**

arcing fault

dangerous unintentional arc

[SOURCE: IEC 60050-442:2019, 442-05-66]

420.3.8**final circuit arc fault**

arc fault occurring in a final circuit causing a fault current not exceeding the design current of the final circuit

Note 1 to entry: The main risk of final circuit arc faults are thermal effects which can cause fire.

Note 2 to entry: Arc fault detection and protective devices (AFDD) are intended to provide protection against arc faults in final circuits.

420.3.9**low-voltage switchgear and controlgear assembly**

assembly

combination of one or more low-voltage switching devices together with associated control, measuring, signalling, protective, regulating equipment, with all the internal electrical and mechanical interconnections and structural parts

[SOURCE: IEC 61439-1:2020, 3.1.1, modified – The last part of the definition and the Notes to entry have been deleted.]

420.3.10**assembly internal arc fault**

free burning arc fault causing a current through air higher than the rated current of an assembly, arising from a fault between conductive parts having different potentials within the assembly

Note 1 to entry: The initiation of a high current arc inside an assembly generates various physical phenomena, causes potentially (very high) overheating and especially high overpressure inside the enclosure, which can endanger people in the close proximity of the assembly (e.g. burns, but also doors sudden opening, projection of hot materials or gases outside the enclosure) and damages the equipment.

Note 2 to entry: Protection against assembly internal arc faults is for example provided by an "internal arc-fault mitigation system".

420.3.11**escape route**

route to follow for access to a safe area in the event of an emergency

420.3.12**flame**

rapid, self-sustaining, sub-sonic propagation of combustion in a gaseous medium, usually with emission of light

[SOURCE: ISO 13943:2023, 3.184]

420.3.13**combustion**

exothermic reaction of a substance with an oxidizing agent

Note 1 to entry: Combustion generally emits fire effluent accompanied by flames and/or glowing.

[SOURCE: ISO 13943:2023, 3.62]

420.3.14**burn**

undergo combustion

[SOURCE: ISO 13943:2023, 3.38]

420.3.15**flammable**

capable of flaming combustion under specified conditions

[SOURCE: ISO 13943:2023, 3.202, modified – The deprecated term has been deleted.]

420.3.16**flaming combustion**

combustion in the gaseous phase, usually with emission of light

[SOURCE: ISO 13943:2023, 3.197]

421 Protection against fire caused by electrical equipment

421.1 Persons, livestock and property shall be protected against damage and injury caused by heat, fire or electric arcing which can be generated by electrical equipment and the propagation of the heat, fire and electric arcing in the electrical installation by taking into account the requirements of this document and the instructions of equipment manufacturers.

The heat generated by electrical equipment shall not cause danger or harmful effects to adjacent fixed material or to material which can foreseeably be in proximity to such equipment. Electrical equipment shall not present a fire hazard to adjacent materials.

NOTE Damage, injury or ignition can be caused by effects such as:

- heat accumulation, heat radiation, hot elements (faulty or loose terminal connections),
- reduction of the safe function of electrical equipment, for example protective devices such as protective switchgear, thermostats, temperature limiters, seals of cable penetrations and wiring systems,
- overcurrents,
- insulation faults,
- parallel or series arcs between conductors and arcing faults to earth (e.g. final circuit arc faults),
- arcs together with light, gas pressure, current (e.g. assembly internal arc faults),
- harmonic currents,
- inappropriate selection or erection of equipment.

421.2 Where fixed equipment can provide temperatures on adjacent materials that can cause a fire hazard, the equipment shall either:

- be mounted on or within materials that shall withstand such temperatures and are of low thermal conductance, or
- be screened from the adjacent material by a barrier of a material which shall withstand such temperatures and is of low thermal conductance, or
- be mounted so as to allow safe dissipation of heat at a sufficient distance from any material on which such temperatures can have deleterious thermal effects, any means of support being of low thermal conductance.

