IEC 60364-4-42

Edition 3.0 2010-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

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

IEC 60364-4-42:2010

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

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

FOREWORD

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International Standard IEC 60364-4-42 has been prepared by IEC technical committee 64: Electrical installations and protection against electric shock.

This third edition cancels and replaces the second edition, published in 2001, and constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

– The scope now includes protection against all thermal effects and flames in case of a fire hazard being propagated from electrical installations to other fire compartments segregated by barriers which are in the vicinity.
– Requirements associated with escape routes for evacuation in an emergency have been expanded/modified.
– Requirements associated with the nature of processed or stored materials have been expanded/modified.

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– Requirements associated with combustible constructional materials have been expanded/modified.
– Requirements associated with fire propagating structures have been modified slightly.
– New requirements for the selection and erection of installations in locations which might endanger precious goods have been added.
– Protection against overheating now includes space heating appliances.

The text of this standard is based on the following documents:

FDIS	Report on voting
64/1725/FDIS	64/1729/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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 standard.

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

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

Part 4-42: Protection for safety – 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, 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.

NOTE 1 For protection against thermal effects, national statutory requirements may be applicable.

NOTE 2 Protection against overcurrent is dealt with in IEC 60364-4-43.

420.2 Normative references

The following referenced documents are indispensable for the application 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 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60364-5-51:2005, *Electrical installations of buildings – Part 5-51: Selection and erection of electrical equipment – Common rules*

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

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

IEC 61534 (all parts), *Power track 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*

420.3 Terms and definitions

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

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420.3.1
combustible
capable of burning

420.3.2
fire
– a process of combustion characterized by the emission of heat and effluent accompanied by smoke, and/or flame and/or glowing
– rapid combustion spreading uncontrolled in time and space

420.3.3
flammability
ability of a material or product to burn with a flame under specified test conditions

420.3.4
ignitability
measure of the ease with which a specimen can be ignited due to the influence of an external source, under specified test conditions

420.3.5
ignition
initiation of combustion

NOTE For more information see IEC 60695-4.

420.3.6
non-flame propagating component
component which is 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

[IEC 60050-442:1998, 442-01-12]

421 Protection against fire caused by electrical equipment

421.1 General requirements

Persons, livestock and property shall be protected against damage or injury caused by heat or fire which may be generated or propagated in electrical installations by taking into account the requirements of this standard 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 may foreseeably be in proximity to such equipment. Electrical equipment shall not present a fire hazard to adjacent materials.

NOTE Damage, injury or ignition may be caused by effects such as
– heat accumulation, heat radiation, hot elements,
– reduction of the safe function of electrical equipment, e.g. protective devices such as protective switchgear, thermostats, temperature limiters, seals of cable penetrations and wiring systems,
– overcurrent,
– insulation faults and/or arcs causing interference,
– harmonic currents,
– lightning strikes, see the IEC 62305 series,
– overvoltages, see Clause 443 of IEC 60364-4-44:2007,
– inappropriate selection or erection of equipment.

Any relevant manufacturer's erection instructions shall be taken into account in addition to the requirements of the IEC 60364 series.

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421.2 Where fixed equipment may attain surface temperatures which could cause a fire hazard to adjacent materials, the equipment shall either

- be mounted on or within materials that will withstand such temperatures and are of low thermal conductance, or
- be screened from elements of building construction by materials which will withstand such temperatures and are 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 could have deleterious thermal effects, any means of support being of low thermal conductance.

421.3 Where arcs or sparks may 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 could 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 could have harmful effects.

Arc-resistant material used for this protective measure shall be non-ignitable, of low thermal conductivity, and of adequate thickness to provide mechanical stability.

NOTE For example, a sheet made of fibreglass silicone of 20 mm thickness may be considered as arc-resistant.

421.4 Fixed equipment causing a concentration of heat shall be at a sufficient distance from any fixed object or building element so that the object or element, in normal conditions, is not subjected to a dangerous temperature. For example, a temperature in excess of its ignition temperature.

NOTE Any information from the manufacturer of the equipment should be taken into account.

421.5 Where electrical equipment in a single location contains flammable liquid in significant quantity, adequate precautions shall be taken to prevent the spread of liquid, flame and the products of combustion.

NOTE 1 Examples of such precautions 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 2 The generally accepted lower limit for a significant quantity is 25 l.

NOTE 3 For quantities less than 25 l, it is sufficient to take precautions to prevent the escape of liquid.

NOTE 4 Products of combustion of liquid are considered to be flame, smoke and gas.

NOTE 5 It is desirable to switch off the supply at the onset of a fire.

