

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Low-voltage switchgear and controlgear –
Part 7-2: Ancillary equipment – Protective conductor terminal blocks for copper
conductors

Appareillage à basse tension –
Partie 7-2: Matériels accessoires – Blocs de jonction de conducteur de
protection pour conducteurs en cuivre



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2009 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 la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: 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 corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

[IEC 60947-7-2:2009](mailto:IEC.60947-7-2:2009)

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) 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 CEI

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

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,...). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:

Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00



INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Low-voltage switchgear and controlgear –
Part 7-2: Ancillary equipment – Protective conductor terminal blocks for copper
conductors**

**Appareillage à basse tension –
Partie 7-2: Matériels accessoires – Blocs de jonction de conducteur de
protection pour conducteurs en cuivre**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

R

ICS 29.120.99; 29.130.20

ISBN 978-2-88910-342-3

CONTENTS

FOREWORD.....	4
1 General.....	6
1.1 Scope.....	6
1.2 Normative references.....	6
2 Definitions.....	7
3 Classification.....	7
4 Characteristics.....	7
4.1 Summary of characteristics.....	7
4.2 Type of protective conductor terminal block.....	7
4.3 Rated and limiting values.....	8
4.3.1 Void.....	8
4.3.2 Short-time withstand current.....	8
4.3.3 Standard cross-sections.....	8
4.3.4 Rated cross-section.....	8
4.3.5 Rated connecting capacity.....	8
5 Product information.....	8
5.1 Marking.....	8
5.2 Additional information.....	9
6 Normal service, mounting and transport conditions.....	9
7 Constructional and performance requirements.....	9
7.1 Constructional requirements.....	9
7.1.1 Clamping units.....	9
7.1.2 Connection of support.....	9
7.1.3 Clearance and creepage distances.....	9
7.1.4 Terminal block identification and marking.....	10
7.1.5 Resistance to abnormal heat and fire.....	10
7.1.6 Rated cross-section and rated connecting capacity.....	10
7.1.7 Protective conductor mounting rails.....	10
7.2 Performance requirements.....	10
7.2.1 Temperature rise.....	10
7.2.2 Dielectric properties.....	10
7.2.3 Short-time withstand current.....	10
7.2.4 Voltage drop.....	10
7.2.5 Electrical performance after ageing (for screwless-type protective conductor terminal blocks only).....	11
7.3 Electromagnetic compatibility (EMC).....	11
8 Tests.....	11
8.1 Kinds of test.....	11
8.2 General.....	11
8.3 Verification of mechanical characteristics.....	11
8.4 Verification of electrical characteristics.....	11
8.4.1 General.....	11
8.4.2 Void.....	12
8.4.3 Dielectric tests.....	12
8.4.4 Verification of the voltage drop.....	13
8.4.5 Temperature-rise test.....	14

8.4.6	Short-time withstand current test	15
8.4.7	Ageing test (for screwless-type terminal blocks only).....	16
8.5	Verification of thermal characteristics	17
8.6	Verification of EMC characteristics	17
Annex A (normative)	Maximum short-time withstand currents allocated to the rail profile and thermal rated current of a PEN busbar	18
Figure 1	– Arrangement for the dielectric test	12
Figure 2	– Arrangement for the voltage drop test	13
Figure 3	– Arrangement for the temperature-rise test for test group a).....	15
Figure 4	– Arrangement for the temperature-rise test for test group b).....	15
Figure 5	– Arrangement for the thermal short-time withstand current test.....	16
Table 1	– Relationship between rated cross-section and rated connecting capacity of protective conductor terminal blocks	8
Table A.1	– Maximum short-time withstand currents allocated to the rail profile and thermal rated current of a PEN busbar	18

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[IEC 60947-7-2:2009](https://standards.iteh.ai/catalog/standards/sist/cefa3cfd-b2f8-4eb6-a2fe-f3803ac0ef98/iec-60947-7-2-2009)

<https://standards.iteh.ai/catalog/standards/sist/cefa3cfd-b2f8-4eb6-a2fe-f3803ac0ef98/iec-60947-7-2-2009>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

**Part 7-2: Ancillary equipment –
Protective conductor terminal blocks for copper conductors**

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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 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 60947-7-2 has been prepared by subcommittee 17B: Low-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

This third edition of IEC 60947-7-2 cancels and replaces the second edition, published in 2002, and constitutes a technical revision.