421.3 Where arcs or sparks can be emitted by permanently connected equipment in normal service, the equipment shall either:

- be totally enclosed in arc-resistant material, or
- be screened by arc-resistant material from materials on which the emission can have harmful effects, or
- be mounted so as to allow safe extinction of the emissions at a sufficient distance from material upon which the emissions can have harmful effects.

421.4 Where a location contains electrical equipment with flammable liquids:

- provision should be made to disconnect (switch-off) all electrical equipment in the location at the onset of a fire, except those installed for safety services, and
- provisions shall be made to prevent the spread of liquid, and
- where electrical equipment contains a significant quantity of flammable liquids (e.g. more than 25 litres) provision shall be made to prevent the spread of flames and the products of combustion.

EXAMPLE Spreading preventions include:

- a retention pit to collect any leakage of liquid and ensure extinction in the event of fire;
- installation of the equipment in a chamber of adequate fire resistance and the provision of sills or other means of preventing liquid spreading to other parts of the building, such a chamber being ventilated solely to the external atmosphere.

NOTE Products of combustion of liquid are: flame, smoke and gas.

421.5 The materials of enclosures erected around electrical equipment shall withstand foreseeable temperatures likely to be generated by the electrical equipment.

421.6 In domestic and similar installations, considerations should be given to provide measures for preventing fires originating from the use of an electrical stove or cooker or hob to be propagated to its environment.

422 Requirements where external influences present particular risks during a fire

422.1 General

422.1.1 The requirements of Clause 422 apply to installations in areas where the external influences are as described in 422.2 to 422.6.

A location may be associated with more than one class of external influence. Accordingly, for such a location, the requirements of 422.2 to 422.6 apply.

NOTE Explanation of codes for external influences are given in IEC 60364-5-51.

422.1.2 Electrical equipment shall be restricted to that necessary for the use of these locations, except wiring systems in accordance with 422.3.4.

422.1.3 Thermal cut-out devices shall not have automatic re-closure. This text is aligned with the text in IEC 60364-5-53:2019, 532.2.1.

422.2 Locations with external influences classified as BD2, BD3 or BD4 for conditions of evacuations in emergency

422.2.1 General

422.2.1.1 Wiring systems of electric circuits for safety services shall have a resistance to fire rating of at least 60 min.

422.2.1.2 Switchgear and controlgear, except certain devices to facilitate evacuation, shall be accessible only to authorized persons.

If switchgear and controlgear are placed in passages, they shall be enclosed in cabinets or boxes constructed of non-combustible or not readily combustible material.

NOTE 1 Some enclosures made of plastic, metallic or composite material are non-combustible or not readily combustible.

NOTE 2 Information on whether a material is considered combustible or non-combustible can be found in ISO 1182 or ISO 1716.

422.2.1.3 Except for BD2 locations, electrical equipment containing flammable liquids shall not be installed.

Electrical equipment where the flammable liquids are contained in capacitors are not subject to this requirement.

NOTE This exception principally concerns discharge luminaires and motor starters with capacitors.

422.2.2 Escape routes

422.2.2.1 Wiring systems shall be provided with sheaths or enclosures, provided by the cable management system itself or by other means.

422.2.2.2 Wiring systems shall not be within arm's reach unless they are provided with protection against mechanical damage likely to occur during an evacuation.

422.2.2.3 Wiring systems in escape routes shall not present an obstruction to evacuation under any circumstances.

422.2.2.4 Wiring systems shall be as short as practicable.

422.2.2.5 Compliance with this requirement may be achieved by using the following products:

- cables fulfilling the tests under fire conditions of IEC 60332-1-2, and appropriate fire conditions as follows: IEC 60332-3-21, IEC 60332-3-22, IEC 60332-3-23, IEC 60332-3-24 and IEC 60332-3-25;
- conduit systems classified as non-flame propagating in accordance with the IEC 61386 series;
- cable trunking systems or cable ducting systems classified as non-flame propagating in accordance with the IEC 61084 series;
- cable tray systems and cable ladder systems classified as non-flame propagating in accordance with IEC 61537;

- powertrack systems in accordance with the IEC 61534 series.

