IEC 60364-4-43

Edition 4.0 2023-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

IEC 60364-4-43:2023-07(en-fr)

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform
La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, …). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished
Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org
Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

IEC 60364-4-43

Edition 4.0 2023-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.120.50; 91.140.50

ISBN 978-2-8322-7031-8

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

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

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.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60364-4-43 has been prepared by IEC technical committee 64: Electrical installations and protection against electric shock. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2008. This edition constitutes a technical revision.

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

a) the standard has been restructured, see Table 1 (Correspondence between IEC 60364-4-43:2008 and this document) below;
b) the measure "automatic disconnection of supply" has been designated as the preferred measure for protection against overcurrent;
c) all measures except the measure "automatic disconnection of supply" have been transferred into new normative annexes to indicate that these measures are usable in certain applications and under certain restricted conditions only (see Annex A, Annex B and Annex E);

d) a new clause "Terms and definitions" has been added;

e) new requirements have been added for the protection of the neutral or mid-point conductor (with and without triplen harmonics).

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

Draft	Report on voting
64/2591/FDIS	64/2618/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 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 F 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,
- replaced by a revised edition, or
- amended.

Correspondence between IEC 60364-4-43:2008 and this document

Table 1 provides a list of contents of both the previous edition and the current edition of IEC 60364-4-43, indicating the new structure of the standard.

Table 1 also indicates which clauses of IEC 60364-4-43:2008 have been transferred to IEC 60364-5-53:2019.

Table 1 – Correspondence between IEC 60364-4-43:2008 and this document

IEC 60364-4-43:2008		IEC 60364-4-43:2023	
Low-voltage electrical installations – Part 4-43: Protection for safety – Protection against overcurrent		**Low-voltage electrical installations – Part 4-43: Protection for safety – Protection against overcurrent**	
43	Protection against overcurrent	430	Protection against overcurrent
430.1	Scope	430.1	Scope
430.2	Normative references	430.2	Normative references
		430.3	Terms and definitions
430.3	General requirements	430.4	General requirements
431	Requirements according to the nature of the circuits	431	Protection against overcurrent by automatic disconnection of supply
431.1	Protection of line conductors	431.1	Protection of line conductors
431.2	Protection of the neutral conductor	431.2	Protection of neutral or mid-point conductor
431.3	Disconnection and reconnection of the neutral conductor in multi-phase systems		Deleted Covered by product standards and 530.4.2
432	Nature of protective devices	431.3	Protection against overcurrent Partly covered by Clause 533
432.1	Devices providing protection against both overload current and short-circuit current	431.3.1	Protection against both overload current and short-circuit current
432.2	Devices ensuring protection against overload current only	431.3.2	Protection against overload current only
432.3	Devices ensuring protection against short-circuit current only	431.3.3	Protection against short-circuit current only
432.4	Characteristics of protective devices		Deleted Covered by Clause 533
433	Protection against overload current	431.4	Protection against overload current
433.1	Coordination between conductors and overload protective devices	431.4.2	Coordination between conductors and overload protective devices
433.2	Position of devices for overload protection		Deleted Covered by 533.4.2
433.3	Omission of devices for protection against overload	Annex A Protection against overcurrent by other means, Clause A.2 Protection against overload **except 433.3.2.1 which was initially transferred to IEC 60364-5-53:2019, 533.4.2.4 but was then deleted at CDV stage from IEC 60364-5-53:2019**	
433.4	Overload protection of conductors in parallel	431.4.3	Protection against overload current of conductors connected in parallel
434	Protection against short-circuit currents	431.5	Protection against short-circuit currents
434.1	Determination of prospective short-circuit currents	431.5.2	Determination of prospective short-circuit currents

