

Australian Standard™

Low-voltage switchgear and controlgear

Part 7.3: Ancillary equipment—Safety requirements for fuse terminal blocks



This Australian Standard was prepared by Committee EL-006, Industrial Switchgear and Controlgear. It was approved on behalf of the Council of Standards Australia on 22 July 2004.

This Standard was published on 23 September 2004.

The following are represented on Committee EL-006:

Australasian Railway Association
Australian Chamber of Commerce and Industry
Australian Electrical and Electronic Manufacturers Association
Bureau of Steel Manufacturers of Australia
Electricity Supply Association of Australia
Engineers Australia
National Electrical and Communications Association
National Electrical Switchboard Manufacturers Association
Testing Interests (Australia)

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about Standards can be found by visiting the Standards Web Shop at www.standards.com.au and looking up the relevant Standard in the on-line catalogue.

Alternatively, the printed Catalogue provides information current at 1 January each year, and the monthly magazine, *The Global Standard*, has a full listing of revisions and amendments published each month.

Australian Standards™ and other products and services developed by Standards Australia are published and distributed under contract by SAI Global, which operates the Standards Web Shop.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at mail@standards.org.au, or write to the Chief Executive, Standards Australia International Ltd, GPO Box 5420, Sydney, NSW 2001.

This Standard was issued in draft form for comment as DR 04170.

Australian Standard™

Low-voltage switchgear and controlgear

Part 7.3: Ancillary equipment—Safety requirements for fuse terminal blocks

First published as AS 60947.7.3—2004.

COPYRIGHT

© Standards Australia International

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher.

Published by Standards Australia International Ltd GPO Box 5420, Sydney, NSW 2001, Australia

ISBN 0 7337 6267 0

PREFACE

This Standard was prepared by the Standards Australia Committee EL-006, Industrial Switchgear and Controlgear.

The objective of this Standard, in addition to that stated in Clause 1, is to bring Australian requirements into line with Edition 1.0 (2002-07) of IEC 60947-7-3.

This Standard is Part 7.3 of a series which, when complete, will consist of the following:

AS 60947	Low-voltage switchgear and controlgear
AS 60947.1*	Part 1: General rules
AS 60947.2*	Part 2: Circuit-breakers
AS 60947.3	Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units
AS 60947.3 Suppl	Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units, Supplement 1: Fuse-switch-disconnectors and switch-disconnectors for use with low-voltage aerial bundled cables
AS 60947.4.1*	Part 4.1: Contactors and motor-starters—Electromechanical contactors and motor-starters
AS 60947.4.2*	Part 4.2: Contactors and motor-starters—A.C. semiconductor motor controllers and starters
AS 60947.4.3	Part 4.3: Contactors and motor-starters—A.C. semiconductor controllers and contactors for non-motor loads
AS 60947.5.1*	Part 5.1: Control circuit devices and switching elements—Electromechanical control circuit devices
AS 60947.5.2*	Part 5.2: Control circuit devices and switching elements—Proximity switches
AS 60947.5.3	Part 5.3: Control circuit devices and switching elements—Requirements for proximity devices with defined behaviour under fault conditions
AS 60947.5.4*	Part 5.4: Control circuit devices and switching elements—Methods of assessing the performance of low-energy contacts—Special tests
AS 60947.5.5	Part 5.5: Control circuit devices and switching elements—Electrical emergency stop devices with mechanical latching function
AS 60947.5.6	Part 5.6: Control circuit devices and switching elements—D.C. interface for proximity sensors and switching amplifiers (NAMUR)
AS 60947.5.7*	Part 5.7: Control circuit devices and switching elements—Requirements for proximity devices with analogue output
AS 60947.6.1	Part 6.1: Multiple function equipment—Automatic transfer switching equipment
AS 60947.6.2*	Part 6.2: Multiple function equipment—Control and protective switching devices (or equipment) (CPS)
AS 60947.7.1*	Part 7.1: Ancillary equipment—Terminal blocks for copper conductors
AS 60947.7.2*	Part 7.2: Ancillary equipment—Protective conductor terminal blocks for copper conductors

AS 60947.7.3*	Part 7.3:	Ancillary equipment—Safety requirements for terminal blocks for the reception of cartridge fuse-links (this Standard)
AS 60947.8*	Part 8:	Control units for built-in thermal protection for rotating machines

It is the intention of the Committee to align the numbering of this series of Standards with that of the corresponding IEC 60947 series of Standards.

