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Low-voltage electrical installations - Part 4-43: Protection for safety - Protection against overcurrent

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# NORME INTERNATIONALE

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

**Installations électriques à basse tension –  
Partie 4-43: Protection pour assurer la sécurité – Protection contre les  
surintensités**

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ELECTROTECHNIQUE  
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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

**Part 4-43: Protection for safety –  
Protection against overcurrent**

## FOREWORD

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International Standard IEC 60364-4-43 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:

- Annex B "IEC 60364 – Parts 1 to 6: Restructuring" deleted.
- Introduction of new informative Annexes B, C and D.
- Information concerning flexible cables added to Scope.
- The word "phase" changed to "line" throughout the standard.
- Requirement not to distribute the neutral in IT systems changed to a NOTE.
- Requirements added for overload detection for the neutral conductor for harmonic currents.

- Requirement that devices for protection against short-circuit current be capable of making as well as breaking short-circuit current added.
- Information added to clarify protection against overload current.
- Requirements where devices for protection against overload need not be provided expanded.
- More examples given where omission of devices for protection against overload is permitted.
- Requirements where devices for protection against short-circuit need not be provided expanded.
- Requirements for short-circuit current ratings of busbar trunking systems added.

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

FDIS	Report on voting
64/1641/FDIS	64/1656/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 E lists all of the "in-some-country" clauses on differing practices of a less permanent nature relating to the subject of this standard.

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

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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 maintenance result 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.

## LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

### Part 4-43: Protection for safety – Protection against overcurrent

#### 43 Protection against overcurrent

##### 430.1 Scope

This part of IEC 60364 provides requirements for the protection of live conductors from the effects of overcurrents.

This standard describes how live conductors are protected by one or more devices for the automatic disconnection of the supply in the event of overload (Clause 433) and short-circuit (Clause 434) except in cases where the overcurrent is limited in accordance with Clause 436 or where the conditions described in 433.3 (omission of devices for protection against overload) or 434.3 (omission of devices for protection against short-circuit) are met. Coordination of overload protection and short-circuit protection is also covered (Clause 435).

NOTE 1 Live conductors protected against overload in accordance with Clause 433 are considered to be protected also against faults likely to cause overcurrents of a magnitude similar to overload currents.

NOTE 2 The requirements of this standard do not take account of external influences.

NOTE 3 Protection of conductors according to this standard does not necessarily protect the equipment connected to the conductors.

NOTE 4 Flexible cables connecting equipment by plugs and socket-outlet to fixed installations are not part of the scope of this standard and for this reason are not necessarily protected against overcurrent.

NOTE 5 Disconnection does not mean isolation in this standard.

##### 430.2 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 60269-2, *Low-voltage fuses – Part 2: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) – Examples of standardized systems of fuses A to I*

IEC 60269-3, *Low-voltage fuses – Part 3: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications) – Examples of standardized systems of fuses A to F*

IEC 60269-4, *Low-voltage fuses – Part 4: Supplementary requirements for fuse-links for the protection of semiconductor devices*

IEC 60364-4-41, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60364-5-52:2001, *Electrical installations of buildings – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

IEC 60439-2, *Low-voltage switchgear and controlgear assemblies – Part 2: Particular requirements for busbar trunking systems (busways)*

IEC 60724, *Short-circuit temperature limits of electric cables with rated voltages of 1 kV ( $U_m = 1,2$  kV) and 3 kV ( $U_m = 3,6$  kV)*

IEC 60898 (all parts), *Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations*

IEC 60947-2, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 60947-3, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*

IEC 60947-6-2, *Low-voltage switchgear and controlgear – Part 6-2: Multiple function equipment – Control and protective switching devices (or equipment) (CPS)*

IEC 61009 (all parts), *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs)*

IEC 61534 (all parts), *Powertrack systems*

IEC Guide 104, *The preparation of safety publications and the use of basic safety publications and group safety publications*

### 430.3 General requirements

Protective devices shall be provided to disconnect any overcurrent in the circuit conductors before such a current could cause danger due to thermal or mechanical effects detrimental to insulation, joints, terminations or material surrounding the conductors.

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### 431 Requirements according to the nature of the circuits

#### 431.1 Protection of line conductors

**431.1.1** Detection of overcurrent shall be provided for all line conductors, except where 431.1.2 applies. It shall cause the disconnection of the conductor in which the overcurrent is detected but not necessarily the disconnection of the other live conductors.