422.2.2.6 Cables and insulated conductors shall have a limited rate of smoke production.

Consideration should be given to the installation of cables that provide at least 60 % light transmittance in accordance with IEC 61034-2.

422.3 Locations with external influences classified as BE2, fire risks, for nature of processed or stored materials

422.3.1 Measures shall be taken to prevent an electrical enclosure of equipment such as a heater or resistor from exceeding the following temperatures:

- 90 °C under normal conditions, and
- 115 °C under fault conditions.

Where materials such as dust or fibres sufficient to cause a fire hazard can accumulate on an enclosure of electrical equipment, adequate measures shall be taken to prevent that enclosure from exceeding the temperatures stated above.

422.3.2 Switchgear for protection, control and isolation shall be placed outside locations presenting condition BE2, unless it is in an enclosure providing a degree of protection appropriate for such a location of at least IP4X or, in the presence of dust, IP5X or, in the presence of conductive dust, IP6X, except where 422.3.10 applies.

422.3.3 Except where wiring and wiring systems are embedded in non-combustible material, only non-flame-propagating wiring systems shall be used, and:

- cables shall at least satisfy the test under fire conditions specified in the IEC 60332 series;
- conduit systems shall at least satisfy the test for resistance to flame propagation specified in the IEC 61386 series;
- cable trunking systems and cable ducting systems shall at least satisfy the test for resistance to flame propagation specified in the IEC 61084 series;
- cable tray systems and cable ladder systems shall at least satisfy the test for resistance to flame propagation specified in IEC 61537;
- powertrack systems shall at least satisfy the test for resistance to flame propagation specified in the IEC 61534 series.

Where the risk of flame propagation is high, for example in long vertical runs of bunched cables, cables should meet the flame propagation characteristics of the appropriate part in the IEC 60332-3 series.

NOTE Only the flame propagation tests for cable management systems performed in a vertical configuration are considered.

422.3.4 Wiring systems which traverse these locations, but are not necessary for the use of the locations:

- shall satisfy the requirements of 422.3.3;
- shall have no connection along the route inside the locations, unless these connections are placed in fire-resistant enclosures;
- shall be protected against overcurrent in accordance with 422.3.9; and
- bare conductors shall not be used.

422.3.5 The air intake of forced-air electrical heating systems shall be located outside the locations where a presence of combustible dust can be expected, unless the system is specifically designed for use in BE2 locations.

The temperature of the outgoing air shall be such as not to cause fire in the location.

422.3.6 Motors which are automatically or remotely controlled, or which are not continuously supervised, shall be protected against excessive temperature rise by temperature responsive devices, unless specifically designed to be inherently heat-limiting.

422.3.7 Every luminaire shall:

- a) be appropriate for the location, and
- b) have a limited surface temperature in accordance with IEC 60598-2-24, and
- c) be of a type that prevents lamp components from falling from the luminaire, and
- d) be provided with an enclosure with a degree of protection of at least:
 - IP4X, or
 - in the presence of dust, IP5X, or
 - in the presence of conductive dust, IP6X.

In locations where fire hazards due to dust or fibres can arise, luminaires shall be installed so that dust or fibres cannot accumulate in dangerous amounts.

422.3.8 Final circuits and current-using equipment shall be protected against the thermal effects resulting from an insulation failure by:

- a) in TT, TN and IT systems earthing, installing a residual current device (RCD) with a rated residual operating current not exceeding:
 - 30 mA where the insulation failure can occur within a resistive load (e.g. in a heating element),
 - 300 mA in all other situations, or
- b) in IT installations galvanically separated from a distribution system:
 - installing an insulation monitoring device (IMD) monitoring the whole installation, and
 - providing measures to eliminate a first earth fault with the shortest practicable delay. For this purpose, an insulation fault location system (IFLS) may be provided.