IEC 60364-4-43:2008		IEC 60364-4-43:2023	
Low-voltage electrical installations – Part 4-43: Protection for safety – Protection against overcurrent		**Low-voltage electrical installations – Part 4-43: Protection for safety – Protection against overcurrent**	
434.2	Position of devices for short-circuit protection		Deleted Covered by 533.4.3
434.3	Omission of devices for protection against short-circuit	Annex A Protection against overcurrent by other means, Clause A.3 Protection against short-circuits	
434.4	Short-circuit protection of conductors in parallel	431.5.3	Protection against short-circuit current of conductors connected in parallel
434.5	Characteristics of short-circuit protective devices	431.5.4	Requirements for protection against short-circuit current
435	Coordination of overload and short-circuit protection	431.6	Coordination of protection against overload current and protection against short-circuit current
435.1	Protection afforded by one device	431.6.1	Protection afforded by one device
435.2	Protection afforded by separate devices	431.6.2	Protection afforded by separate devices
		431.6.3	Coordination for selectivity and combined short-circuit protection
		Annex A (normative) Protection against overcurrent by other means	
436	Limitation of overcurrent by characteristics of supply	Annex B (normative) Protection against overcurrent by limitation of the characteristics of supply	
Annex A (informative) Protection of conductors in parallel against overcurrent.		Annex C (informative) Protection of conductors in parallel against overcurrent	
Annex B (informative) Conditions 1 and 2 of 433.1			Deleted Covered by Figure 1 in 431.4.2
Annex C (informative) Position or omission of devices for overload protection			Moved to IEC 60364-5-53:2019, Annex A (Position of devices for overload protection)
Annex D (informative) Position or omission of devices for short-circuit protection			Moved to IEC 60364-5-53:2019, Annex B (Position of devices for short-circuit protection)
		Annex D (informative) Design current	
		Annex E (normative) Cases where automatic disconnection of supply for protection against overcurrent can cause an increased risk	
Annex E (informative) List of notes concerning certain countries		Annex F (informative) List of notes concerning certain countries	

LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

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

430 Protection against overcurrent

430.1 Scope

This part of IEC 60364 provides requirements for:

– protection of live conductors, PEN conductors, PEM conductors, and PEL conductors against the harmful effects caused by overcurrent;

– coordination of measures for protection against overcurrent.

NOTE 1 The requirements of this document do not take account of external influences.

NOTE 2 Protection of conductors according to this document does not necessarily protect the equipment connected to the conductors.

NOTE 3 Flexible cables connecting equipment by plugs and socket-outlet to fixed installations are not part of the scope of this document and for this reason are not necessarily protected against the harmful effects caused by overcurrent.

430.2 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 60364-5-52:2009, *Low-voltage electrical installations – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

430.3 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

430.3.1
overcurrent
electric current the value of which exceeds a specified limiting value

Note 1 to entry: For conductors, the specified limiting value is equal to the current-carrying capacity.

Note 2 to entry: An overcurrent is an overload current or a short-circuit current.

[SOURCE: IEC 60050-151:2001, 151-15-28, modified – The Notes to entry have been added.]

430.3.2
overload current
<of an electric circuit> overcurrent occurring in an electric circuit, which is not caused by a short-circuit or an earth fault

[SOURCE: IEC 60050-826:2022, 826-11-15]

430.3.3
short-circuit current
electric current in a given short-circuit

[SOURCE: IEC 60050-195:2021, 195-05-18]

430.3.4
short-circuit
accidental or intentional conductive path between two or more conductive parts forcing the electric potential differences between these conductive parts to be equal to or close to zero

[SOURCE: IEC 60050-151:2001, 151-12-04]

430.3.5
overload
operating conditions in an electrically undamaged circuit, which cause an overcurrent

[SOURCE: IEC 60050-441:1984, 441-11-08]

430.3.6
design current
<of an electric circuit> electric current intended to be carried by an electric circuit in normal operation

[SOURCE: IEC 60050-826:2022, 826-11-10]

430.3.7
rated conditional short-circuit current
I_{cc}
value of prospective short-circuit current, declared by the busbar trunking or powertrack system manufacturer, that can be withstood for the disconnection time of the overcurrent protective device under specified conditions

[SOURCE: IEC 61439-1:2020, 3.8.10.4, modified – The definition has been adapted to busbar trunking or powertrack system.]

430.3.8
combined short-circuit protection
coordination of two overcurrent protective devices in series, capable of breaking short-circuit currents higher than the breaking capacity of one of the devices alone

430.3.9
diversity
prospective simultaneous demand of a group of electrical loads.

[SOURCE: IEC 60364-1:—, 1.3.1]

430.4 General requirements

Electric circuits shall be protected so as to eliminate the harmful effects caused by overcurrent in live conductors, PEN conductors, PEM conductors, and PEL conductors.

This protection shall be achieved by the use of a protective device to disconnect any overcurrent in the circuit conductors in accordance with Clause 431.

However, in certain cases, where automatic disconnection of the supply can be inappropriate, protection may be achieved by other means as given in Annex A or by limitation of overcurrent by the characteristics of supply as given in Annex B. In those cases where automatic disconnection of supply can cause a danger or an increased risk, Annex E applies.

NOTE 1 Disconnection does not mean isolation in this document.

