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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

IEC 60947-7-2:2009

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LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

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

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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.

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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

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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 mm^2 (250 kcmil) and for protective conductor terminal blocks with PEN function equal to and above 10 mm^2 (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 mm^2 and 120 mm^2 (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*

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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).

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.

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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 mm^2 (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;

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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 mm^2 (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

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.

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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/mm^2 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.

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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 dismounted 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);

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