Cables with earthed metallic coverings or equivalent solution should be used.

Mineral insulated cables and busbar trunking systems are not considered likely to cause a fire from insulation faults and therefore they need not be protected.

422.3.9 Circuits supplying or traversing locations where condition BE2 applies, shall be protected against overcurrent by protective devices located outside and on the supply side of these locations.

Circuits originating inside the locations shall be protected against overcurrent by protective devices located at their origin.

422.3.10 Where either SELV or PELV protective measures are applied, live parts shall be:

- contained in enclosures affording the degree of protection IP2X or IPXXB, or
- provided with insulation capable of withstanding a test voltage of 500 V DC for 1 min.

422.3.11 Wiring systems supplying current-using equipment in BE2 locations shall not include a PEN conductor.

PEN conductors in wiring systems traversing BE2 locations shall not have any connection with conductive parts in the locations.

422.3.12 Every circuit supplying equipment in locations where condition BE2 applies shall be provided with a means of isolation in accordance with IEC 60364-5-53:2019, 536.2.2.

422.4 Locations with external influences classified as CA2, combustible, for construction materials

422.4.1 Precautions shall be taken to ensure that electrical equipment cannot cause the ignition of walls, floors or ceilings. This can be achieved by proper design, choice and installation of electrical equipment.

To avoid the ingress of solid foreign objects, boxes and enclosures installed in prefabricated hollow walls liable to be drilled during erection of the wall shall have a degree of protection of at least IP3X.

422.4.2 Where cables are installed, consideration should be given to the use of non-flame propagating insulated cables.

422.5 Locations with external influences classified as CB2, propagation of fire for building design

In structures of which the shape and dimensions facilitate the spread of fire, precautions shall be taken to ensure that the electrical installation cannot propagate a fire (e.g. chimney effect).

Fire detectors may be provided which ensure the implementation of measures for preventing propagation of fire, for example, the closing of fire dampers in ducts, building voids and the like.

Boxes and enclosures in accordance with IEC 60670-1 for hollow walls and cables in accordance with the IEC 60332-3 series can be used. IEC 60670-1 includes marking with the symbol H for boxes and enclosures for hollow walls.

422.6 Locations with irreplaceable goods or with business critical facilities

The requirements given in 422.6 apply to electrical installations in locations with assets of significant value, irreplaceable goods or with business critical facilities.

EXAMPLE National monuments, museums, certain facilities in public buildings (e.g. in railway stations and airports), facilities such as laboratories, data centres and certain industrial and storage facilities.

Wiring systems of electric circuits for safety services (e.g. smoke extraction, centrally powered emergency lighting system, alarms) shall have a resistance to fire rating of at least 60 min.

Wiring systems shall be non-flame propagating. Compliance with this requirement may be achieved by using the following products:

- cables fulfilling tests under the fire conditions of IEC 60332-1-2, and appropriate fire conditions as follows: IEC 60332-3-21, IEC 60332-3-22, IEC 60332-3-23, IEC 60332-3-24 and IEC 60332-3-25;
- conduit systems classified as non-flame propagating in accordance with the IEC 61386 series;
- cable trunking systems or cable ducting systems classified as non-flame propagating in accordance with the IEC 61084 series;
- cable tray systems and cable ladder systems classified as non-flame propagating in accordance with IEC 61537;
- powertrack systems in accordance with the IEC 61534 series.

Where these measures are not practicable, enhanced fire protection shall be considered.

423 Protection against burns

Accessible parts of electrical equipment within arm's reach shall not attain a temperature likely to cause burns to persons and shall comply with the appropriate limit stated in Table 1. All parts of the installation likely in normal service to attain, even for short periods, temperatures exceeding the limits stated in Table 1 shall be guarded so as to prevent any accidental contact. However, the values in Table 1 do not apply to equipment complying with IEC standards for the type of equipment concerned.

