UL 60947-7-1

STANDARD FOR SAFETY

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

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

Fourth Edition, Dated January 27, 2017

Summary of Topics

This revision of ANSI/UL 60947-7-1 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-538/7-1-ANCE
First Edition

CSA Group
CAN/CSA-C22.2 No. 60947-7-1:17
First Edition
(IEC 60947-7-1:2002, MOD)

Underwriters Laboratories Inc.
UL 60947-7-1
Fourth Edition

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

January 27, 2017

(Title Page Reprinted: April 16, 2021)

This national standard is based on publication IEC 60947-7-1, second edition (2002) including Corrigendum 1 (2003).

ANSI/UL 60947-7-1-2017 (R2021)

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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.

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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 60947-7-1 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 7-1: Ancillary equipment – Terminal blocks for copper conductors. It is the first edition of NMX-J-538/7-1-ANCE, the first edition of CAN/CSA-C22.2 No. 60947-7-1, and the fourth edition of UL 60947-7-1. This edition of UL 60947-7-1 supersedes the previous edition(s) published on May 6, 2011.

This harmonized standard is based on IEC Publication 60947-7-1: Edition 2 (2002), Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors, as revised by corrigendum (March 2003). IEC 60947-7-1 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.

This is the NMX-J-538/7-1-ANCE Standard for Safety for Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors. This NMX-J-538/-1-ANCE Part 1 is to be used in conjunction with the appropriate NMX-J-538/7-1-ANCE Part 2 and 3, which contains clauses to supplement or modify the corresponding clauses in the Part 1, to provide relevant requirements for each type of product. This is the CAN/CSA-C22.2 No. 60947-7-1 Standard for Safety for Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors. This CSA Group Part 1 is to be used in conjunction with the appropriate CSA Group Part 2 and 3, which contain clauses to supplement or modify the corresponding clauses in the Part 1, to provide relevant requirements for each type of product. This is the UL Standard for Safety for Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors. This UL Part 1 is to be used in conjunction with the appropriate UL Part 2 and 3, which contain clauses to supplement or modify the corresponding clauses in the Part 1, to provide relevant requirements for each type of product

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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 60947-7-1, Low-Voltage Switchgear and Controlgear – Part 7–1: Ancillary Equipment – Terminal Blocks for Copper Conductors, 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 60947-7-1, Low-Voltage Switchgear and Controlgear – Part 7–1: Ancillary Equipment – Terminal Blocks for Copper Conductors, 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 60947-7-1, Low-Voltage Switchgear and Controlgear – Part 7-1: Ancillary Equipment – Terminal Blocks for Copper Conductors 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 60947-7-1 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 60947-7-1, Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment – 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 7-1: Ancillary equipment – 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 60947-7-1 has been prepared by subcommittee 17B: Low-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

This second edition of IEC 60947-7-1 cancels and replaces the first edition, published in 1989, and amendment 1 (1999), and constitutes a technical revision.

This standard shall be read in conjunction with IEC 60947-1. The provisions of the general rules dealt with in IEC 60947-1 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, e.g. 1.2 of IEC 60947-1, table 4 of IEC 60947-1 or annex A of IEC 60947-1.

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

This standard shall be read in conjunction with the country specific versions of the standards contained in Annex DVB, Table DVB.2, reference No. 9. The provisions of the general rules dealt with in those standards are applicable to this standard, where specifically called for. Clauses and subclauses, tables, figures, and annexes thus applicable are identified by like designated references contained in those standards.

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

FDIS	Report on voting
17B/1187/FDIS	17B/1218/RVD

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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.

Annex C forms an integral part of this standard.

Annexes A and B are for information only.

DV.2 D2 ***Modification by adding the following paragraph to the IEC Foreword:***

Annexes DVA and DVB 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.

The contents of the corrigendum of March 2003 have been included in this copy

DV.3 DE ***Add the following paragraph to the IEC Foreword:***

The numbering system in the standard uses a space instead of a comma to indicate thousands and uses a comma instead of a period to indicate a decimal point. For example, 1 000 means 1,000 and 1,01 means 1.01.

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LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors

DV.4 DC *Modification to Standard Title:*

Replace "Terminal blocks for copper conductors" with "Terminal blocks for copper and aluminum conductors".