421.6 The materials of enclosures installed around electrical equipment during erection shall withstand the highest temperature likely to be produced by the electrical equipment.

Combustible materials are not suitable for the construction of these enclosures unless preventive measures against ignition are taken, such as covering with non-combustible or not readily combustible material of low thermal conductivity.

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422 Precautions where particular risks of fire exist

422.1 General

422.1.1 Electrical equipment shall be restricted to that necessary for the use of these locations, except wiring systems according to 422.3.5.

422.1.2 Electrical equipment shall be so selected and erected that its temperature in normal use and foreseeable temperature rise during a fault cannot cause a fire.

These arrangements may be effected by the construction of equipment or its conditions of installation.

Special measures are not necessary where the temperature of surfaces is unlikely to cause ignition of nearby substances.

422.1.3 Thermal cut-out devices shall have manual resetting only.

422.2 Conditions of evacuation in an emergency

Condition BD2: Low density occupation, difficult conditions of evacuation

BD3: High density occupation, easy conditions of evacuation

BD4: High density occupation, difficult conditions of evacuation

(according to Table 51A of IEC 60364-5-51:2005).

NOTE Authorities responsible for building construction, public gatherings, fire prevention, etc. may specify which BD condition is applicable.

422.2.1 In conditions BD2, BD3 and BD4, wiring systems shall not encroach on escape routes unless the wiring in the wiring system is provided with sheaths or enclosures, provided by the cable management system itself or by other means.

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

Wiring systems in escape routes shall be as short as practicable and shall be non-flame propagating.

NOTE 1 Compliance with this requirement may be achieved by using the following products:

– cables fulfilling 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 according to IEC 61386-1;
– cable trunking systems classified as non-flame propagating according to IEC 61084-1;
– cable tray systems and cable ladder systems classified as non-flame propagating according to IEC 61537;
– for powertrack systems: the IEC 61534 series.

In conditions BD2, BD3 and BD4, wiring systems that are supplying safety circuits shall have a resistance to fire rating of either the time authorized by regulations for building elements or 1 h in the absence of such a regulation.

NOTE 2 For the requirements for maintaining the function of wiring systems of safety services under fire conditions, refer to Part 56.

Wiring within escape routes shall have a limited rate of smoke production.

NOTE 3 In the absence of any detailed requirement provided by cable standards, it is recommended that a value of 60 % light transmittance is adopted as a minimum for any cable tested against IEC 61034-2.

422.2.2 In conditions BD2, BD3 and BD4, switchgear and controlgear devices, except certain devices to facilitate evacuation, shall be accessible only to authorized persons. If they

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

NOTE This clause does not prohibit plastic enclosures that are not readily combustible.

422.2.3 In conditions BD3 and BD4 and in escape routes, electrical equipment containing flammable liquids shall not be installed.

NOTE Individual capacitors incorporated in equipment are not subject to this requirement. This exception principally concerns discharge luminaires and capacitors of motor starters.

422.3 Locations with risks of fire due to the nature of processed or stored materials

Condition BE2: Fire risk (according to Table 51A of IEC 60364-5-51:2005).

NOTE 1 Quantities of flammable materials or the surface or volume of the location may be regulated by national authorities.

NOTE 2 For explosion risks, see IEC 60079-14.

422.3.1 Luminaires shall be kept at an adequate distance from combustible materials. If no other information is given by manufacturers, spotlights and projectors shall be installed at the following minimum distances from combustible materials:

≤ 100 W	0,5 m
> 100 W to 300 W	0,8 m
> 300 W to 500 W	1,0 m

> 500 W greater distances can be necessary.

NOTE In the absence of manufacturers' instructions, the above distances imply all directions.

Lamps and other components of luminaires shall be protected against foreseeable mechanical stresses. Such protective means shall not be fixed on lampholders unless they form an integral part of the luminaire. Modifications to luminaires are not acceptable.

A luminaire with a lamp that could eject flammable materials in case of failure shall be installed with a safety protective shield for the lamp in accordance with the manufacturer's instructions.

NOTE Luminaires suitable for direct mounting on normally flammable surfaces were earlier marked with the symbol

according to IEC 60598-1:2003 (sixth edition).

With the publication of IEC 60598-1:2008[1], luminaires suitable for direct mounting have no special marking and only luminaires not suitable for mounting on normally flammable surfaces are marked with symbols

and/or

(see Clause N.4 of IEC 60598-1:2008 for further explanations).

[1] This seventh edition cancelled and replaced the sixth edition.