NOTE Lower temperatures can be applicable where condition BA2 (children) applies.

Table 1 – Temperature limits in normal service for accessible parts of equipment within arm's reach

Accessible parts	Material of accessible surfaces	Maximum temperatures °C
Hand-held means of operation	Metallic	55
	Non-metallic	65
Parts intended to be touched but not hand-held	Metallic	70
	Non-metallic	80
Parts not intended to be touched for normal operation	Metallic	80
	Non-metallic	90

424 Protection against overheating

424.1 Forced air heating systems

Forced air heating systems shall be such that their heating elements, other than those of central storage heaters, cannot be activated until the specified air flow has been established and are disactivated when the air flow is less than the specified value. In addition, they shall have two temperature limiting devices independent of each other which prevent permissible temperatures from being exceeded in air ducts.

It is required that one of the temperature-limiting devices is a thermal release. The thermal release shall disconnect all live conductors and shall have manual resetting.

Supporting parts, frames and enclosures of heating elements shall be of non-combustible material.

424.2 Appliances producing hot water or steam

All appliances producing hot water or steam shall be protected by design or erection against overheating in all service conditions. The protection shall be by means of an appropriate non-self-resetting device, functioning independently of the thermostat, unless the appliances comply as a whole with the appropriate IEC standards.

If an appliance has no free outlet, it shall also be provided with a device which limits the internal water pressure.

424.3 Space heating appliances

The frame and enclosure of space heating appliances shall be of non-combustible material.

The side walls of radiant heaters which are not touched by the heat radiation should have a sufficient distance from flammable parts. In case of a reduction of the distance by a non-flammable partition, this partition should have a distance of at least 1 cm to the enclosure of the radiant heater and to flammable parts.

Radiant heaters should be mounted so that in the direction of radiation a safety distance of at least 2 m from flammable parts is ensured, unless otherwise declared by the manufacturer.

425 Protection against fire due to fault currents

Except where IEC 60364-4-43:2023, Annex A, Annex B or Annex E apply and for a first earth fault in an IT installation, any short circuit current shall be disconnected within 5 s, in order to protect against fire in the case of a fault within the installation.

426 Additional protective measures against thermal effects for locations where consequences of fire are severe

426.1 General

Appropriate protective measures specified in 426.2 and 426.3 shall be taken to mitigate the probability of fire ignition due to an electrical installation in locations specified in 426.4.

The requirements in 426.2 and 426.3 are based on criticality of fire which depends on the type of building, its configuration and the functional area in the building. Information on a Fires Risk Assessment Matrix can be accessed via TC 64 supporting documents on the IEC website: www.iec.ch/tc64/supportingdocuments.

426.2 Protection against thermal effects caused by insulation failure

All circuits supplying locations in accordance with 426.4 shall be protected against the effects resulting from an insulation failure by:

- a) in TT, TN and IT systems earthing, installing an RCD with a rated residual operating current not exceeding:
 - 30 mA where the insulation failure can occur within a resistive load (e.g. in a heating element),
 - 300 mA in all other situations, or
- b) in IT installations galvanically separated from a distribution system:
 - installing an insulation monitoring device (IMD) monitoring the whole installation, and
 - providing measures to eliminate a first earth fault with the shortest practicable delay. For this purpose, an insulation fault location system (IFLS) may be provided.

An RCD may be used to protect one or several circuits.

Circuits traversing locations in accordance with 426.4 shall also be protected against the effects of insulation faults as required above, except where one or more of the following wiring systems are used:

- mineral insulated cables in accordance with IEC 60702-1;
- busbar trunking systems (busways) in accordance with IEC 61439-6;
- cables in non-flame propagating conduit systems in accordance with the IEC 61386 series;
- cables in non-flame propagating trunking or ducting systems in accordance with the IEC 61084 series;
- cables installed in masonry.

PEN conductors shall not be installed in locations in accordance with 426.4, except for circuits traversing such locations and having no connection between their traversing PEN conductor and any conductive part in these locations.

