UL 60947-7-2

STANDARD FOR SAFETY

Low-Voltage Switchgear and Controlgear – Part 7-2: Ancillary Equipment – Protective Conductor Terminal Blocks for Copper Conductors

UL Standard for Safety for Low-Voltage Switchgear and Controlgear – Part 7-2: Ancillary Equipment – Protective Conductor Terminal Blocks for Copper Conductors, UL 60947-7-2

Fourth Edition, Dated January 27, 2017

Summary of Topics

This revision of ANSI/UL 60947-7-2 dated April 16, 2021 is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made.

As noted in the Commitment for Amendments statement located on the back side of the title page, CSA Group, ANCE and UL are committed to updating this harmonized standard jointly. However, the revision pages dated April 16, 2021 will not be jointly issued by UL, CSA, and ANCE as these revision pages only address UL ANSI approval dates.

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The requirements are substantially in accordance with Proposal(s) on this subject dated February 12, 2021.

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Association of Standardization and Certification
NMX-J-538/7-2-ANCE
First Edition

CSA Group
CAN/CSA-C22.2 No. 60947-7-2:17
First Edition
(IEC 60947-7-2:2002, MOD)

Underwriters Laboratories Inc.
UL 60947-7-2
Fourth Edition

Low-Voltage Switchgear and Controlgear – Part 7-2: Ancillary Equipment – Protective Conductor Terminal Blocks for Copper Conductors

January 27, 2017

(Title Page Reprinted: April 16, 2021)

This national standard is based on publication IEC 60947-7-2, second edition (2002).

Commitment for Amendments

This standard is issued jointly by the Association of Standardization and Certification (ANCE), the Canadian Standards Association (operating as “CSA Group”), and Underwriters Laboratories Inc. (UL). Comments or proposals for revisions on any part of the standard may be submitted to ANCE, CSA Group, or UL at anytime. Revisions to this standard will be made only after processing according to the standards development procedures of ANCE, CSA Group, and UL. CSA Group and UL will issue revisions to this standard by means of a new edition or revised or additional pages bearing their date of issue. ANCE will incorporate the same revisions into a new edition of the standard bearing the same date of issue as the CSA Group and UL pages.

ISBN 978-1-4883-0020-2 © 2017 Canadian Standards Association

This Standard is subject to review within five years from the date of publication, and suggestions for its improvement will be referred to the appropriate committee. The technical content of the IEC and ISO publications is kept under constant review by IEC and ISO. To submit a proposal for change, please send the following information to inquiries@csagroup. org and include "Proposal for change" in the subject line: Standard designation (number); relevant clause, table, and/or figure number; wording of the proposed change; and rationale for the change.

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This ANSI/UL Standard for Safety consists of the Fourth Edition including revisions through April 16, 2021. The most recent designation of ANSI/UL 60947-7-2 as a Reaffirmed American National Standard (ANS) occurred on March 31, 2021. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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Preface

This is the harmonized ANCE, CSA Group, and UL standard for Low-Voltage Switchgear and Controlgear – Part 7-2: Ancillary Equipment – Protective Conductor Terminal Blocks for Copper Conductors. It is the first edition of NMX-J-538/7-2-ANCE, the first edition of CAN/CSA No. 60947-7-2, and the fourth edition of UL 60947-7-2. This edition of UL 60947-7-2 supersedes the previous edition(s) published on May 6, 2011.

This harmonized standard is based on IEC Publication 60947-7-2: Edition 2 (2002), Low-voltage switchgear and controlgear – Part 7-2: Ancillary equipment – Protective conductor terminal blocks for copper conductors. IEC 60947-7-2 is copyrighted by the IEC.

This harmonized standard was prepared by the Association of Standardization and Certification (ANCE), CSA Group, and Underwriters Laboratories Inc. (UL). The efforts and support of the Technical Harmonization Committee for Industrial Control Equipment, of the Council on the Harmonization of Electrotechnical Standards of the Nations of the Americas (CANENA), are gratefully acknowledged.

This Standard is considered suitable for use for conformity assessment within the stated scope of the Standard.

The Mexican Standard was developed by the CT PIE-A from the Comite de Normalizacion de la Asociacion de Normalizacion y Certificacion, A.C., CONANCE, with the collaboration of the manufacturers and users.

This standard was reviewed by the CSA Subcommittee on Terminal Assemblies, under the jurisdiction of the CSA Technical Committee on Industrial Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee.

This standard has been approved as a National Standard of Canada by the Standards Council of Canada (SCC).

This standard has been approved by the American National Standards Institute (ANSI) as an American National Standard.

Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

Note: Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

NMX-J-538/7-2-ANCE, Standard for Safety for Low-Voltage Switchgear and Controlgear – Part 7-2: Ancillary Equipment – Protective Conductor Terminal Blocks for Copper Conductors is to be used in conjunction with the first edition of NMX-J-538/7-1-ANCE. The requirements for Ancillary Equipment – Protective Conductor Terminal Blocks for Copper Conductors are contained in this Part 2 Standard and NMX-J-538/7-1-ANCE. Requirements of this Part 2 Standard, where stated, amend the requirements of NMX-J-538/7-1-ANCE. Where a particular subclause of NMX-J-538/7-1-ANCE is not mentioned in NMX-J-538/7-2-ANCE, the NMX-J-538/7-1-ANCE subclause applies.

This CAN/CSA-C22.2 No. 60947-7-2, Standard for Safety for Low-Voltage Switchgear and Controlgear – Part 7-2: Ancillary Equipment – Protective Conductor Terminal Blocks for Copper Conductors, is to be used in conjunction with the first edition of CAN/CSA-C22.2 No. 60947-7-1. The requirements for Ancillary Equipment – Protective Conductor Terminal Blocks for Copper Conductors are contained in this Part 2 Standard and CAN/CSA-C22.2 No. 60947-7-1. Requirements of this Part 2 Standard, where stated,

amend the requirements of CAN/CSA C22.2 No. 60947-7-1. Where a particular subclause of CAN/CSA-C22.2 No. 60947-7-1 is not mentioned in CAN/CSA-C22.2 No. 60947-7-2, the CAN/CSA-C22.2 No. 60947-7-1 subclause applies.

This UL 60947-7-2, Standard for Safety for Low-Voltage Switchgear and Controlgear – Part 7-2: Ancillary Equipment – Protective Conductor Terminal Blocks for Copper Conductor, is to be used in conjunction with the fourth edition of UL 60947-7-1. The requirements for Ancillary Equipment – Protective Conductor Terminal Blocks for Copper Conductor are contained in this Part 2 Standard and UL 60947-7-1. Requirements of this Part 2 Standard, where stated, amend the requirements of UL 60947-7-1. Where a particular subclause of UL 60947-7-1 is not mentioned in UL 60947-7-2, the UL 60947-7-1 subclause applies.

Level of harmonization

This standard adopts the IEC text with national differences.

This standard is published as an equivalent standard for ANCE, CSA Group, and UL.

An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical national differences are allowed for codes and governmental regulations as well as those recognized as being in accordance with NAFTA Article 905, for example, because of fundamental climatic, geographical, technological, or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate. Presentation is word for word except for editorial changes.

All national differences from the IEC text are included in the ANCE, CSA Group and UL versions of the standard. While the technical content is the same in each organization's version, the format and presentation may differ.

Reasons for differences from IEC

National differences from the IEC are being added in order to address safety and regulatory situations present in the US, Canada and Mexico.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

IEC Copyright

For ANCE, the text, figures, and tables of International Electrotechnical Commission Publication 60947-7-2, Low-Voltage Switchgear and Controlgear – Part 7-2: Ancillary Equipment – Protective Conductor Terminal Blocks for Copper Conductor, are used in this standard according to the guidelines provided in the ISO/IEC/POCOSA.

For CSA Group, the text, figures, and tables of International Electrotechnical Commission Publication 60947-7-2, Low-Voltage Switchgear and Controlgear – Part 7-2: Ancillary Equipment – Protective Conductor Terminal Blocks for Copper Conductor, copyright 2002, are used in this standard with the consent of the International Electrotechnical Commission. The IEC Foreword is not a part of the requirements of this standard but is included for information purposes only.

For UL, the text, figures and tables of IEC publication 60947-7-2, Low-Voltage Switchgear and Controlgear – Part 7-2: Ancillary Equipment – Protective Conductor Terminal Blocks for Copper Conductor copyright 2002 are used in this Standard with the consent of the IEC and the American National Standards Institute (ANSI). The IEC copyrighted material has been reproduced with permission from ANSI. ANSI should be contacted regarding the reproduction of any portion of the IEC material. The IEC Foreword is not a part of the requirements of this Standard but is included for information purposes only. Copies of IEC Publication 60947-7-2 may be purchased from ANSI, 25 West 43rd Street, 4th Floor, New York, New York, 10036, (212) 642-4900.

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NATIONAL DIFFERENCES

National Differences from the text of International Electrotechnical Commission (IEC) Publication 60947-7-2, Low-Voltage Switchgear and Controlgear – Part 7-2: Ancillary Equipment – Protective Conductor Terminal Blocks for Copper Conductors, second edition (2002), are indicated by notations (differences) and are presented in bold text. The national difference type is included in the body.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

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FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR – Part 7-2: Ancillary equipment – Protective conductor terminal blocks for copper conductors

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.

3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.

4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.

6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

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 second edition of IEC 60947-7-2 cancels and replaces the first edition, published in 1995, and constitutes a technical revision.

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.

DV.1 D2 ***Modification by replacing the third paragraph after item 6) in the IEC Foreword with the following:***

This standard shall be read in conjunction with those standards referenced in Annex DVA, items 1 and 2. The provisions of the general rules dealt with in Annex DVA, item 2, and the requirements for terminal blocks of Annex DVA, item 1 are applicable to this standard. Any references to IEC 60947-1, and IEC 60947-7-1 are to those standards referenced in Annex DVA, items 1 and 2, since the requirements may have been modified by country-specific clauses.

The text of this standard is based on the following documents:

FDIS	Report on voting
17B/1192/FDIS	17B/1219/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.

Annexes A and B form an integral part of this standard.

The committee has decided that the contents of this publication will remain unchanged until 2008. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

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 = 1000 cmil

1 cmil = 1 circular mil = surface of a circle having a diameter of 1 mil

1 mil = 1/1000 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.

1.1DV.1 D2 *Modification of Clause 1.1:*

Replace “0,2 mm^2 and 120 mm^2 (AWG 24 and 250 kcmil)” with “0,1 mm^2 and 120 mm^2 (AWG 30 and 250 kcmil)”.

1.1DV.2 D2 *Modification by adding the following:*

This standard applies to insulation displacement terminals.

1.1DV.3 DR *Modification by adding the following:*

Terminal blocks with PEN function are not permitted.

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.

1.1DV.4 D2 *Modification by adding the following:*

This standard also applies to terminal blocks that have insulation piercing or displacement clamping units.

1.1DV.5 D2 *Modification by adding the following:*

This standard 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, in accordance with Annex DVB of item 1 in Annex DVA, National Electrical Code, NFPA 70 (for use in the USA), CSA C22.1-15 Canadian Electrical Code, Part I (for use in Canada), or NOM-001-SEDE, Electrical Installations (Utility) [for use in Mexico].

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

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

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

1.2DV D1 *Modification by adding the following*

See Annex DVA for Canada, Mexico, and USA Standard References.

2 Definitions

For the purpose of this part of IEC 60947, 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

2.2DV D2 *Modification by adding the following:*

It is mechanically and electrically attached to its support, path 2-2 in Figure 5. In some cases it will have path 1-1, and in other cases it will not.

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).

2.3DV DR *Delete Clause 2.3:*

This definition does not apply.

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.

3DV.1 D2 *Modification by adding the following dashed item to the list:*

– application: commercial and industrial, or service

3DV.2 DR *Modification by replacing the seventh dashed item in the list with the following:*

– PE functions.

3DV.3 D3 *Modification by adding the following:*

In Canada, the general requirements applicable to this Standard are provided in CAN/CSA-C22.2 No. 0.

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.

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.

4.3.2DV D2 *Modification by adding the following:*

A protective conductor terminal block, classified for use as an unprotected circuit, shall be subjected to the Short-time withstand current test for Service Applications.

NOTE 1DV: In Canada, a "protective conductor terminal block" is a "bonding conductor terminal block". They are deemed to be the same.

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.

4.3.5DV D2 *Modification by replacing 4.3.5 with the following:*

Subclause 4.3.5 of Annex DVA, item 1 applies.

Table 1
Relationship between rated cross-section and rated connecting capacity of protective conductor terminal blocks

Rated cross-section		Rated connecting capacity	
mm²	AWG/kcmil	mm²	AWG/kcmil
0,2	24	0,2	24
0,34	22	0,2 – 034	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

Table 1DV D2 *Delete Table 1:*

This table does not apply.

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;

b) a type reference permitting its identification in order to obtain relevant information from the manufacturer or his catalogue.

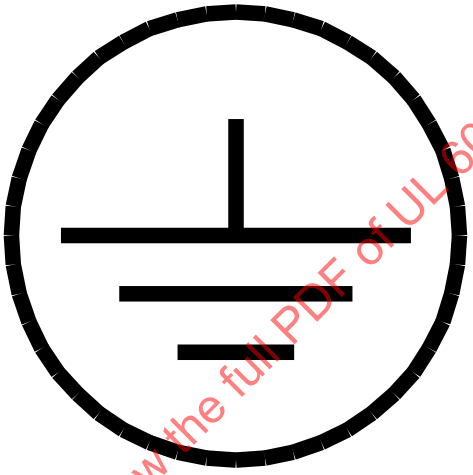
5.1DV D2 ***Add the following to Clause 5.1:***

cDV) A protective conductor terminal block, not complying with 7.1.4, shall be marked with the symbol in Figure 6DV or with "G", "GR", "GND", "Ground", "Grounding", or equivalent marking.

Figure 6DV D2 ***Addition of the following figure:***

Figure 6DV

Grounding symbol



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.

5.2DV.1 DE ***Deletion of item a).***

5.2DV.2 DE ***Modification by replacing item c) with the following:***

c) the rated connecting capacity;

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.

5.2DV.3 D2 *Modification by replacing the Note with the following:*

NOTE: No marking indicates suitability for use in PE function.

5.2DV.4 D2 *Modification by adding the following:*

The information in Subclause 5.2 of Annex DVA, item 1 shall be stated by the manufacturer, except for rated operational voltage, rated current, rated insulation voltage, and rated impulse withstand voltage.

6 Normal service, mounting and transport conditions

Clause 6 of IEC 60947-1 applies.

7 Constructional and performance requirements

7.1 Constructional and performance 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.

7.1.1DV D2 *Modification by replacing the fourth paragraph with the following:*

Compliance is checked by inspection, by the test of 8.3.4.1, and by the tests of 8.3.4.2 and 8.3.4.3 of Annex DVA, item 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.

7.1.2DV D2 *Modification by adding the following:*

The protective earthing connection of a protective conductor terminal block to its support shall be made independently or simultaneously with its fixation to the support.

7.1.3 Clearance and creepage distances

Clearance and creepage distances do not apply to protective conductor terminal blocks.

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.

7.1.3DV D2 *Modification by adding the following:*

Subclause 7.1.3 of Annex DVA, item 1 applies.

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.

7.1.4DV D2 *Addition of the following NOTE to 7.1.4:*

Note 1DV: A green-colored screw head alone does not meet the intent of this requirement.

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 Rated short-time withstand current

Protective conductor terminal blocks shall be capable of withstanding three applications of 1 s duration each of the rated 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.

7.2.3DV DE *Modification of the heading for 7.2.3 for commercial and industrial use as follows:*

Rated short-time withstand current (Commercial and industrial)

7.2.3ADV D2 *Addition of Clause 7.2.3ADV.1 and Table 7.2.3DV:*

7.2.3ADV.1 Rated short-time withstand current (Service)

A protective conductor terminal block, intended for use in service applications, shall be capable of withstanding a single application of the current specified in Subclause 7.2.3, for the time specified in Table 7.2.3DV, without damage to the terminal block or its support. At the conclusion of the test, continuity shall exist when tested as described in 8.4.6DV.4.1.2.

Table 7.2.3DV
Rated short-time withstand current test duration (Service)

Conductor size AWG/kcmil	mm^2	Time, seconds
14	2,1	4
12	3,3	4
10	5,3	4
8	8,4	4
6	13,3	6
4	21,2	6
3	26,7	6
2	33,6	6
1	42,4	6
1/0 and larger	53,5	9

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.

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.

Table 8.2DV D2 *Addition of the following table:*

Table 8.2DV
Test sequence

Sequence Number	Quantity	Test	Referenced Clause
1	2 of 5	Verification of Mechanical Characteristics	8.3
2	2 of 5	Mechanical properties of clamping units	8.3.3.1
		Verification of voltage drop[a]	8.4.4
		Mechanical properties of attachment to support	8.3.3.1
		Verification of voltage drop[a]	8.4.4
3	2	Verification of clearances and creepage distances	8.4.2
4	3 of 5	Dielectric tests	8.4.3
		Dielectric tests for insulation displacement terminals	8.4.3DV
5	5	Temperature rise sequence	
		Verification of the voltage drop [a]	8.4.4
		Temperature rise test	8.4.5
		Verification of the voltage drop [a]	8.4.4
6	1	Short time withstand current sequence	
		Verification of the voltage drop	8.4.4

Table 8.2DV Continued on Next Page

Table 8.2DV Continued

Sequence Number	Quantity	Test	Referenced Clause
		Short time withstand current test (Commercial and Industrial Application)	8.4.6DV.1
		Verification of the voltage drop	8.4.4
6A	1	Short time current sequence (Service Applications)	8.4.6DV.4.1
		Current Test	8.4.6DV.4.1.1
		Continuity Test	8.4.6DV.4.1.2
7	5	Aging test sequence	
		Verification of the voltage drop [a]	8.4.4
		Aging test for protective conductor terminal blocks with screwless type clamping units	8.4.7
		Verification of the voltage drop [a]	8.4.4
7A	2	Aging test for protective conductor terminal blocks with insulation displacement type clamping units	8.4.7DV
8	1 of 3	Verification of thermal characteristics[a]	8.5
[a] Not required in Canada and the US.			

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 of 8.2.4.2 of IEC 60947-1 applies to screwless-type clamping units accordingly.

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.

For screw-type clamping units with a diameter of threads up to and including 2,8 mm, the tightening torque shall be in accordance with Table B.1 or 110 % of the torque specified by the manufacturer, whichever is the greater.

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 test (with neighbouring terminal blocks according IEC 60947-7-1) (see 8.4.3);

– verification of voltage drop (see 8.4.4);

– temperature-rise test (for protective conductor terminal blocks with PEN function) (see 8.4.5);

– short-time withstand current test (see 8.4.6);

– ageing test (for screwless protective conductor terminal blocks) (see 8.4.7).

8.4.2 Void

8.4.3 Dielectric test

This test applies only if partially insulated protective conductor terminal blocks are intended to be arranged directly beside terminal blocks according to IEC 60947-7-1.

The test is made on protective conductor terminal blocks installed with terminal blocks of the same series and size according to the manufacturer's instructions.

a) If the manufacturer has declared a value for the rated impulse withstand voltage U_{imp}, the impulse withstand voltage test shall be made in accordance with 8.3.3.4.1, item 2), of IEC 60947-1, except item 2) c) which does not apply.

b) The power-frequency withstand verification of solid insulation shall be made in accordance with 8.3.3.4.1, item 3), of IEC 60947-1. The value of the test voltage shall be as stated in table 12A of IEC 60947-1 (see 8.3.3.4.1, item 3) b) i), of IEC 60947-1).

The protective conductor terminal blocks and terminal blocks shall be wired and installed on a metal support as shown in Figure 1 and under the conditions a), b) and c) of 8.4.2.1 of IEC 60947-7-1.

The test voltage shall be applied between the protective conductor terminal blocks and the terminal blocks.

8.4.3DV D2 *Modification by adding the following:*

Insulation displacement terminals shall be conditioned according to Subclause 8.4.7DV.2.1 of Annex DVA, item 1, prior to the dielectric test.