If disconnection of a single phase may cause danger, for example in the case of a three-phase motor, appropriate precautions shall be taken.

**431.1.2** In a TT or TN system, for a circuit supplied between line conductors and in which the neutral conductor is not distributed, overcurrent detection need not be provided for one of the line conductors, provided that the following conditions are simultaneously fulfilled:

- a) there exists, in the same circuit or on the supply side, protection intended to detect unbalanced loads and intended to cause disconnection of all the line conductors;
- b) the neutral conductor is not distributed from an artificial neutral point of the circuits situated on the load side of the protective device mentioned in a).

#### 431.2 Protection of the neutral conductor

##### 431.2.1 TT or TN systems

Where the cross-sectional area of the neutral conductor is at least equivalent to that of the line conductors, and the current in the neutral is expected not to exceed the value in the line conductors, it is not necessary to provide overcurrent detection for the neutral conductor or a disconnecting device for that conductor.

Where the cross-sectional area of the neutral conductor is less than that of the line conductors, it is necessary to provide overcurrent detection for the neutral conductor, appropriate to the cross-sectional area of that conductor; this detection shall cause the disconnection of the line conductors, but not necessarily of the neutral conductor.

In both cases the neutral conductor shall be protected against short-circuit current.

NOTE This protection may be achieved by the overcurrent protective devices in the line conductors. In that case it is not necessary to provide overcurrent protection for the neutral conductor or a disconnecting device for that conductor.

Where the current in the neutral conductor is expected to exceed the value in the line conductors, refer to 431.2.3.

Except for disconnection the requirements for a neutral conductor apply to a PEN conductor.

#### 431.2.2 IT systems

Where the neutral conductor is distributed, it is necessary to provide overcurrent detection for the neutral conductor of every circuit. The overcurrent detection shall cause the disconnection of all the live conductors of the corresponding circuit, including the neutral conductor. This measure is not necessary if

- the particular neutral conductor is effectively protected against overcurrent by a protective device placed on the supply side, for example at the origin of the installation, or if
- the particular circuit is protected by a residual current operated protective device with a rated residual current not exceeding 0,20 times the current-carrying capacity of the corresponding neutral conductor. This device shall disconnect all the live conductors of the corresponding circuit, including the neutral conductor. The device shall have sufficient breaking capacity for all poles.

NOTE In IT systems, it is strongly recommended that the neutral conductor should not be distributed.

#### 431.2.3 Harmonic currents

Overload detection shall be provided for the neutral conductor in a multi-phase circuit where the harmonic content of the line currents is such that the current in the neutral conductor is expected to exceed the current-carrying capacity of that conductor. The overload detection shall be compatible with the nature of the current through the neutral and shall cause the disconnection of the line conductors but not necessarily the neutral conductor. Where the neutral is disconnected, the requirements of 431.3 apply.

NOTE Further requirements regarding protection of neutral conductors are given in IEC 60364-5-52.

#### 431.3 Disconnection and reconnection of the neutral conductor in multi-phase systems

Where disconnection of the neutral conductor is required, disconnection and reconnection shall be such that the neutral conductor shall not be disconnected before the line conductors and shall be reconnected at the same time as or before the line conductors.

### 432 Nature of protective devices

The protective devices shall be of the appropriate types indicated by 432.1 to 432.3.

#### 432.1 Devices providing protection against both overload current and short-circuit current

Except as stated in 434.5.1, a device providing protection against both overload and short-circuit current shall be capable of breaking and, for a circuit-breaker, making any overcurrent

up to and including the prospective short-circuit current at the point where the device is installed. Such devices may be:

- circuit-breakers incorporating overload and short-circuit release;
- circuit-breakers in conjunction with fuses;
- fuses having fuse links with gG characteristics.

NOTE 1 The fuse comprises all the parts that form the complete protective device.

NOTE 2 This subclause does not exclude the use of other protective devices if the requirements in 433.1 and 434.5 are fulfilled.

### 432.2 Devices ensuring protection against overload current only

These protective devices shall satisfy the requirements of Clause 433 and may have an interrupting capacity below the value of the prospective short-circuit current at the point where the devices are installed.