NOTE 2 Harmful effects include: thermal or mechanical effects detrimental to insulation, joints, terminations or material surrounding the conductors.

NOTE 3 Conductors protected against overload in accordance with 431.4 are considered to be protected also against faults likely to cause short-circuit currents of a magnitude similar to overload currents.

431 Protection against overcurrent by automatic disconnection of supply

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

431.1.2 Detection of overcurrent is not required for a PEL conductor in DC circuits.

431.2 Protection of neutral or mid-point conductor

431.2.1 AC circuits without triplen harmonics and DC circuits

NOTE 1 AC circuits with triplen harmonics THD_{i3n} < 5 % are considered to be AC circuits without triplen harmonics.

Where the cross-sectional area (CSA) of the neutral or mid-point conductor is at least equivalent to that of the line conductors, and the current in the neutral or mid-point conductor is expected not to exceed the value in the line conductors, it is not necessary to provide overload current detection for the neutral or mid-point conductor or a disconnecting device for that conductor, except for IT systems where 431.2.2 applies.

Where the CSA of the neutral or mid-point conductor is at least equivalent to that of the line conductors, and the current of the neutral or mid-point conductor is expected to exceed the value of the line conductors, it is necessary to provide overload current detection for the neutral or the mid-point 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 or the mid-point conductor.

Where the CSA of the neutral or mid-point conductor is less than that of the line conductors, a detection of overload current in the neutral or mid-point conductor shall be provided, causing disconnection of the line conductors, but not necessarily of the neutral or mid-point conductor. In the case where the conductors are of the same material the detection of the current in the neutral conductor should follow the following equation:

$$I_N \leq I_Z \times \sqrt{\frac{S_N}{S_L}} \quad (1)$$

where

I_N is the detection setting current for the neutral conductor or the mid-point conductor;

I_Z is the current-carrying capacity of the line conductors in the circuit;

S_N is the CSA of the neutral conductor or the mid-point conductor;

S_L is the CSA of the line conductor.

NOTE 2 The formula is based on the assumption that the power loss in the neutral conductor will not be greater than the power loss in the line conductor when loaded with a current corresponding to the current-carrying capacity for the cable as given in IEC 60364-5-52.

The neutral or mid-point conductor shall be protected against short-circuit currents. This protection may be achieved by the overcurrent protective devices in the line conductors. In that case it is not necessary to provide short-circuit current detection for the neutral or mid-point conductor or a disconnecting device for that conductor. Except for disconnection, the requirements for a neutral conductor apply to a PEN conductor in AC systems, and the requirements for a mid-point conductor apply to a PEM conductor in DC systems.

431.2.2 Additional requirements for IT systems

Where the neutral conductor is distributed, one of the following measures shall be provided:

– overcurrent detection for the neutral conductor of every circuit, causing disconnection of all live conductors of the corresponding circuit;
– the neutral conductor is effectively protected against overcurrent by a protective device placed on the supply side;
– the circuit is protected by a residual current operated protective device with a rated residual operating current not exceeding 0,2 times the current-carrying capacity of the corresponding neutral conductor. This device shall disconnect all the live conductors of the corresponding circuit. The device shall have sufficient breaking capacity for all poles.

Where a circuit in an IT DC system includes a mid-point conductor, overcurrent detection shall be provided for the mid-point conductor, causing the disconnection of all the live conductors of the corresponding circuit, including the mid-point conductor.

431.2.3 AC system with triplen harmonics

Where a neutral conductor carries triplen harmonics, the following applies:

a) where the harmonic content of the line currents is such that the current in the neutral conductor is expected to cause the conductor temperature to exceed the maximum allowed conductor temperature of the cable, the neutral conductor shall be provided with means for overload detection causing disconnection of the line conductors but not necessarily the neutral conductor, or

b) the CSA of the conductors shall be selected by using a reduction factor for the current-carrying capacity as provided in IEC 60364-5-52.

NOTE In case of b), the protection of the neutral conductor is ensured by the protection of the line conductors according to 431.4.1.

431.3 Protection against overcurrent

431.3.1 Protection against both overload current and short-circuit current

Except where the circuit is protected according to 431.3.2 or 431.3.3, protection against both overload and short-circuit current shall be provided.

431.3.2 Protection against overload current only

Where protection against overcurrent by automatic disconnection of the supply is provided only in case of overload, protection against short-circuit current shall be achieved by other means as specified in Clause A.3 or Annex B.

Devices for protection against overload current shall comply with the requirements of 431.4.

431.3.3 Protection against short-circuit current only

Where protection against overcurrent by automatic disconnection of the supply is provided only in case of short-circuit, protection against overload current shall be achieved by other means as specified in Clause A.2 or Annex B.

Devices for protection against short-circuit current shall comply with the requirements of 431.5.

431.4 Protection against overload current

431.4.1 General

Conductors shall be protected by an overcurrent protective device that disconnects overload currents in the conductors before such currents cause detrimental effects on the conductors or their insulation.

431.4.2 Coordination between conductors and overload protective devices

Protection against overload currents is provided if the following two conditions are satisfied:

$$I_B \leq I_n \leq I_Z \tag{2}$$

$$I_2 \leq 1{,}45 \times I_Z \tag{3}$$

where:

I_B is the design current for that circuit (see Annex D);

I_Z is the continuous current-carrying capacity of the conductor system;

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.

For conductor systems comprising insulated conductors or cables, the current-carrying capacity shall be determined in accordance with IEC 60364-5-52:2009, Clause 523. For conductor systems not covered by IEC 60364-5-52:2009, Clause 523, such as busbar trunking systems and power track systems, information on current-carrying capacities shall be obtained from the manufacturer.

The current I_2 ensuring effective operation of the protective device shall be obtained from the manufacturer.

It is possible that the requirement given by Formula (3) will not ensure protection in certain cases, for example where sustained overcurrents less than I_2 occur. In such cases, consideration should be given to the selection of a wiring system with a higher current-carrying capacity.

NOTE 2 The current ensuring effective operation in the conventional time of protective devices is also symbolized I_t or I_f according to some product standards. Both I_t and I_f are multiples of I_n.

NOTE 3 Refer to Annex D for information on I_B.

Figure 1 illustrates the different currents considered.

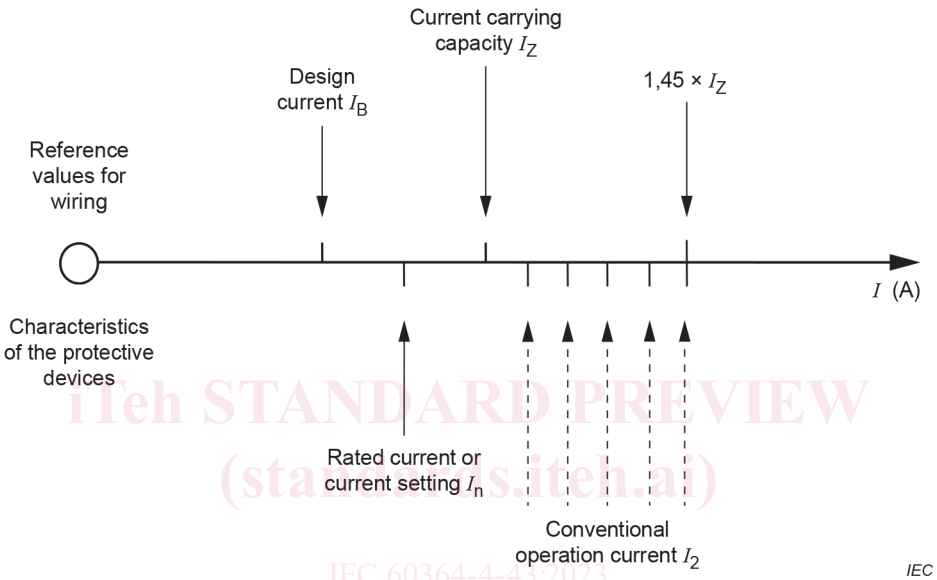

Figure 1 – Coordination between conductor and protective device (conditions 1 and 2)

431.4.3 Protection against overload current of conductors connected in parallel

431.4.3.1 General

Where a single protective device protects several conductors in parallel, there shall be no branch circuits or devices for isolation or switching in the parallel conductors.

This Subclause 431.4.3 does not preclude the use of ring final circuits with or without spur connections.

NOTE 1 A ring final circuit is a final circuit where both ends of the circuit are connected to a single point of supply.

NOTE 2 Annex C, Clause C.2 provides further information on protection against overload current of conductors connected in parallel.

431.4.3.2 Equal current sharing between parallel conductors

Where a single device protects conductors in parallel sharing currents equally, and having the same current-carrying capacities, the value of I_Z to be used in 431.4.2 is the sum of the current-carrying capacity of each conductor.

It is deemed that current sharing is equal if the requirements of IEC 60364-5-52:2009, 523.7 a) are satisfied.