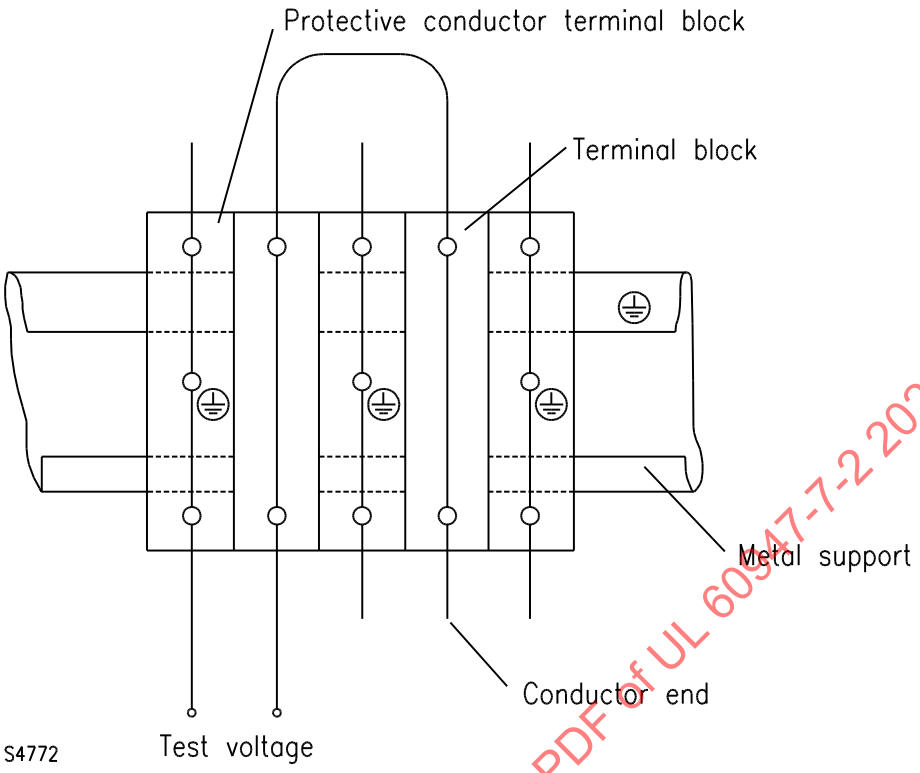


Figure 1

Arrangement for the dielectric test

8.4.4 Verification of the voltage drop

The voltage drop shall be verified

a) before and after the test of mechanical strength of clamping units (see 8.3.3.1);

b) before and after the temperature-rise test (see 8.4.5);

c) before and after the short-time withstand current test (see 8.4.6);

d) before, during and after the ageing test (see 8.4.7).

The verification is made as specified in 8.3.3.1, 8.4.5, 8.4.6 and 8.4.7.

If the protective conductor connection is made to steel supports with a chromated surface, the chromate coat shall be removed at the contact points prior to the connection, except for the short-time withstand current test in accordance with 8.4.6, for which the voltage drop shall be measured only after the test.

The voltage drop is measured on each protective conductor terminal block as indicated in Figure 2. The measurement is made with a direct current of 0,1 times the value given in table 4 or table 5 of IEC 60947-7-1.