Standards from the list above that are marked with an asterisk (*) are, at the time of publication of this document, available as a part of the AS 60947 series of Standards.

Standards that are not so marked remain as AS/(NZS) 3947 series Standards. Following the next amendment or revision of the corresponding IEC Standard, each of these Standards remaining in the AS/(NZS) 3947 series will be revised and renumbered as a part of the AS 60947 series.

This Standard is identical with and has been reproduced from Edition 1.0 (2002-07) of IEC 60947-7-3:2002, *Low-voltage switchgear and controlgear—Part 7-3: Ancillary equipment—Safety requirements for fuse terminal blocks* including Corrigendum 1:2003.

The provisions of the general rules dealt with in AS 60947.1 (hereinafter referred to as Part 1) are applicable to this standard, where specifically called for. Clauses and subclauses, tables, figures and appendices of the general rules thus applicable are identified by reference to Part 1, for example, 1.2.3 of Part 1, table 4 of Part 1, or annex A of Part 1.

This 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 AS 60947.7.1 (referred to herein as Part 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 AS/NZS 3000, 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 terminal block. For more information, see annex B.

As this Standard is reproduced from an International Standard, the following applies:

- (a) Its number does not appear on each page of text and its identity is shown only on the cover and title page.
- (b) In the source text ‘this standard’ should read ‘this Australian Standard’.
- (c) A full point should be substituted for a comma when referring to a decimal marker.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the annex to which they apply. A ‘normative’ annex is an integral part of a Standard, whereas an ‘informative’ annex is only for information and guidance.

CONTENTS

	<i>Page</i>
1 General.....	1
1.1 Scope	1
1.2 Normative references	1
2 Definitions.....	2
3 Classification	3
4 Characteristics	3
4.1 Fuse-links	3
4.2 Rated power dissipation value	3
4.3 Rated and limiting values	4
5 Product information	4
5.1 Marking.....	4
5.2 Additional information	4
5.3 Marking on the packing unit	5
6 Normal service, mounting and transport conditions	5
7 Constructional and performance requirements	5
7.1 Constructional requirements	5
7.2 Performance requirements	6
7.3 Electromagnetic compatibility (EMC)	7
8 Tests.....	7
8.1 Kinds of test.....	7
8.2 General.....	8
8.3 Verification of mechanical characteristics.....	8
8.4 Verification of electrical characteristics	10
8.5 Verification of thermal characteristics.....	14
8.6 Verification of EMC characteristics.....	20
Annex A (normative) Gauges.....	21
Annex B (informative) Power dissipation values P_V and P_{VK}	22
Annex C (normative) Order of tests and number of specimens	30
Bibliography	31

STANDARDS AUSTRALIA

Australian Standard

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 60947-1 AS 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 Part 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.

References to international standards that are struck through in this clause are replaced by references to Australian or Australian/New Zealand Standards that are listed immediately thereafter and identified by shading. Any Australian or Australian/New Zealand Standard that is identical to the International Standard it replaces is identified as such.

IEC 60127-1:1988, *Miniature fuses – Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links*
 Amendment 1 (1999)

IEC 60127-2:1989, *Miniature fuses – Part 2: Cartridge fuse-links*

IEC 60216-1:2001, *Guide for the determination of thermal endurance properties of electrical insulating materials – Part 1: General guidelines for ageing procedures and evaluation of test results*

~~IEC 60695-2-2:1991, Fire hazard testing – Part 2: Test methods – Section 2: Needle flame test Amendment 1 (1994)~~

AS/NZS 4695.2.2, *Fire hazard testing—Test methods—Needle-flame test*

~~IEC 60947-1:1999, Low-voltage switchgear and controlgear – Part 1: General rules – Amendment 1 (2000) – Amendment 2 (2001)~~

AS 60947.1, *Low-voltage switchgear and controlgear – Part 1: General rules*

~~IEC 60947-7-1:2002, Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors~~

AS 60947.7.1, *Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors* (identical to Edition 2.0 (2003-07) of IEC 60947-7-1 and includes its Corrigendum 1:2003)

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

ISO 4046:1978, *Paper, board, pulp and related terms – Vocabulary*

2 Definitions

For the purpose of this part of ~~IEC 60947~~ AS 60947, definitions given in Part 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.