The main technical modifications of this standard since this previous publication are listed below:

- requirements for tightening torques for the tests improved and referenced to Table 4 of IEC 60947-1, Annex B deleted;
- the wording of the short-time withstand current test improved in 8.4.6.

This standard shall be read in conjunction with IEC 60947-1 and IEC 60947-7-1. The provisions of the general rules dealt with in IEC 60947-1 and the requirements for terminal blocks of IEC 60947-7-1 are applicable to this standard, where specifically called for. Clauses and subclauses, tables, figures and annexes thus applicable are identified by reference to IEC 60947-1 or IEC 60947-7-1, e.g. 1.2 of IEC 60947-1, Table 4 of IEC 60947-7-1 or Annex A of IEC 60947-1.

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

FDIS	Report on voting
17B/1655/FDIS	17B/1669/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.

A list of all the parts in the IEC 60947 series, under the general title *Low-voltage switchgear and controlgear*, can be found on the IEC website.

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 [IEC 60947-7-2:2009](https://standards.iteh.ai/catalog/standards/sist/cefa3cfd-b2f8-4eb6-a2fe-f3803ac0ef98/iec-60947-7-2-2009)
- amended. <https://standards.iteh.ai/catalog/standards/sist/cefa3cfd-b2f8-4eb6-a2fe-f3803ac0ef98/iec-60947-7-2-2009>

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 7-2: Ancillary equipment – Protective conductor terminal blocks for copper conductors

1 General

1.1 Scope

This part of IEC 60947 specifies requirements for protective conductor terminal blocks with PE function up to 120 mm² (250 kcmil) and for protective conductor terminal blocks with PEN function equal to and above 10 mm² (AWG 8) with screw-type or screwless-type clamping units, primarily intended for industrial applications.

NOTE AWG is the abbreviation of “American Wire Gage” [Gage (US) = Gauge (UK)]

kcmil = 1 000 cmil

1 cmil = 1 circular mil = surface of a circle having a diameter of 1 mil

1 mil = 1/1 000 inch

Protective conductor terminal blocks are used to form the electrical and mechanical connection between copper conductors and the fixing support.

It is applicable to protective conductor terminal blocks for the connection of round copper conductors with or without special preparation having a cross-section between 0,2 mm² and 120 mm² (AWG 24 and 250 kcmil), intended to be used in circuits of a rated voltage not exceeding 1 000 V a.c. up to 1 000 Hz or 1 500 V d.c. most commonly in conjunction with terminal blocks according to IEC 60947-7-1.

This standard may be used as guide for

- protective conductor terminal blocks requiring the fixing of special devices to the conductors, for example quick connect terminations or wrapped connections, etc.;
- protective conductor terminal blocks providing direct contact to the conductors by means of edges or points penetrating the insulation, for example insulation displacement connections, etc.

Where applicable in this standard, the term “clamping unit” has been used instead of the term “terminal”. This is taken into account in case of reference to IEC 60947-1.

1.2 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 60439-1:1999, *Low-voltage switchgear and controlgear assemblies – Part 1: Type-tested and partially type-tested assemblies*
Amendment 1 (2004)

IEC 60715:1981, *Dimensions of low-voltage switchgear and controlgear – Standardized mounting on rails for mechanical support of electrical devices in switchgear and controlgear installations*
Amendment 1 (1995)

IEC 60947-1:2007, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC 60947-7-1, *Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors*

2 Definitions

For the purposes of this document, definitions given in IEC 60947-7-1, together with the following definitions, apply.

2.1

protective conductor terminal block

device with one or more clamping units for connecting and/or joining protective conductors (PE and PEN conductors) with conducting connection to their supports, which may be designed with screw-type or screwless-type fixing means

NOTE 1 Supports are, for example, mounting rails, sheet metal cut-outs, mounting plates, etc.

NOTE 2 A protective conductor terminal block can be either partially insulated or not at all. It does not require any functional insulation.

2.2

partially insulated protective conductor terminal block

device which is only insulated against live parts of other devices but not against the support itself

2.3

PEN conductor

earthed conductor combining the functions of both protective conductor and neutral conductor

NOTE The acronym PEN results from the combination of both symbols PE for the protective conductor and N for the neutral conductor (see 2.1.15 of IEC 60947-1).

<https://standards.iteh.ai/catalog/standards/sist/cefa3cfd-b2f8-4eb6-a2fe-f3803ac0ef98/iec-60947-7-2-2009>

3 Classification

Distinction is made between various types of protective conductor terminal blocks as follows:

- method of fixing the protective conductor terminal block to the support;
- type of clamping units: screw-type clamping units or screwless-type clamping units;
- ability to receive conductors with or without special preparation (e.g. cable lugs);
- terminal assemblies with identical or dissimilar clamping units;
- number of clamping units on each terminal assembly;
- service conditions;
- PE or PEN functions.

4 Characteristics

4.1 Summary of characteristics

Subclause 4.1 of IEC 60947-7-1 applies.

4.2 Type of protective conductor terminal block

Subclause 4.2 of IEC 60947-7-1 applies.

4.3 Rated and limiting values

4.3.1 Void

4.3.2 Short-time withstand current

Subclause 4.3.2 of IEC 60947-7-1 applies.

4.3.3 Standard cross-sections

Subclause 4.3.3 of IEC 60947-7-1 applies with the following addition.

In accordance with the scope of this standard, Table 1 of IEC 60947-7-1 applies only up to 120 mm² (250 kcmil).

4.3.4 Rated cross-section

Subclause 4.3.4 of IEC 60947-7-1 applies.

4.3.5 Rated connecting capacity

Subclause 4.3.5 of IEC 60947-7-1 applies with the modification for one conductor per clamping unit only, as for 7.4.3.1.6 of IEC 60439-1, and with the following Table 1.

Table 1 – Relationship between rated cross-section and rated connecting capacity of protective conductor terminal blocks

Rated cross-section		Rated connecting capacity		
mm ²	AWG/kcmil	mm ²	AWG/kcmil	
0,2	24	0,2	24	
0,34	22	0,2 – 0,34	24 – 22	
0,5	20	0,2 – 0,34 – 0,5	24 – 22 – 20	
0,75	18	0,34 – 0,5 – 0,75	22 – 20 – 18	
1	–	0,5 – 0,75 – 1	–	
1,5	16	0,75 – 1 – 1,5	20 – 18 – 16	
2,5	14	1 – 1,5 – 2,5	18 – 16 – 14	
4	12	1,5 – 2,5 – 4	16 – 14 – 12	
6	10	2,5 – 4 – 6	14 – 12 – 10	
10	8	4 – 6 – 10	12 – 10 – 8	
16	6	6 – 10 – 16	10 – 8 – 6	
25	4	10 – 16 – 25	8 – 6 – 4	
35	2	16 – 25 – 35	6 – 4 – 2	
50	0	25 – 35 – 50	4 – 2 – 0	
70	00	35 – 50 – 70	2 – 0 – 00	
95	000	50 – 70 – 95	0 – 00 – 000	
120	250	70 – 95 – 120	00 – 000 – 250	

5 Product information

5.1 Marking

A protective conductor terminal block shall be marked in a durable and legible manner with the following:

- a) the name of the manufacturer or a trade mark by which the manufacturer can be readily identified;

- b) a type reference permitting its identification in order to obtain relevant information from the manufacturer or his catalogue.

5.2 Additional information

The following information shall be stated by the manufacturer, if applicable, e.g. in the manufacturer's data sheet or his catalogue or on the packing unit:

- a) IEC 60947-7-2, if the manufacturer claims compliance with this standard;
- b) the rated cross-section;
- c) the rated connecting capacity if different from Table 1;
- d) service conditions, if different from those of Clause 6.

The manufacturer shall declare if the protective conductor terminal block rated equal to or above 10 mm² (AWG 8) is intended for PE function only.

NOTE No marking indicates suitability for use in both PE + PEN functions.

6 Normal service, mounting and transport conditions

Clause 6 of IEC 60947-1 applies.

7 Constructional and performance requirements

7.1 Constructional requirements

7.1.1 Clamping units

[IEC 60947-7-2:2009](https://standards.iteh.ai/catalog/standards/sist/cef3cfd1-b2f8-4eb6-a2fe-b803ac0e98/iec-60947-7-2-2009)

Subclause 7.1.1 of IEC 60947-7-1 applies with the following additions.

The protective conductor terminal block shall permit a reliable connection between the conductor clamping units and the clamping unit to the support.

The clamping units shall be able to withstand the forces that can be applied through the connected conductors and the connected support.

Compliance is checked by inspection, by the test of 8.3.3.1 and by the tests of 8.3.3.2 and 8.3.3.3 of IEC 60947-7-1.

7.1.2 Connection of support

Protective conductor terminal blocks shall be provided with means for secure attachment to the corresponding support without risk of galvanic corrosion.

The design of the protective conductor terminal block shall clearly show how the fixation has to be made to ensure the correct conducting connection to the appropriate support.

