IEC 60947-7-3

Edition 2.0 2009-04

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

IEC 60947-7-3:2009

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LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

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

FOREWORD

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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 coverted 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.

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

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 of power dissipation for overload and short-circuit protection (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 of power dissipation for exclusive short-circuit protection (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).

NOTE “Maximum sustained power dissipation” of a fuse link is given in IEC 60127-1.

4.3 Rated and limiting values

4.3.1 Rated voltages

Subclause 4.3.1 of IEC 60947-7-1 applies.

4.3.2 Void

4.3.3 Standard cross-sections

Subclause 4.3.3 of IEC 60947-7-1 applies.

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 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 IEC 60947-1.

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, if the manufacturer claims compliance with this standard;

b) the rated cross-section;

c) the rated connecting capacity, if different from Table 2 of IEC 60947-7-1, including the number of conductors simultaneously connectable;

d) the rated insulation voltage (U_i) 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 withstand voltage (U_{imp});

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

g) rated value of the power dissipation for overload and short-circuit protection (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) rated value of the power dissipation for exclusive short-circuit protection (P_{VK}) and rated current of the fuse-link as declared by the manufacturer

- 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.

The breaking capacity of the fuse-link(s) shall be selected according to expected short-circuit level at the point of installation.

NOTE A warning may be written on the package and the literature to notify that the breaking capacity of the fuse-link(s) according to IEC 60127-2 shall be selected according to expected short-circuit level at the point of installation.

6 Normal service, mounting and transport conditions

Clause 6 of IEC 60947-1 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 IEC 60947-7-1 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 60715.

7.1.3 Clearances and creepage distances

Subclause 7.1.3 of IEC 60947-7-1 applies with the following additions.

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

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 of adjacent fuse terminal blocks of same series and size;
b) basic insulation:
   - insulation between live parts and the fixing support.

Compliance is checked by measurement. Subclause 8.3.3.4 of IEC 60947-1 applies.

7.1.4 Terminal identification and marking

Subclause 7.1.4 of IEC 60947-7-1 applies.

7.1.5 Void

7.1.6 Rated cross-section and rated connecting capacity

Subclause 7.1.6 of IEC 60947-7-1 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 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 h 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 60695-11-5, as specified in 8.5.4.

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 with the following modification.

The tests shall be carried out in the order as given in Annex C.

8.3 Verification of mechanical characteristics

8.3.1 General

The verification of mechanical characteristics includes the following tests: