

Australian Standard™

Application guide for low-voltage fuses



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Application guide for low-voltage fuses

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PREFACE

This Standard was prepared by the Standards Australia Committee EL-007, Power Switchgear.

The objective of this Standard is to demonstrate that low-voltage current-limiting fuses are easy to apply to protect today's complex and sensitive electronic equipment.

This Standard is identical with, and has been reproduced from IEC/TR 61818 Ed. 1.0 (2003), *Application guide for low-voltage fuses*.

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.
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INTRODUCTION

The effects of overcurrent on electrical equipment can be dramatic if no appropriate protection is provided, for example:

- melting of conductors or busbars;
- vaporization of metal;
- ionization of gases;
- arcing, fire and explosion;
- insulation damage.

Apart from being hazardous to personnel, significant economic losses can result from downtime and the repairs required to restore damaged equipment.

Fuses are common overcurrent protective devices in use today

STANDARDS AUSTRALIA

Australian Standard**Application guide for low-voltage fuses****1 Scope**

This technical report, which serves as an application guide for low-voltage fuses, shows how current-limiting fuses are easy to apply to protect today's complex and sensitive electronic equipment. This guide specifically covers low-voltage fuses up to a.c. 1 000 V and d.c. 1 500 V according to IEC 60269. This guide provides information on the application of fuses, which are not always covered, as well as important facts, which are sometimes difficult to locate in standards.

In the interest of keeping the guide current and up to date with new developments, readers are invited to comment on this guide and their application experience to their National Committees.

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 60146-6:1992, *Semiconductor convertors – Part 6: Application guide for the protection of semiconductor convertors against overcurrent by fuses*

~~IEC 60269 (all parts), Low-voltage fuses~~

AS 60269 (all parts), *Low-voltage fuses*

IEC 60269-1:1998, *Low-voltage fuses – Part 1: General requirements*

IEC 60269-2:1986, *Low-voltage fuses – Part 2: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application)*

IEC 60269-2-1:1998, *Low-voltage fuses – Part 2-1: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) – Sections I to V: Examples of types of standardized fuses*

IEC 60269-3-1:1994, *Low-voltage fuses – Part 3-1: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications) – Sections I to IV*

IEC 60269-4:1986, *Low-voltage fuses – Part 4: Supplementary requirements for fuse-links for the protection of semiconductor devices*

IEC 60364-4-41:2001, *Electrical installations of buildings – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60364-5-52:1993, *Electrical installations of buildings – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

~~IEC 60947-3:1999, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*~~

AS/NZS 3947.3, *Low-voltage switchgear and controlgear, Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units* (identical to IEC 60947-3)

IEC 60947-4-1:2000, *Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters*

~~IEC 61459:1996, *Low-voltage fuses – Coordination between fuses and contactors/motor-starters – Application guide*~~

AS/NZS 61459, *Low-voltage fuses—Coordination between fuses and contactors/motor-starters—Application guide* (identical to IEC 61459)

3 Terms and definitions

For the purposes of this document, the following definitions apply.

3.1

switch (mechanical)

mechanical switching device capable of making, carrying and breaking currents under normal circuit conditions, which may include specified operating overload conditions and also carrying, for a specified time, currents under specified abnormal conditions such as those of short circuits

NOTE A switch may be capable of making but not breaking, short circuit currents.

[IEV 441-14-10]

3.2

disconnector

mechanical switching device that, in the open position, complies with the requirements specified for isolating function

[IEV 441-14-05, modified]

3.3

fuse-combination unit

combination of a mechanical switching device and one or more fuses in a composite unit, assembled by the manufacturer or in accordance with his instructions

[IEV 441-14-04, modified]

3.4

switch-fuse

switch in which one or more poles have a fuse in series in a composite unit

[IEV 441-14-14]

3.5

fuse-switch

switch in which a fuse-link or a fuse-carrier with fuse-link forms the moving contact

[IEV 441-14-17]

4 Fuse benefits

The current-limiting fuse provides complete protection against the effects of overcurrents by protecting both electric circuits and their components. Fuses offer a combination of exceptional features, for example:

- a) High breaking capacity (current interrupting rating).
- b) No need for complex short-circuit calculations.
- c) Easy and inexpensive system expansion involving increased fault currents.
- d) Mandatory fault elimination before resetting.
Unlike other short-circuit protective devices (SCPD), fuses cannot be reset, thus forcing the user to identify and correct the overcurrent condition before re-energizing the circuit.
- e) Reliability.
No moving parts to wear out or become contaminated by dust, oil or corrosion. Fuse replacement ensures protection is restored to its original state of integrity.
- f) Cost effective protection.
Compact size offers low cost overcurrent protection at high short-circuit levels.
- g) No damage for type 2 protection according to IEC 60947-4-1.
By limiting short-circuit energy and peak currents to extremely low levels, fuses are particularly suitable for type 2 protection without damage to components in motor circuits. This type of protection may be achieved without installing a fuse with a smaller ampere rating.
- h) Safe, silent operation.
No emission of gas, flames, arcs or other materials when clearing the highest levels of short-circuit currents. In addition, the speed of operation at high short-circuit currents significantly limits the arc flash hazard at the fault location.
- i) Easy coordination.
Standardized fuse characteristics and a high degree of current limitation ensure effective coordination between fuses and other devices.
- j) Standardized performance
Fuse-links according to IEC 60269 ensure availability of replacements with standardized characteristics throughout the world.
- k) Improved power supply quality.
Current-limiting fuses interrupt high fault currents in a few milliseconds, minimizing dips in system supply voltage.
- l) Tamperproof.
Once installed, fuses cannot be modified or adjusted in order to change their level of performance, thus malfunction is avoided.

5 Fuse construction and operation

A fuse is a protective device comprising

- the fuse-link,
- the fuse-base,
- the fuse-carrier or replacement handle.

These components may be integrated in a fuse combination unit.

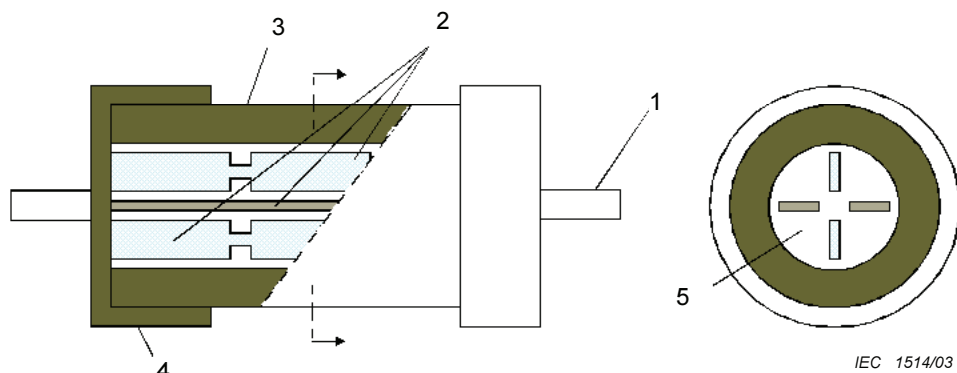
5.1 Fuse-link

Figures 1 and 2 show the design of typical low voltage fuse-links for industrial application. Such fuse-links are commonly called current-limiting or high breaking capacity fuse-links. Fuse-links according to IEC 60269-2-1 (fuses for industrial application) shall have a breaking capacity of at least a.c. 50 kA or 25 kA d.c. at current ratings from 2 A to 6 000 A. Fuse-links according to IEC 60269-3-1 (fuses for household application) cover current ratings from 2 A to 100 A with a breaking capacity of at least a.c. 6 kA.

5.1.1 Fuse-element

The fuse-element is usually made of flat silver or copper with restrictions in the cross-section. This restriction pattern is one of the important features of fuse design, normally achieved by precision stamping.

M-effect material is added to the fuse-element to achieve controlled fuse operation in the overload range. The purity of the fuse-element materials and their precise physical dimensions are of vital importance for reliable fuse operation.



Key

- 1 Blade contact
- 2 Fuse-elements
- 3 Fuse body
- 4 End cap
- 5 Filler

Figure 1 – Typical fuse-link according to IEC 60269-2-1, section II