The clamping connection to the support shall only be released by means of tools.

The test shall be carried out in accordance with 8.3.2 of IEC 60947-7-1.

NOTE Information on mounting rails can be found in IEC 60715.

7.1.3 Clearance and creepage distances

Clearance and creepage distances do not apply to protective conductor terminal blocks.

NOTE The value of the clearance and creepage distances between protective conductor terminal blocks and terminal blocks according to IEC 60947-7-1 should be as stated in 7.1.3 of IEC 60947-7-1.

7.1.4 Terminal block identification and marking

Subclause 7.1.4 of IEC 60947-7-1 applies with the following addition.

Any partially insulated protective conductor terminal block shall be coloured green and yellow.

7.1.5 Resistance to abnormal heat and fire

Subclause 7.1.5 of IEC 60947-7-1 applies.

7.1.6 Rated cross-section and rated connecting capacity

Subclause 7.1.6 of IEC 60947-7-1 applies.

7.1.7 Protective conductor mounting rails

Mounting rails may be used as protective conductor busbars, provided the values specified in Table A.1 for thermal short-time withstand current and the thermal rated current are not exceeded.

Other types of mounting rails may be used for this purpose if the values of Table A.1 are comparable.

Table A.1 gives examples of standardized mounting rails meeting these requirements.

Steel protective conductor busbars are not allowed to be used as a PEN conductor.

NOTE Special tests may be necessary for protective conductor terminal blocks involving connection of aluminium to copper or aluminium to copper alloy.

7.2 Performance requirements

7.2.1 Temperature rise

When protective conductor terminal blocks for PEN functions are tested in accordance with 8.4.5, the temperature rise of the terminals shall not exceed 45 K.

7.2.2 Dielectric properties

Protective conductor terminal blocks which shall be arranged directly beside terminal blocks in accordance with IEC 60947-7-1 shall pass the dielectric tests according to 8.4.3.

7.2.3 Short-time withstand current

Protective conductor terminal blocks shall be capable of withstanding three applications of 1 s duration each of the short-time withstand current which corresponds to 120 A/mm² of its rated cross-section. The test shall be made in accordance with 8.4.6.

7.2.4 Voltage drop

The voltage drop caused by the conductor connection and by the connection to the support of a protective conductor terminal block, measured according to 8.4.4, shall not exceed the values specified in 8.4.4 and, where applicable, in 8.4.7.

7.2.5 Electrical performance after ageing (for screwless-type protective conductor terminal blocks only)

Protective conductor terminal blocks shall be capable of withstanding the ageing test comprising 192 temperature cycles in accordance with 8.4.7.

7.3 Electromagnetic compatibility (EMC)

Subclause 7.3 of IEC 60947-7-1 applies.

8 Tests

8.1 Kinds of test

Subclause 8.1 of IEC 60947-7-1 applies.

8.2 General

Subclause 8.2 of IEC 60947-7-1 applies.

8.3 Verification of mechanical characteristics

Subclause 8.3 of IEC 60947-7-1 applies with the modification of 8.3.3.1 which is replaced by the following.

8.3.3.1 Test of mechanical strength of clamping units

Subclauses 8.2.4.1 and 8.2.4.2 of IEC 60947-1 apply with the following addition.

The test shall be made first on two conductor clamping units at the centre terminal block out of five protective conductor terminal blocks mounted as in normal use on the appropriate support according to the manufacturer's instructions.

After verification of the voltage drop U_{CC} according to 8.4.4 with a connected rigid conductor of the rated cross-section stated by the manufacturer and subsequently, if applicable, with a connected flexible conductor of the minimum cross-section stated by the manufacturer, rigid conductors of the rated cross-section shall be connected and disconnected five times each.

At the end of this test, the protective conductor terminal blocks shall pass the voltage drop test (U_{CC}) according to 8.4.4 with a connected rigid conductor of the rated cross-section and subsequently, if applicable, with a connected flexible conductor of the minimum cross-section.

Subsequently the voltage drop U_{CS} is verified on the protective conductor terminal block with a connected rigid conductor of the rated cross-section.

The protective conductor terminal blocks are then mounted and dismantled from their support five times.

At the end of this test, the protective conductor terminal blocks shall pass the voltage drop test (U_{CS}) according to 8.4.4.

8.4 Verification of electrical characteristics

8.4.1 General

The verification of electrical characteristics includes the following:

- dielectric tests (see 8.4.3);