

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Low-voltage switchgear and controlgear –
Part 7-3: Ancillary equipment – Safety requirements for fuse terminal blocks**

**Appareillage à basse tension –
Partie 7-3: Matériels accessoires – Exigences de sécurité pour les blocs de
jonction à fusible**



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 It also gives information on projects, withdrawn and replaced publications.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.

- 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 7-3: Ancillary equipment – Safety requirements for fuse terminal blocks**

**Appareillage à basse tension –
Partie 7-3: Matériels accessoires – Exigences de sécurité pour les blocs de
jonction à fusible**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

W

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 General.....	7
1.1 Scope.....	7
1.2 Normative references.....	7
2 Definitions.....	8
3 Classification.....	9
4 Characteristics.....	9
4.1 Fuse-links.....	9
4.2 Rated power dissipation value.....	9
4.2.1 Overload and short-circuit protection (P_V).....	9
4.2.2 Exclusive short-circuit protection (P_{VK}).....	9
4.3 Rated and limiting values.....	9
4.3.1 Rated voltages.....	9
4.3.2 Void.....	9
4.3.3 Standard cross-sections.....	9
4.3.4 Rated cross-section.....	9
4.3.5 Rated connecting capacity.....	9
4.3.6 Working voltage.....	10
5 Product information.....	10
5.1 Marking.....	10
5.2 Additional information.....	10
5.3 Marking on the packing unit.....	10
6 Normal service, mounting and transport conditions.....	11
6.1.1 Ambient temperature.....	11
7 Constructional and performance requirements.....	11
7.1 Constructional requirements.....	11
7.1.1 Clamping units.....	11
7.1.2 Mounting.....	11
7.1.3 Clearances and creepage distances.....	11
7.1.4 Terminal identification and marking.....	12
7.1.5 Void.....	12
7.1.6 Rated cross-section and rated connecting capacity.....	12
7.1.7 Void.....	12
7.1.8 Actuating conditions.....	12
7.2 Performance requirements.....	12
7.2.1 Mechanical requirements during actuation.....	12
7.2.2 Electrical requirements.....	12
7.2.3 Thermal requirements.....	13
7.3 Electromagnetic compatibility (EMC).....	13
8 Tests.....	13
8.1 Kinds of test.....	13
8.2 General.....	13
8.3 Verification of mechanical characteristics.....	13
8.3.1 General.....	13
8.3.2 Attachment of the fuse terminal block on its support.....	14

8.3.3	Mechanical properties of clamping units of a fuse terminal block	14
8.3.4	Compatibility between fuse terminal blocks and the fuse-link	14
8.3.5	Mechanical strength of the connection between the terminal block base and the fuse-carrier	15
8.4	Verification of electrical characteristics	15
8.4.1	General	15
8.4.2	Void	16
8.4.3	Dielectric tests	16
8.4.4	Contact resistance	17
8.4.5	Temperature rise of clamping units	18
8.4.6	Void	18
8.4.7	Ageing test (for screwless-type fuse terminal blocks only)	18
8.5	Verification of thermal characteristics	19
8.5.1	General	19
8.5.2	Rated power dissipation	20
8.5.3	Durability	24
8.5.4	Needle flame test	24
8.6	Verification of EMC characteristics	26
Annex A (normative)	Gauges	27
Annex B (informative)	Power dissipation values P_V and P_{VK}	28
Annex C (normative)	Order of tests and number of specimens	36
	Bibliography	37
	Figure 1 – Test arrangement for the verification of the contact resistance	17
	Figure 2 – Test arrangement for separate arrangement	20
	Figure 3 – Test arrangement for compound arrangement	21
	Figure 4 – Test arrangement for compound arrangement of short-circuit protection	22
	Figure 5 – Test arrangement for the needle flame test	25
	Figure 6 – Point of test flame contact (view from the layer placed below the fuse terminal block)	25
	Figure A.1 – Outline of the gauges	27
	Figure B.1 – Derating curve in the case of exclusive short-circuit protection for a separate arrangement	30
	Figure B.2 – Derating curve in the case of exclusive short-circuit protection for a compound arrangement	31
	Figure B.3 – Derating curve in the case of overload and short-circuit protection for a separate arrangement	33
	Figure B.4 – Derating curve in the case of overload and short-circuit protection for a compound arrangement	34
	Table 1 – Test forces	14
	Table 2 – Dummy fuse-links	23
	Table A.1 – Dimensions and materials for gauges for fuse-links according to IEC 60127-2	27
	Table B.1 – Results of derating curves in the case of exclusive short-circuit protection	32
	Table B.2 – Results of derating curves in case of overload and short-circuit protection	35
	Table C.1 – Order of tests and number of specimens	36

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –**Part 7-3: Ancillary equipment –
Safety requirements for fuse terminal blocks**

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 60947-7-3 has been prepared by subcommittee 17B: Low-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

This second edition of IEC 60947-7-3 cancels and replaces the first edition, published in 2002, and constitutes a technical revision.