NOTE 1 These devices are generally inverse time lag protective devices.

NOTE 2 Fuses type aM do not protect against overload.

### 432.3 Devices ensuring protection against short-circuit current only

A device providing protection against short-circuit current only shall be installed where overload protection is achieved by other means or where Clause 433 permits overload protection to be dispensed with. Such a device shall be capable of breaking, and for a circuit-breaker making, the short-circuit current up to and including the prospective short-circuit current. Such a device shall satisfy the requirements of Clause 434.

Such devices may be

- circuit-breakers with short-circuit release only.
- fuses with gM, aM type fuse links.

### 432.4 Characteristics of protective devices

The operating characteristics of overcurrent protective devices shall comply with those specified in, for example, IEC 60898, IEC 60947-2, IEC 60947-6-2, IEC 61009, IEC 60269-2, IEC 60269-3, IEC 60269-4 or IEC 60947-3.

NOTE The use of other devices is not excluded provided that their time/current characteristics provide an equivalent level of protection to that specified in this clause.

## 433 Protection against overload current

### 433.1 Coordination between conductors and overload protective devices

The operating characteristics of a device protecting a cable against overload shall satisfy the two following conditions:

$$I_B \leq I_n \leq I_Z \quad (1)$$

$$I_2 \leq 1,45 \times I_Z \quad (2)$$

where

$I_B$  is the design current for that circuit;

$I_Z$  is the continuous current-carrying capacity of the cable (see Clause 523);

$I_n$  is the rated current of the protective device;

NOTE 1 For adjustable protective devices, the rated current  $I_n$  is the current setting selected.

$I_2$  is the current ensuring effective operation in the conventional time of the protective device.

The current  $I_2$  ensuring effective operation of the protective device shall be provided by the manufacturer or as given in the product standard.

Protection in accordance with this clause may not ensure protection in certain cases, for example where sustained overcurrents less than  $I_2$  occur. In such cases, consideration should be given to selecting a cable with a larger cross-sectional area.

NOTE 2  $I_B$  is the design current through the line or the permanent current through neutral in case of a high level of the third harmonic

NOTE 3 The current ensuring effective operation in the conventional time of protective devices may also be named  $I_t$  or  $I_f$  according to the product standards. Both  $I_t$  and  $I_f$  are multiples of  $I_n$  and attention should be given to the correct representation of values and indexes.

NOTE 4 See Annex B for an illustration of conditions (1) and (2) of 433.1.

NOTE 5 Design current  $I_B$  can be considered as an actual current  $I_a$  after applying correction factors. See Clause 311.

### 433.2 Position of devices for overload protection

**433.2.1** A device ensuring protection against overload shall be placed at the point where a change, such as a change in cross-sectional area, nature, method of installation or in constitution, causes a reduction in the value of current-carrying capacity of the conductors, except where 433.2.2 and 433.3 apply.

**433.2.2** The device protecting the conductor against overload may be placed along the run of that conductor if the part of the run between the point where a change occurs (in cross-sectional area, nature, method of installation or constitution) and the position of the protective device has neither branch circuits nor socket-outlets and fulfils at least one of the following two conditions:

- a) it is protected against short-circuit current in accordance with the requirements stated in Clause 434;
- b) its length does not exceed 3 m, it is carried out in such a manner as to reduce the risk of short-circuit to a minimum, and it is installed in such a manner as to reduce to a minimum the risk of fire or danger to persons (see also 434.2.1).

NOTE For installation according to a) see Figure C.1. For installation according to b) see Figure C.2.

### 433.3 Omission of devices for protection against overload

The various cases stated in this subclause shall not be applied to installations situated in locations presenting a fire risk or risk of explosion or where the requirements for special installations and locations specify different conditions.

#### 433.3.1 General

Devices for protection against overload need not be provided:

- a) for a conductor situated on the load side of a change in cross-sectional area, nature, method of installation or in constitution, that is effectively protected against overload by a protective device placed on the supply side;
- b) for a conductor that is not likely to carry overload current, provided that this conductor is protected against short-circuit in accordance with the requirements of Clause 434 and that it has neither branch circuits nor socket-outlets;
- c) at the origin of an installation where the distributor provides an overload device and agrees that it affords protection to the part of the installation between the origin and the main distribution point of the installation where further overload protection is provided.