426.3 Protection against thermal effects caused by final circuit arc faults

In the locations specified in 426.4, protection against the effect caused by a final circuit arc fault:

- shall be provided for final circuits incorporating one or more socket-outlets; and
- should be provided for all other final circuits.

In AC circuits, the use of arc fault detection devices (AFDD) in compliance with IEC 62606, placed at the origin of the final circuit to be protected, will satisfy the above-mentioned requirements.

Where the use of an AFDD is not applicable, other applicable methods shall be used.

NOTE Methods minimizing the possibility for an arc fault to arise can be applied.

Consideration shall be given to applying a method that does not disconnect any circuit where such disconnection can cause a danger, for example:

- the exciter circuit of a rotating machine;
- the supply circuit of a lifting magnet;
- a circuit supplying a fire fighting equipment such as sprinkler pumps, smoke extract fans and fire fighters' lifts;
- a circuit supplying a safety service, such as a fire alarm or a gas alarm;
- a circuit supplying medical equipment used for life support in specific medical locations where an IT system is incorporated.

The use of AFDDs does not obviate the need to apply one or more measures provided in other clauses in this document.

426.4 Locations

The measures of 426.2 and 426.3 shall be applied to the following locations:

- a) locations intended for people to sleep in:
 - facilities for the elderly and people with disabilities;
 - hotels and guest houses;
 - elementary educational establishments and kindergartens;
 - dwellings (e.g. houses, apartment blocks);
- b) locations intended to be occupied by a group of persons in:
 - facilities for the elderly and people with disabilities;
 - elementary educational establishments and kindergartens;
 - workplaces in high-rise buildings;

NOTE A high-rise building is any structure where its height, above the surrounding ground, can have a serious impact on evacuation.

- c) locations intended for storage of either flammable materials or environmentally hazardous products (including batteries), or both, classified BE2 in:
 - facilities for the elderly and people with disabilities;
 - hotels and guest houses;
 - elementary educational establishments and kindergartens;
- d) locations intended for storing of irreplaceable goods in the following buildings:
 - museums;
 - historical buildings;
 - libraries, archives and documentation centres;
- e) agricultural premises where livestock are kept.

427 Protection against assembly internal arc faults

427.1 Protection of persons

Electrical installations shall be designed and erected so that persons are protected as far as reasonably practicable from the effects of an assembly internal arc fault.

In an AC system where:

- the rated current of an assembly is greater than or equal to 800 A; and
- the maximum prospective short-circuit current at the point of installation of the assembly is greater than or equal to 25 kA,

one or more of the following measures to protect against dangers resulting from assembly internal arc faults shall be applied:

- a) Locate the assembly in a closed electrical area with restricted access to skilled persons (BA5). The assembly shall not present a fire hazard to adjacent materials in this room in case of internal arc fault.
- b) Use assemblies following the recommendations for design and test of IEC TR 61641.
- c) Use current-limiting overcurrent protective devices on the supply side of the assembly.
- d) Reduce arc fault energy by applying:
 - an internal arc-fault mitigation system (IAMS) using one or more effects of an arc fault, for example light, gas pressure, harmonics in the current or voltage, and possibly the magnitude of the current to detect an arc fault inside the switchgear and control gear assemblies, or

NOTE 1 With arc quenching devices (AQDs, see IEC 60947-9-1) the arc-fault energy is limited by reducing the voltage and the arcing time.

- an instantaneous overcurrent protection on the supply side of the assembly.

NOTE 2 This solution can be permanent or applied temporarily when people are present in the vicinity of the assembly.

Where an assembly is intended to be serviced and maintained frequently without interruption of supply, protective measure c) or d) should be considered.

NOTE 3 The incident energy of an assembly internal arc-fault can be determined by an appropriate method.

NOTE 4 Subclause 427.1 does not cover the effects of toxic gases and loud noises.