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

- requirements regarding clearances and creepage distances replaced by reference to Annex H of IEC 60947-1;
- requirements for the test of the mechanical strength of the clamping units improved in 8.3.3.1;
- requirements for tightening torques for the tests improved and referenced to Table 4 of IEC 60947-1;

- requirements for the resistance and the dimensions of dummy fuse-links specified in 8.5.2.5.

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/1657/FDIS	17B/1671/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
- amended.

INTRODUCTION

The standard for fuse terminal blocks covers not only the terminal block requirements but also takes into account the specifications of the cartridge fuse-links according to IEC 60127-1 and IEC 60127-2. A connection between these two standards is made by adding (adapting) the fundamental specifications of cartridge fuse-links (rated current, rated voltage, maximum voltage drop and maximum sustained power dissipation for cartridge fuse-links with the dimension of 5 mm × 20 mm or 6,3 mm × 32 mm with their different response characteristics) to the IEC 60947-7-1 requirements for terminal blocks. By this means, it is possible to judge the quality of the product “fuse terminal blocks”.

An important fact when using such cartridge fuse-links with fuse terminal blocks is that fuses heat up much less under rated load than they would do under overload conditions. The rated load is the result of rated current and maximum voltage drop. But there is a considerably increased power dissipation under overload conditions, equalling the maximum sustained power dissipation loss according to IEC 60127-2.

In industrial applications, single fuse terminal blocks are used within an arrangement of terminal blocks or many of them forming an arrangement on their own. This means that the same current and fuse-link will result in different heat emissions. Furthermore, it should be taken into account that apart from the general full range fuse (for overload and short-circuit protection), some fuse terminal blocks are exclusively used for short-circuit protection according to IEC 60364-4-43, e.g. in control circuits, where no overloads occur (i.e. safety coils, indicator lights or similar equipment).

Consequently there are four different types of application that need to be described in the catalogue or indicated on the fuse terminal block. For more information, see Annex B.

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 7-3: Ancillary equipment – Safety requirements for fuse terminal blocks

1 General

1.1 Scope

This part of IEC 60947 applies to fuse terminal blocks with screw-type or screwless-type clamping units for the connection of rigid (solid or stranded) or flexible copper conductors for the reception of cartridge fuse-links in accordance with IEC 60127-2, intended primarily for industrial or similar use in circuits not exceeding 1 000 V a.c., up to 1 000 Hz or 1 500 V d.c., and having a maximum short-circuit breaking capacity of 1 500 A.

They are intended for installation in electrical equipment with enclosures which surround the fuse terminal blocks to such an extent that they are accessible only with the aid of a tool.

For certain applications, for example in control circuits, the fuse terminal blocks may be designed exclusively for short-circuit protection.

NOTE This standard may be used as a guide for fuse terminal blocks for the reception of special cartridge fuse-links which do not meet the requirements of IEC 60127-2.

The object of this standard is to specify safety requirements and test methods for the mechanical, electrical and thermal characteristics of fuse terminal blocks, to ensure the compatibility between terminal blocks and standardized fuse-links.

This standard may be used as a guide for

- fuse terminal blocks requiring the fixing of special devices to the conductors, for example quick connect terminations or wrapped connections, etc.;
- fuse 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 60127-1:2006, *Miniature fuses – Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links*

IEC 60127-2:2003, *Miniature fuses – Part 2: Cartridge fuse-links*
Amendment 1 (2003)

IEC 60216-1:2001, *Electrical insulating materials – Properties of thermal endurance – Part 1: Ageing procedures and evaluation of test results*

IEC 60695-11-5:2004, *Fire hazard testing – Part 11-5: Test flames – Needle flame test method – Apparatus, confirmatory test arrangement and guidance*

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*

ISO 3:1973, *Preferred numbers – Series of preferred numbers*

ISO 4046-4:2002, *Paper, board, pulp and related terms – Vocabulary– Part 4: Paper and board grades and covered products*

2 Definitions

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

2.1

fuse terminal block

terminal block base with a fuse-carrier

2.2

terminal block base

insulating part of a fuse terminal block carrying the clamping units and contacts, intended to be fixed to a support

2.3

fuse-carrier

movable part of a fuse terminal block designed to carry the cartridge fuse-link and enable its exchange

NOTE The fuse-carrier can be mechanically coupled with the terminal block base.

2.4

maximum power dissipation of the cartridge fuse-link

2.4.1 in the case of an overload of P_{V1} , equal to the maximum sustained power dissipation as given in IEC 60127-2

2.4.2 in the case of a nominal load of P_{V2} , equal to the power dissipation value calculated from the nominal values, i.e. the maximum voltage drop and the rated current in accordance with IEC 60127-2

2.5

separate arrangement of a fuse terminal block

arrangement of a single fuse terminal block between adjacent terminal blocks (without additional function) (see Figure 2)

NOTE Mounting of fuse terminal blocks side by side with a spacing that securely prevents any mutual thermal influence is also considered as a separate arrangement.

2.6

compound arrangement of fuse terminal blocks

arrangement of two or several fuse terminal blocks side by side or the arrangement of a single fuse terminal block between adjacent terminal blocks with additional function (see Figure 3)

NOTE Additional functions within the meaning of this standard include all components which may thermally influence the function of the fuse terminal block due to their own power dissipation.