

INTERNATIONAL STANDARD

NORME INTERNATIONALE



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

**Installations électriques à basse tension –
Partie 5-53: Choix et mise en œuvre des matériels électriques – Dispositifs
de protection pour assurer la sécurité, le sectionnement, la coupure,
la commande et la surveillance**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2019 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
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 It also gives information on projects, replaced and withdrawn publications.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.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

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.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



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

**Installations électriques à basse tension –
Partie 5-53: Choix et mise en œuvre des matériels électriques – Dispositifs
de protection pour assurer la sécurité, le sectionnement, la coupure,
la commande et la surveillance**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.130.01; 91.140.50

ISBN 978-2-8322-7598-6

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD	6
530.1 Scope	8
530.2 Normative references	8
530.3 Terms and definitions	11
530.4 General and common requirements	14
530.5 Erection of equipment	14
531 Devices for protection against indirect contact by automatic disconnection of supply	14
531.1 Overcurrent protective devices	14
531.1.1 TN systems	14
531.1.2 TT systems	14
531.1.3 IT systems	15
531.2 Residual current protective devices	15
531.2.1 General conditions of installation	15
531.2.2 Selection of devices according to their method of application	15
531.2.3 TN systems	15
531.2.4 TT systems	16
531.2.5 IT systems	16
531.3 Insulation monitoring devices	16
532 Devices and precautions for protection against thermal effects	16
532.1 General	16
532.2 Locations with a particular risk of fire	16
532.2.1 General	16
532.2.2 Locations with external influences BD2, BD3 or BD4	17
532.2.3 Locations with external influences BE2	17
532.3 Selection of arc fault detection devices (AFDD)	18
533 Devices for protection against overcurrent	18
533.1 General requirements	18
533.1.1 General	18
533.1.2 Compliance with standards	18
533.1.3 Fuses	19
533.2 Selection of devices for protection against overload current	19
533.2.1 General	19
533.2.2 Presence of harmonic currents	20
533.2.3 Unequal current sharing between parallel conductors	20
533.3 Selection of devices for protection against short-circuit current	20
533.3.1 Thermal stresses	20
533.3.2 Breaking capacity	21
533.4 Positioning of overcurrent protection devices	21
533.4.1 General	21
533.4.2 Positioning of devices for overload protection	21
533.4.3 Positioning of devices for short-circuit protection	22
533.5 Co-ordination of overload and short-circuit protective functions	23
533.5.1 Protective functions provided by one device	23
533.5.2 Protective functions provided by separate devices	23
534 Devices for protection against transient overvoltages	23

534.1	General.....	23
534.2	Void.....	24
534.3	Void.....	24
534.4	Selection and erection of SPDs.....	24
534.4.1	SPD location and SPD test class.....	24
534.4.2	Transient overvoltage protection requirements.....	25
534.4.3	Connection types.....	25
534.4.4	Selection of SPDs.....	27
534.4.5	Protection of the SPD against overcurrent.....	31
534.4.6	Fault protection.....	33
534.4.7	SPDs installation in conjunction with RCDs.....	34
534.4.8	Connections of the SPD.....	34
534.4.9	Effective protective distance of SPDs.....	36
534.4.10	Connecting conductors of SPDs.....	37
535	Co-ordination of protective devices.....	37
535.1	Selectivity between overcurrent protective devices.....	37
535.1.1	General.....	37
535.1.2	Partial selectivity.....	38
535.1.3	Full selectivity.....	38
535.1.4	Total selectivity.....	38
535.1.5	Enhanced selectivity.....	38
535.2	Co-ordination between residual current protective devices and OCPDs.....	39
535.3	Selectivity between residual current protective devices.....	39
535.4	Selectivity of RCD and OCPD.....	39
535.5	Combined short-circuit protection of OCPDs.....	39
536	Isolation and switching.....	40
536.2	Isolation.....	40
536.2.1	General.....	40
536.2.2	Devices for isolation.....	41
536.3	Switching-off for mechanical maintenance.....	42
536.3.1	General.....	42
536.3.2	Devices for switching-off for mechanical maintenance.....	42
536.4	Emergency switching.....	43
536.4.1	General.....	43
536.4.2	Devices for emergency switching-off.....	43
536.4.3	Devices for emergency stopping.....	44
536.5	Functional switching (control).....	44
536.5.1	General.....	44
536.5.2	Devices for functional switching.....	44
537	Monitoring.....	45
537.1	General.....	45
537.1.1	Monitoring devices.....	45
537.1.2	Selection of insulation monitoring devices (IMDs).....	45
537.1.3	Selection of residual current monitoring devices (RCMs).....	45
537.2	IT systems for continuity of supply.....	45
537.2.1	General.....	45
537.2.2	Insulation monitoring devices (IMDs).....	46
537.2.3	Installation of IMDs.....	46
537.3	IT public distribution system.....	46

