UL 60947-7-3

STANDARD FOR SAFETY

Low-Voltage Switchgear and Controlgear – Part 7-3: Ancillary Equipment – Safety Requirements for Fuse Terminal Blocks

UL Standard for Safety for Low-Voltage Switchgear and Controlgear – Part 7-3: Ancillary Equipment – Safety Requirements for Fuse Terminal Blocks UL 60947-7-3

Third Edition, Dated January 27, 2017

Summary of Topics

This revision of ANSI/UL 60947-7-3 dated April 21, 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 21, 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-538/7-3-ANCE
First Edition

CSA Group
CAN/CSA-C22.2 No. 60947-7-3:17
First Edition
(IEC 60947-7-3:2002, MOD)

Underwriters Laboratories Inc.
UL 60947-7-3
Third Edition

Low-Voltage Switchgear and Controlgear – Part 7-3: Ancillary Equipment – Safety Requirements for Fuse Terminal Blocks

January 27, 2017

(Title Page Reprinted: April 21, 2021)

This national standard is based on publication IEC 60947-7-3, first edition (2002) including Corrigendum 1 (2003).

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 Third edition including revisions through April 21, 2021. The most recent designation of ANSI/UL 60947-7-3 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 7-3: Ancillary Equipment – Safety Requirements for Fuse Terminal Blocks. It is the first edition of NMX-J-538/7-3-ANCE, the first edition of CAN/CSA-C22.2 No. 60947-7-3, and the third edition of UL 60947-7-3. This edition of UL 60947-7-3 supersedes the previous edition(s) published on May 6, 2011.

This harmonized standard is based on IEC Publication 60947-7-3: Edition 1 (2002), Low-Voltage Switchgear and Controlgear – Part 7-3: Ancillary Equipment – Safety Requirements for Fuse Terminal Blocks, as revised by corrigendum (March 2003). IEC 60947-7-3 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-538/7-3-ANCE Standard for Safety for Low-Voltage Switchgear and Controlgear – Part 7-3: Ancillary Equipment – Safety Requirements for Fuse Terminal Blocks is to be used in conjunction with the first edition of NMX-J-538/7-1-ANCE. The requirements for Ancillary Equipment – Safety Requirements for Fuse Terminal Blocks 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-538/7-3-ANCE, the NMX-J-538/7-1-ANCE subclause applies.

This CAN/CSA-C22.2 No. 60947-7-3, Standard for Safety for Low-Voltage Switchgear and Controlgear – Part 7-3: Ancillary Equipment – Safety Requirements for Fuse Terminal Blocks, is to be used in conjunction with the first edition of CAN/CSA-C22.2 No. 60947-7-1. The requirements for Ancillary Equipment – Safety Requirements for Fuse Terminal Blocks 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. 60947-7-3, the CAN/CSA-C22.2 No. 60947-7-1 subclause applies.

This UL 60947-7-3, Standard for Safety for Low-Voltage Switchgear and Controlgear – Part 7-3: Ancillary Equipment – Safety Requirements for Fuse Terminal Blocks, is to be used in conjunction with the fourth edition of UL 60947-7-1. The requirements for Ancillary Equipment – Safety Requirements for Fuse Terminal Blocks 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 60947-7-3, 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 60947-7-3, Low-Voltage Switchgear and Controlgear – Part 7-3: Ancillary Equipment – Safety Requirements for Fuse Terminal Blocks, 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 60947-7-3, Low-Voltage Switchgear and Controlgear – Part 7-3: Ancillary Equipment – Safety Requirements for Fuse Terminal Blocks, copyright 2002, are used in this standard with the consent of the International Electrotechnical Commission. The IEC Foreword and Introduction are not a part of the requirements of this standard but are included for information purposes only.

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NATIONAL DIFFERENCES

National Differences from the text of International Electrotechnical Commission (IEC) Publication 60947-7-3, Low-Voltage Switchgear and Controlgear – Part 7-3: Ancillary Equipment – Safety Requirements for Fuse Terminal Blocks, first 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 7-3: Ancillary equipment – Safety requirements for fuse terminal blocks

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 60947-7-3 has been prepared by subcommittee 17B: Low-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

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 A and F. The provisions of the general rules dealt with in Annex DVA, item F, and the requirements for terminal blocks of Annex DVA, item A 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 A and F, 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/1193/FDIS	17B/1226/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 C form an integral part of this standard.

Annex B is for information only.

DV.2 DR *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 2005. 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.

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 terminal block. For more information, see annex B.

No Text on This Page

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.

1.1DV D2 *Modification by adding the following:*

This standard specifies requirements for 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 Annex DVB, National Electrical Code, NFPA 70 (for use in the USA), CSA C22.1-15 Canadian Electrical Code, Part I (for use in Canada), and NOM-001-SEDE, Electrical Installations (Utility) [for use in Mexico].

1.2 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 60127-1:1998,
Miniature fuses – Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links

IEC 60127-2:1989,
Miniature fuses – Part 2: Cartridge fuse-links

IEC 60216-1:2001,
Guide for the determination of thermal endurance properties of electrical insulating materials – Part 1: General guidelines for ageing procedures and evaluation of test results

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 7: 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

ISO 3:1973,
Preferred numbers – Series of preferred numbers

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

1.2DV DR *Modification by adding the following:*

For a list of Canada, Mexico, and USA Normative Standards, see Annex DVA of this standard.

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 **fuse terminal block** terminal block base with a fuse-carrier

2.1DV D2 *Modification by replacing 2.1 with the following:*

fuse terminal block: terminal block base with or without 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 an overload of P_{V1}, equal to the maximum sustained power dissipation as given in 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

2.8 **rated cross-section** value, stated by the manufacturer, of a rigid (solid or stranded) or flexible conductor to which certain thermal, mechanical and electrical requirements are referred

2.9 **rated connecting capacity** range of cross-sections and/or the number of conductor cross-sections for which the fuse terminal block is designed

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.

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

cDV) fuse terminal block without a fuse-carrier, e.g. fixed mounted fuse clips.

3DV.2 D2 *Modification by adding the following:*

Clause 3, Classification, of Annex DVA, Item A applies.

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 Fuse-links

The fuse links shall be in accordance with IEC 60127-2.

4.1DV D2 *Addition:*

Dimensions of cartridge fuse-link shall be stated.

4.2 Rated power dissipation value

4.2.1 Overload and short-circuit protection (P_V)

The rated value (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 (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).

4.2DV D2 *Modification by adding the following:*

Subclause 4.2 does not apply in the United States.

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.

4.3DV D2 *Modification by adding 4.3.7DV and 4.3.8DV:*

4.3.7DV D2 *Type of terminal block*

Subclause 4.2, Type of terminal block, of Annex DVA, Item A applies.

4.3.8DV D2 *Rated and limiting values*

Subclause 4.3.6DV.1, Rated and limiting values, of Annex DVA, Item A applies.

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 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 voltage;

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

g) rated value of the power dissipation (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) maximum power dissipation (P_{VK}) and rated current of the fuse-link

– in case of separate arrangement,

– in case of compound arrangement;

i) operating conditions, if different from clause 6;

j) size of the fuse-link.

5.2DV.1 D2 *Modification by replacing item a) with the following:*

a) to Annex DVA, Item F (NMX-J-515-ANCE), if the manufacturer claims compliance with this standard;

5.2DV.2 D2 *Deletion of items g) and h):*

These items are not applicable.

5.2DV.3 D2 *Modification by adding the following:*

Subclause 5.2DV, Additional information, of Annex DVA, Item A applies.

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.

5.3DV D2 *Deletion:*

Subclause 5.3 does not apply.

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

7.1DV D2 *Modification by adding the following:*

Subclause 7.1, Constructional requirements, of Annex DVA, Item A applies as modified by the requirements of 7.1.1 through 7.1.9– DV and addition of 7.1.5– DV.

7.1.1 Clamping units

Subclause 7.1.1 of IEC 60947-7-1 applies

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

7.1.1DV.1 A metal part for mounting or holding contact clips shall be securely and rigidly fastened to the supporting base or mounting surface. All current-carrying parts shall be prevented from turning or shifting in position by means other than friction between surfaces.

NOTE: Turning or shifting may be prevented by the use of two screws or rivets, by noncircular shoulders or mortises, by a dowel pin, lug, or offset, by a connecting strap or clip fitted into an adjacent part, or by an equivalent method.

7.1.1DV.2 For Canada and the USA, where parts are held together by screws, a threaded part shall not have fewer than two full, clean-cut threads. Threads shall not be finer than 12-24, 10-32, 8-32, and 6-36 if the screw extends all the way through the threaded part. If the screw does not extend all the way through the threaded part, it shall engage full, clean-cut threads for a distance of not less than the diameter of the screw.

7.1.1DV.3 Copper and brass are not acceptable for the plating of an iron or steel wire-binding screw, nut, or stud terminal, but a plating of zinc is acceptable.

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.