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422.3.2 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 could accumulate on an enclosure of electrical equipment, adequate measures shall be taken to prevent that enclosure from exceeding the temperatures stated above.

NOTE Luminaires marked ▽D in compliance with IEC 60598-2-24 are designed to provide limited surface temperature.

422.3.3 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 422.3.11 applies.

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

As a minimum, equipment shall be selected in accordance with the following requirements:

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

NOTE 1 Where the risk of flame propagation is high, e.g. 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 2 Flame propagation tests for cable management systems are always performed in a vertical configuration.

422.3.5 Wiring systems which traverse these locations, but are not necessary for the use of the locations, shall satisfy the following conditions:

- the wiring systems shall meet the requirements of 422.3.4;
- they have no connection along the route inside the locations, unless these connections are placed in fire-resistant enclosures;
- they are protected against overcurrent in accordance with 422.3.10;
- bare conductors shall not be used.

422.3.6 In forced-air heating installations, the air intake shall be outside locations where a presence of combustible dust may be expected.

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

422.3.7 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.

422.3.8 Every luminaire shall

- be appropriate for the location, and

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

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

NOTE Luminaires should also comply with relevant parts of the IEC 60598 series. See also Clause 559 of IEC 60364-5-55:2001.

422.3.9 Final circuits and current-using equipment shall be protected against insulation faults as follows:

a) In TN and TT systems, RCDs with a rated residual operating current $I_{\Delta n} \leq 300$ mA shall be used. Where resistive faults may cause a fire, e.g. for overhead heating with heating film elements, the rated residual operating current shall be $I_{\Delta n} \leq 30$ mA.

b) In IT systems, insulation monitoring devices monitoring the whole installation or RCMs (residual current monitoring devices) in the final circuits, both with audible and visual signals, shall be provided. Alternatively, RCDs with a rated residual operating current as specified in a) may be used. In the event of a second fault see Part 41 for disconnection times.

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

NOTE Cables with metallic coverings are recommended. The metallic covering should be connected to the protective conductor.

422.3.10 Circuits supplying or traversing locations where condition BE2 applies, shall be protected against overload and short-circuit 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.

422.3.11 In circuits supplied at SELV or PELV, 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 d.c. for 1 min.

regardless of the nominal voltage of the circuit. This is in addition to the requirements of 414.4.5 of IEC 60364-4-41:2005.

422.3.12 PEN conductors are not allowed in locations where condition BE2 applies, except for circuits traversing such locations and having no connection between their traversing PEN conductor and any conductive part in the locations.

422.3.13 Every circuit supplying equipment in locations where condition BE2 applies shall be provided with a means of isolation from all live supply conductors such that no live supply conductor can remain closed when one or more others are open. This may be achieved, for example, by a mechanically linked switch or a mechanically linked circuit-breaker.

NOTE Provision may be made for isolation of a group of circuits by a common means, if the service conditions allow this.

422.4 Locations with combustible constructional materials

Condition CA2: Combustible materials (according to Table 51A of IEC 60364-5-51:2005).

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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 Luminaires shall be kept at an adequate distance from combustible materials. If no other information is given by manufacturers, spotlights and projectors shall be installed at the following minimum distances from combustible materials:

≤ 100 W	0,5 m
> 100 W to 300 W	0,8 m
> 300 W to 500 W	1,0 m

> 500 W greater distances can be necessary.

NOTE 1 In the absence of manufacturers' instructions, the above distances imply all directions.

Lamps and other components of luminaires shall be protected against foreseeable mechanical stresses. Such protective means shall not be fixed on lampholders, unless they form an integral part of the luminaire.

A luminaire with a lamp that could eject flammable materials in case of failure shall be installed with a safety protective shield for the lamp in accordance with the manufacturer's instructions.

NOTE 2 Luminaires suitable for direct mounting on normally flammable surfaces were earlier marked with the symbol

according to IEC 60598-1:2003 (sixth edition).

With the publication of IEC 60598-1:2008, luminaires suitable for direct mounting have no special marking and only luminaires not suitable for mounting on normally flammable surfaces are marked with symbols

and/or

(see Clause N.4 of IEC 60598-1:2008 for further explanations).

422.5 Fire propagating structures

Condition CB2: Propagation of fire (according to Table 51A of 60364-5-51:2005).

422.5.1 In structures where 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).

NOTE Fire detectors may be provided which ensure the implementation of measures for preventing propagation of fire, for example, the closing of fire-proof shutters in ducts, building voids and the like. Boxes and enclosures according to 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 Selection and erection of installations in locations with endangering of irreplaceable goods

The requirements of 422.1.2 shall be met.

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