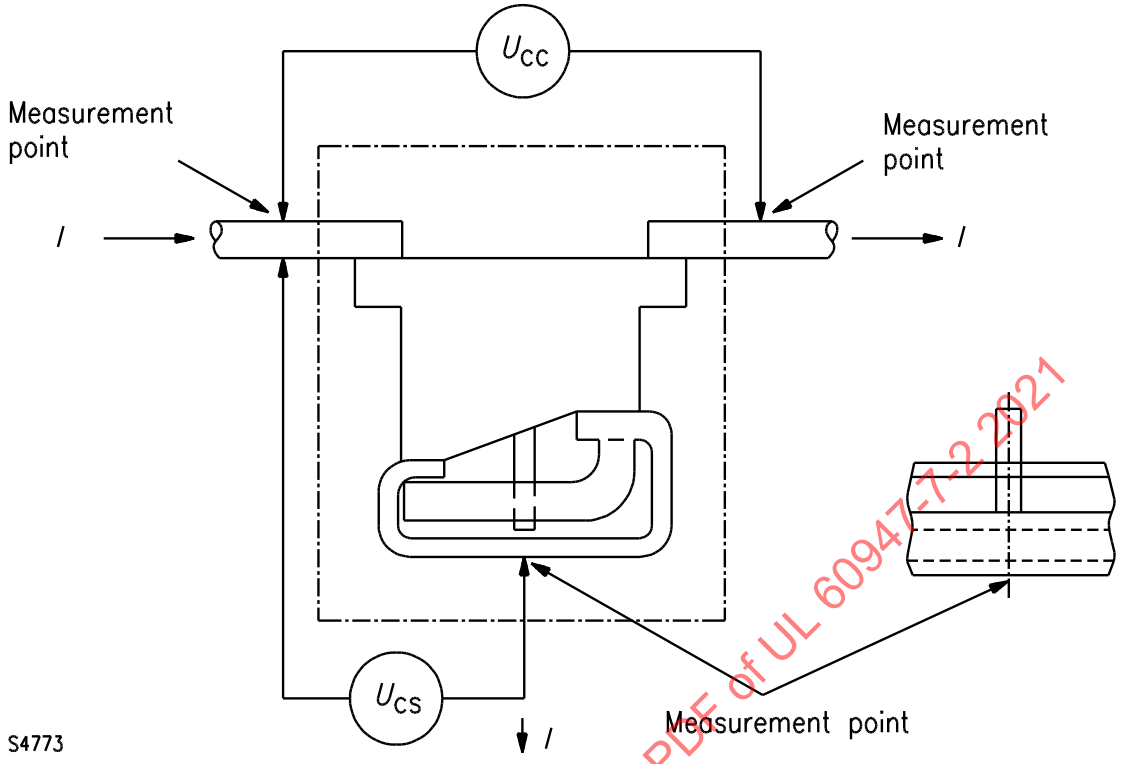


Figure 2

Arrangement for the voltage drop test

Before the tests according to a), b), c) and d), the voltage drop U_{cc} shall not exceed 3,2 mV; and the voltage drop U_{cs} shall not exceed 6,4 mV with the exception of test c) for which the voltage drop test is performed after the test only, if steel supports with a chromated surface are used.

If the measured value of U_{cc} or U_{cs} exceeds 3,2 mV or 6,4 mV respectively, the voltage drop is determined on each individual clamping unit separately, which shall not exceed 1,6 mV or 4,8 mV respectively.

After the tests according to a), b) and c), voltage drops U_{cc} and U_{cs} shall not exceed 4,8 mV or 9,6 mV respectively, or 150 % of the values measured before the tests, whichever is the lower.

During and after the test according to d), voltage drops U_{cc} and U_{cs} shall not exceed the values specified in 8.4.7.

8.4.5 Temperature-rise test

This test is only applicable for protective conductor terminal blocks with PEN function equal to and above 10 mm^2 (AWG 8) rated cross-section. To this effect, the thermal rated current values allotted to the rail profiles in Table A.1 are to be seen as limit values.

Steel supports are not permissible. The test circuit shall be located horizontally as shown in Figure 3 and Figure 4 on a wooden surface (e.g. tabletop or floor). The conductors shall lie freely on the surface.

The test shall be made with PVC-insulated conductors having the rated cross-section.

If applicable, the conductor connection and the connection to the support shall be made with the torque according to table 4 of IEC 60947-1 with the respective Table B.1 for screw-type clamping units with a diameter of threads up to and including 2,8 mm or a higher value specified by the manufacturer.

The minimum conductor length L shall be 1 m for the cross-section of 10 mm^2 (AWG 8) and 2 m for larger cross-sections.

The conductors shall be rigid stranded.

During the test, screws of clamping units shall not be re-tightened.

Two different test groups shall be provided:

a) five insulated protective conductor terminal blocks shall be arranged adjacently without support (see Figure 3). The temperature shall be measured on the middle protective conductor terminal block;

b) five protective conductor terminal blocks shall be arranged adjacently on their support (see Figure 4), the two outer protective conductor terminal blocks being linked through their support. The temperature shall be measured on the two outer protective conductor terminal blocks.

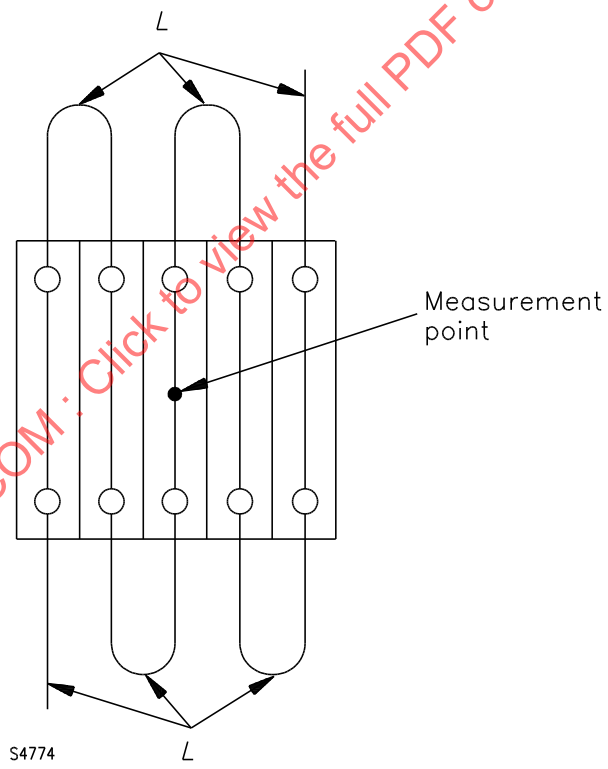


Figure 3

Arrangement for the temperature-rise test for test group a)