2.7**rated power dissipation value of a fuse terminal block**

maximum permissible value with which the fuse terminal block can be continuously loaded by the cartridge fuse-link under specified conditions

2.8**rated cross-section**

value, stated by the manufacturer, of a rigid (solid or stranded) or flexible conductor to which certain thermal, mechanical and electrical requirements are referred

2.9**rated connecting capacity**

range of cross-sections and/or the number of conductor cross-sections for which the fuse terminal block is designed

3 Classification

Fuse terminal blocks are classified as follows:

- a) fuse terminal block with separate fuse-carrier, e.g. screw type or plug-in type;
- b) fuse terminal block with mechanically coupled fuse-carrier, e.g. hinged type.

4 Characteristics**4.1 Fuse-links**

The fuse links shall be in accordance with IEC 60127-2.

4.2 Rated power dissipation value**4.2.1 Overload and short-circuit protection (P_V)**

The rated value (P_V) is the maximum permissible power dissipation value of a fuse terminal block under overload and short-circuit conditions related to an ambient temperature of 23 °C.

4.2.2 Exclusive short-circuit protection (P_{VK})

The rated value (P_{VK}) is the maximum permissible power dissipation value of a fuse terminal block, which can accept a fuse-link with an equal or lower sustained power dissipation used under exclusive short-circuit conditions and related to an ambient temperature of 23 °C (see annex B).

4.3 Rated and limiting values

4.3.1 Rated voltages

Subclause 4.3.1 of Part 7.1 applies.

4.3.2 Void

4.3.3 Standard cross-sections

Subclause 4.3.3 of Part 7.1 applies.

4.3.4 Rated cross-section

Subclause 4.3.4 of Part 7.1 applies.

4.3.5 Rated connecting capacity

Subclause 4.3.5 of Part 7.1 applies with the following addition.

The conductor cross-section specified for the temperature-rise test according to 8.4.5 shall be included in the range of the rated connecting capacity.

4.3.6 Working voltage

See 2.5.52 of Part 1.

5 Product information

5.1 Marking

A fuse 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;
- c) energy flow direction, if required to ensure protection against electric shock, according to 7.1.8, e.g. line-load marking or →.

5.2 Additional information

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

- a) ~~IEC 60947-7-3~~ AS 60947.7.3, if the manufacturer claims compliance with this standard;
- b) the rated cross-section;
- c) the rated connecting capacity, if different from table 2 of Part 7.1, including the number of conductors simultaneously connectable;
- d) the rated insulation voltage of the terminal block base and the fuse-carrier, if applicable;
- e) the working voltage or working voltage range, primarily determined by the fuse-link or by additional components, e.g. illuminated indicators;
- f) rated impulse voltage;

NOTE This value may be marked on the fuse terminal block only if the rated insulation voltage or the working voltage is also marked on the fuse terminal block, e.g. 250 V/4 kV or 250/4 kV.

- g) rated value of the power dissipation (P_V) and rated current of the fuse-link as declared by the manufacturer
 - in case of separate arrangement,
 - in case of compound arrangement;
- h) maximum power dissipation (P_{VK}) and rated current of the fuse-link
 - in case of separate arrangement,
 - in case of compound arrangement;
- i) operating conditions, if different from clause 6;
- j) size of the fuse-link.

5.3 Marking on the packing unit

- a) No overload protection" in case of fuse terminal blocks which are designed exclusively for short-circuit protection.
- b) No overload protection in compound arrangement" in case of fuse terminal blocks which are designed for overload only in separate arrangement and short-circuit protection in compound arrangement.

6 Normal service, mounting and transport conditions

Clause 6 of Part 1 applies with the following addition.

6.1.1 Ambient temperature

The rated value of the power dissipation refers to an ambient temperature of 23 °C.

In those cases where the ambient temperature differs from 23 °C, this fact shall be taken into account with respect to the function. See derating curves in annex B.

7 Constructional and performance requirements

7.1 Constructional requirements

7.1.1 Clamping units

Subclause 7.1.1 of Part 7.1 applies.