537.4 Off-line systems in TN, TT and IT systems	46
Annex A (informative) Position of devices for overload protection	48
A.1 General.....	48
A.2 Cases where overload protection need not be placed at the origin of the branch circuit	48
Annex B (informative) Position of devices for short-circuit protection	50
B.1 General.....	50
B.2 Cases where short-circuit protection need not be placed at the origin of branch circuit	50
Annex C (informative) SPD installation – Examples of installation diagrams according to system configurations	52
C.1 TT system – 3 phase supply plus neutral	52
C.2 TN-C and TN-C-S systems – 3 phase supply	56
C.3 TN-S system – 3 phase supply plus neutral.....	60
C.4 IT system – 3 phase supply with or without neutral	62
Annex D (informative) Installation supplied by overhead lines	65
Annex E (normative) Reference standards for devices for isolation and switching.....	66
Annex F (informative) List of notes concerning certain countries	68
Bibliography.....	75
Figure 1 – Example of installation of class I, class II and class III tested SPDs	25
Figure 2 – Connection type CT1 (4+0-configuration) for a three-phase system with neutral	26
Figure 3 – Connection type CT1 (3+0-configuration) for a three-phase system.....	26
Figure 4 – Connection type CT2 (e.g. 3+1-configuration) for a three-phase system with neutral	27
Figure 5 – Connection points of an SPD assembly.....	31
Figure 6 – Example of overcurrent protection in the SPD branch by using a dedicated external overcurrent protective device.....	32
Figure 7 – Protective device, which is a part of the installation, also used to protect the SPD.....	33
Figure 8 – Connection of the SPD.....	35
Figure 9 – Example of installation of an SPD in order to decrease lead length of SPD supply conductors.....	36
Figure 10 – Example of selectivity.....	38
Figure 11 – Example of currents and their correlation to selectivity	39
Figure 12 – Example of combined short-circuit protection of OCPDs	40
Figure A.1 – Overload protective device (P ₂) not at the origin of branch circuit (B)	48
Figure A.2 – Overload protective device (P ₂) installed within 3 m of the origin of the branch circuit (B)	49
Figure B.1 – Limited change of position of short-circuit protective device (P ₂) on a branch circuit.....	50
Figure B.2 – Short-circuit protective device P ₂ installed at a point on the supply side of the origin of a branch circuit.....	51
Figure C.1 – Example of SPDA installation with connexion type CT2 on the supply side (upstream) of the main RCD in TT system.....	52
Figure C.2 – Example of SPD installation with connexion type CT2 on the supply side (upstream) of the main RCD in TT system.....	53

Figure C.3 – Example of SPDA installation on the load side (downstream) of the main RCD in TT system.....	54
Figure C.4 – Example of SPD installation on the load side (downstream) of the RCD in TT system.....	55
Figure C.5 – Example of SPDA installation in TN-C system	56
Figure C.6 – Example of SPD installation with connexion type CT1 in TN-C system.....	57
Figure C.7 – Example of SPD installation in TN-C-S system where the PEN is separated into PE and N at the origin of the installation (upstream of the SPD)	58
Figure C.8 – Example of SPDs installation in TN-C-S in different distribution boards	59
Figure C.9 – Example of SPDA installation in TN-S system.....	60
Figure C.10 – Example of SPDs installation in TN-S	61
Figure C.11 – Example of SPDA installation in IT system with neutral.....	62
Figure C.12 – Example of SPD installation in IT system without neutral	63
Figure C.13 – Example of SPD installation in IT system with neutral	64
Figure F.1 – Single user.....	71
Figure F.2 – Several users.....	71
Figure F.3 – Lamp control circuit with switching in the neutral conductor	73
Table 1 – Required rated impulse voltage of equipment	28
Table 2 – U_c of the SPD dependent on supply system configuration	29
Table 3 – Nominal discharge current (I_n) in kA depending on supply system and connection type	30
Table 4 – Selection of impulse discharge current (I_{imp}) where the building is protected against direct lightning strike	30
Table 5 – Connection of the SPD dependent on supply system.....	34
Table D.1 – Selection of impulse discharge current (I_{imp})	65
Table E.1 – Devices for isolation and switching.....	66

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

Part 5-53: Selection and erection of electrical equipment – Devices for protection for safety, isolation, switching, control and monitoring

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, accept 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.

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

This bilingual version (2019-11) corresponds to the monolingual English version, published in 2019-12.

This fourth edition cancels and replaces the third edition published in 2001, Amendment 1:2002 and Amendment 2:2015. This edition constitutes a technical revision.

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

- a) revision of all clauses except 531 and 534;
- b) introduction of a new Clause 537 Monitoring;
- c) Clause 530 contains all normative references and all terms and definitions.

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

FDIS	Report on voting
64/2352/FDIS	64/2359/RVD

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

The French version of this standard has not been voted upon.

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

The reader's attention is drawn to the fact that Annex F lists all of the “in-some-country” clauses on differing practices relating to the subject of this standard.

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 committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

Part 5-53: Selection and erection of electrical equipment – Devices for protection for safety, isolation, switching, control and monitoring

530.1 Scope

This document provides requirements for:

- a) isolation, switching, control and monitoring, and
- b) selection and erection of:
 - 1) devices for isolation, switching, control and monitoring, and
 - 2) devices to achieve compliance with measures of protection for safety.

530.2 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 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

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 K*

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 use-links for the protection of semiconductor devices*

IEC 60309 (all parts), *Industrial socket-outlets and couplers for industrial purposes*

IEC 60364 (all parts), *Low-voltage electrical installations*

IEC 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*
IEC 60364-4-41:2005/AMD1:2017

IEC 60364-4-42:2010, *Low-voltage electrical installations – Part 4-42: Protection for safety – Protection against thermal effects*
IEC 60364-4-42:2010/AMD1:2014

IEC 60364-4-43:2008, *Low-voltage electrical installations – Part 4-43: Protection for safety – Protection against overcurrent*

IEC 60364-4-44:2007, *Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*
IEC 60364-4-44:2007/AMD1:2015