7.1.2DV D2 *Modification by adding the following:*

7.1.2DV.1 A mounting-screw hole shall be located or countersunk so that there will be a spacing of not less than 12.7 mm over the surface of the insulating material between the head of the screw or washer and the nearest uninsulated live part.

7.1.2DV.2 A mounting-screw hole located between uninsulated live parts of opposite polarity shall be countersunk unless barriers of the equivalent are provided to prevent the screwhead from being in the path of a possible arc between such live parts.

7.1.2DV.3 For Canada and the United States, testing per 8.3.2 is not required.

7.1.3 Clearances and creepage distances

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

The requirements in accordance with IEC 60947-7-1 apply with the following additions.

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 to adjacent fuse terminal blocks of same type of construction 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.

7.1.8DV D2 *Modification by adding the following:*

For Canada and the United States, products claiming safety from finger touch shall be IP 20. Products not claiming safety from finger touch shall be IP 00. Definitions of IP Codes can be found in IEC 60529.

7.1.9DV D2 *Addition:*

Contact clips of cartridge fuse terminal blocks

End stops in the contact clips, or other suitable means, shall be provided to ensure the proper location of a fuse-link.

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.

7.2.1DV D2 *Modification by adding the following:*

Subclause 7.2.6DV.1, Test of mechanical strength of clamping units, Subclause 7.2.6DV.2, Tab pull test, and Subclause 7.2.6DV.3, Solid-wire tightening test, of Annex DVA, Item A apply.

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.

7.2.2.1DV D2 *Modification by adding the following:*

Subclause 7.2.2, Dielectric properties, of Annex DVA, Item A applies.

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.

7.2.2.2DV D2 *Deletion:*

Subclause 7.2.2.2 does not apply.

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.

7.2.2.3DV D2 *Modification by adding the following and Table 7.2.2.3DV:*

For Canada and the United States, the temperature rises of a fuse terminal block shall not exceed the values listed in Table 7.2.2.3DV. For Mexico, the temperature rises on a terminal block shall not exceed the applicable values specified in Table 7.2.2.3DV, except any bus, strap or fuse clip when tested with a fuse, and pressure terminal connectors for field installed conductors shall not exceed 45 K.

Table 7.2.2.3DV
Maximum acceptable temperature rises

Materials and components	°C	(°F)
1. Insulation base	a	a
2. Any bus, strap or fuse clip when tested with a dummy fuse	30	(54)
3. Any bus, strap or fuse clip when tested with a fuse	85	(185)
4. Pressure terminal connectors for field installed conductors	50[b]	(90)[b]
NOTE – These limits do not apply to an insulated conductor or other material that has been investigated and found acceptable for a higher temperature. [a] Rated temperature limit of material minus test ambient temperature. [b] In a fuse type terminal block tested with dummy fuse links, the recorded temperature rise shall be increased 20°C to represent the heating of fuses.		

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.

7.2.2.4DV D2 *Modification by adding the following:*

For Canada and the United States, Subclause 7.2.5, Electrical performance after ageing (for screwless-type terminal blocks only), of Annex DVA, Item A applies.

7.2.3 Thermal requirements

7.2.3DV D2 *Modification by adding the following:*

For Canada and the United States, subclause 7.2.3 does not apply.

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 air 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 hours 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 60695-2-2, 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:

– attachment of the fuse terminal block on its support (8.3.2);

– mechanical strength of the clamping units of a fuse terminal block (8.3.3);

– compatibility between fuse terminal blocks and fuse-link (8.3.4);

– mechanical strength of the connection between the terminal block base and the fuse-carrier (8.3.5).

8.3.1DV D2 *Modification by adding the following dashed items to the list:*

– tab pull test (8.3.6DV);

– solid wire tightening test (8.3.7DV).

8.3.2 Attachment of the fuse terminal block on its support

Subclause 8.3.2 of IEC 60947-7-1 applies.

8.3.2DV D2 *Modification by adding the following:*

For Canada and the United States, subclause 8.3.2 does not apply.

8.3.3 Mechanical properties of clamping units of a fuse terminal block

8.3.3.1 Testing of mechanical strength of the 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 on two clamping units of five fuse 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 C.1 of IEC 60947-7-1 or 110 % of the torque specified by the manufacturer, whichever is the greater.

Rigid conductors of the rated cross-section shall be connected and disconnected five times.

8.3.3.2 Testing for damage to and accidental loosening of conductors of a fuse terminal block (flexion test)

Subclause 8.3.3.2 of IEC 60947-7-1 applies.