7.1.2 Mounting

Fuse terminal blocks shall be provided with means that allow them to be securely attached to a rail or a mounting surface.

Tests shall be made in accordance with 8.3.2.

NOTE Information on mounting rails can be found in IEC 60745 AS 2756.

7.1.3 Clearances and creepage distances

Clearances and creepage distances shall be designed for overvoltage category III and pollution degree 3.

The requirements in accordance with Part 7.1 apply with the following additions.

Clearances and creepage distances shall be checked where the fuse terminal block is assembled for normal use, e.g. fuse-carrier and gauge no. 3 or no. 6 is inserted in the terminal block base in accordance with table A.1.

The following aspects shall be considered:

- a) functional insulation:
 - insulation between live parts with different potential;
 - insulation between live parts to adjacent fuse terminal blocks of same type of construction and size;
- b) basic insulation:
 - insulation between live parts and the fixing support.

Compliance is checked by measurement. Subclause 8.3.3.4 of Part 1 applies.

7.1.4 Terminal identification and marking

Subclause 7.1.4 of Part 7.1 applies.

7.1.5 Void

7.1.6 Rated cross-section and rated connecting capacity

Subclause 7.1.6 of Part 7.1 applies.

7.1.7 Void

7.1.8 Actuating conditions

The fuse terminal block shall be so designed that live parts are not accessible when it is assembled, installed and operated under normal use.

The safety from finger touch of live parts of the fuse-carrier shall be ensured during replacement of the fuse-link, unless otherwise specified by the manufacturer. The safety from finger touch shall be maintained until the fuse-carrier and the fuse-link are de-energized.

7.2 Performance requirements

7.2.1 Mechanical requirements during actuation

Fuse terminal blocks shall have an adequate mechanical strength so as to withstand the stresses which occur during operation.

Compliance shall be checked in accordance with 8.3.4 and 8.3.5.

7.2.2 Electrical requirements

7.2.2.1 Dielectric strength

The dielectric strength shall be adequate.

Verification shall be made by an impulse voltage test and a power-frequency withstand test on the fuse terminal block assembled by means of gauges as in normal use, in accordance with 8.4.3.

7.2.2.2 Contact resistance

The test shall be carried out in accordance with 8.4.4. If not otherwise specified, the mean value of the contact resistance shall not exceed 10 mΩ. The value of an individual measurement shall not exceed 15 mΩ.

7.2.2.3 Temperature rise of clamping units

The temperature rise of the clamping units shall not exceed 45 K.

Compliance shall be checked in accordance with 8.4.5.

7.2.2.4 Electrical performance after ageing (for screwless-type fuse terminal blocks only)

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

7.2.3 Thermal requirements

7.2.3.1 Rated value of power dissipation

A fuse terminal block shall be so designed that it can use a fuse-link with rated current and maximum sustained power dissipation, according to IEC 60127-1, lower or equal to the rated power dissipation value of the fuse terminal block and at an ambient air temperature of 23 °C (see annex B).

In this way, the temperature of 85 °C on the surface of the actuating elements of the fuse-carrier and the relative temperature index (RTI) of the insulating material as stated by the manufacturer in accordance with IEC 60216-1 shall not be exceeded.

Compliance shall be checked in accordance with 8.5.2.

For fuse terminal blocks which are exclusively designed for short-circuit protection, the tests in accordance with 8.5.2.2 do not apply.

Generally, the maximum permanent allowed temperature can be defined with a RTI value according to IEC 60216-1, based on 20 000 hours taking into account the electrical property.

7.2.3.2 Durability

Fuse terminal blocks shall be sufficiently resistant to thermal stresses which can occur under normal use.

Compliance shall be checked in accordance with 8.5.3.

7.2.3.3 Resistance to abnormal heat and fire

The insulation materials of fuse terminal blocks shall not be adversely affected by abnormal heat and fire.

Compliance shall be checked by the needle flame test, according to ~~IEC 60695-2-2~~ AS/NZS 4695.2.2, as specified in 8.5.4.

7.3 Electromagnetic compatibility (EMC)

Subclause 7.3 of Part 7.1 applies.

8 Tests

8.1 Kinds of test

Subclause 8.1 of Part 7.1 applies.