1 General

1.1 Scope

This part of IEC 60947 specifies requirements for terminal blocks with screw-type or screw-less-type clamping units primarily intended for industrial or similar use and to be fixed to a support to provide electrical and mechanical connection between copper conductors. It applies to terminal blocks intended to connect round copper conductors, with or without special preparation, having a cross-section between 0,2 mm^2 and 300 mm^2 (AWG 24/600 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.

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

This standard may be used as a guide for

– terminal blocks requiring the fixing of special devices to the conductors, for example quick connect terminations or wrapped connections, etc.;

– terminal blocks providing direct contact to the conductors by means of edges or points penetrating the insulation, for example insulation displacement connections, etc.;

– special types of terminal blocks, for example disconnect terminal blocks, 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 D2 *Modification to add the following:*

1.1DV.1 This standard specifies requirements for terminal blocks with screw-type or screw-less-type clamping units primarily intended for industrial or similar use and to be fixed to a support, in accordance with Annex DVB, National Electrical Code, NFPA 70 (for use in the USA), or CSA C22.1-15 Canadian Electrical Code, Part I (for use in Canada), and NOM-001-SEDE, Electrical Installations (Utility) ([for use in Mexico]).

1.1DV.2 The wire range for terminal blocks covered by this standard include 0,051 mm^2 to 1 010 mm^2 (30 AWG to 2 000 kcmil) copper conductors and 3,31 mm^2 to 1 010 mm^2 (12 AWG to 2 000 kcmil) aluminum conductors. See Annex DVA for aluminum requirements.

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In Mexico, 3,31 mm^2 (12 AWG), 5,26 mm^2 (10 AWG), and 8,37 mm^2 (8 AWG) aluminum conductors are not allowed.

1.1DV.3 The voltage range includes up to 1 500 Vac and 1 500 Vdc.

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

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

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

1.2DV D1 *Modification to add the following:*

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

2 Definitions

For the purposes of this part of IEC 60947, the definitions given in IEC 60947-1, together with the following definitions, apply.

2.1 terminal block: insulating part carrying one or more mutually insulated terminal assemblies and intended to be fixed to a support.

2.2 rated cross-section: value of the maximum cross-section of all connectable types of conductors, rigid (solid and stranded) and flexible, stated by the manufacturer, and to which certain thermal, mechanical and electrical requirements are referred.

2.3 rated connecting capacity: range of cross-sections and, if applicable, the number of connectable conductors, for which the terminal block is designed.

2.4 terminal assembly:two or more clamping units fixed to the same conductive part.

2.5DV D2 *Addition of the following definitions:*

2.5DV.1 printed circuit board (PCB) terminal block: a one-piece, or modular, or two-piece terminal block fixed to a printed circuit board by soldering or other suitable means.

2.5DV.2 special preparation (of conductor end): alteration of the manufactured shape or surface of the conductor to enable it to be connected to the terminal.

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2.5DV.3 factory wiring terminal: a terminal intended in the end application to be connected under controlled conditions, usually at a manufacturer's location. Such terminations use prepared or unprepared conductors. Applicable for the United States. In Canada and Mexico, this definition does not apply.

2.5DV.4 insulation piercing or displacement clamping unit: a clamping unit for the connection and possible disconnection of one conductor or the interconnection of two or more conductors, the connection being made by piercing, boring through, cutting through, removing, displacing, or making ineffective in some other manner the insulation of the conductor or conductors without previous stripping.

2.5DV.5 post connector: a connector utilizing a post onto which one or more conductors are secured by means of a tool.

2.5DV.6 stud-and-nut type connector: a connector in which a conductor can be looped around a stud and retained by a nut or a connector that can retain a conductor that is first terminated in a wire connector.

3 Classification

Distinction is made between various types of terminal blocks as follows:

– method of fixing the terminal block to the support;

– number of poles;

– type of clamping units: screw-type clamping units or screwless-type clamping units;

– ability to receive prepared conductors (see 2.3.27 of IEC 60947-1);

– terminal assemblies with identical or dissimilar clamping units;

– number of clamping units on each terminal assembly;

– service conditions.

3DV.1 D2 ***Modification by adding the following to the list of distinction for types of terminal blocks:***

– for field and factory wiring or for factory wiring only. In Canada and Mexico, this does not apply.

3DV.2 D3 ***Modification to add the following:***

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

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