8.3.3.3 Pull-out test

Subclause 8.3.3.3 of IEC 60947-7-1 applies.

8.3.3.4 Verification of rated cross-section and rated connecting capacity

Subclause 8.3.3.4 of IEC 60947-7-1 applies.

8.3.3.4DV D2 *Modification by adding the following:*

For Canada and the United States, subclause 8.3.3.4 does not apply.

8.3.4 Compatibility between fuse terminal blocks and the fuse-link

8.3.4DV D2 *Deletion:*

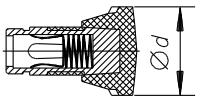
Subclause 8.3.4 does not apply.

The maximum gauge no. 1 or no. 4, in accordance with Table A.1, shall be inserted and withdrawn 10 times from the fuse-carrier.

Following each insertion of the gauge, the fuse-carrier shall be fitted to the terminal block base as in normal operation. In the case of fuse terminal blocks with screw-type fuse-carrier, the fuse-carriers shall be fitted with a torque of two-thirds of the value specified in Table 1.

Table 1

Test forces

Diameter (d) of fuse carrier 	Torque Nm	Axial pulling force N
Up to and including 16 mm	0,4	25
Over 16 mm, up to and including 25 mm	0,6	50

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No visible damage or loosening of parts shall be observed. The minimum gauge no. 2 or no. 5, according to Table A.1 shall be prevented from falling out of the fuse-carrier in the most unfavourable position.

The minimum gauge no. 2 or no. 5 shall then be inserted into the fuse terminal block and the contact resistance be measured according to 8.4.4 (see Figure 1).

The mean value of the contact resistance shall not exceed 10 mΩ. The value of an individual measurement shall not exceed 15 mΩ.

8.3.5 Mechanical strength of the connection between the terminal block base and the fuse-carrier

8.3.5DV D2 *Deletion:*

Subclause 8.3.5 does not apply.

8.3.5.1 Torque test on screw-type fuse-carriers

The fuse-carrier equipped with the maximum gauge no. 1 or no. 4, in accordance with Table A.1, shall be screwed in five times into the terminal block base by applying the respective torque specified in Table 1.

The fuse-carrier shall be securely kept in the terminal block base during and after the test, and shall show no changes impairing its normal use.

8.3.5.2 Pull-out test on screw-type and bayonet-type fuse-carriers

The fuse-carrier equipped with the maximum gauge no. 1 or no. 4, according to Table A.1, shall be inserted in the terminal block base.

Screw-type fuse-carriers shall be tightened with a torque of two-thirds of the value specified in Table 1.

The fuse-carrier shall then be subjected to an axial pulling force as specified in Table 1 for 1 min.

The fuse-carrier shall be securely kept in the terminal block base during and after the test, and shall show no changes impairing its normal use.

8.3.5.3 Actuating forces on plug-on type or hinged-type fuse-carriers

The fuse-carrier, together with the maximum gauge no. 1 or no. 4 according to Table A.1, shall be inserted in and withdrawn from or slewed out of the terminal block base.

The actuating forces shall be measured with appropriate measuring means. This test shall be conducted 10 times.

The value of each individual measurement shall be within the limit values as stated by the manufacturer.

The fuse-carrier shall be securely kept in the terminal block base during and after the test, and shall show no change impairing its normal use.

8.3.6DV D2 *Addition:*

8.3.6DV.1 Tab pull test

Subclause 8.3.3.6DV.1 of Annex DVA, Item A applies.

8.3.7DV D2 *Addition:*

8.3.7DV.1 Solid wire tightening test

Subclause 8.3.3.6DV.2 of Annex DVA, Item A applies.

8.4 Verification of electrical characteristics

8.4.1 General

The verification of electrical characteristics includes the following:

– dielectric test (8.4.3);

– contact resistance (8.4.4);

– temperature-rise test of the clamping units (8.4.5);

– ageing test for screwless-type fuse terminal blocks (8.4.7).

8.4.1DV D2 *Modification by adding the following dashed items to the list:*

– verification of clearances and creepage distances (8.4.2DV)

– temperature-rise for screw-less and insulation displacement terminal blocks (8.4.8DV)

– ageing test for insulation displacement terminal blocks (8.4.9DV)

8.4.2 Void

8.4.2DV D2 *Modification by adding the title "Verification of clearances and creepage distances" and replacing this subclause with the following:*

Subclause 8.4.2 of Annex DVA, Item A applies.

8.4.3 Dielectric test

8.4.3DV D2 *Modification by replacing with the following:*

Subclause 8.4.3 of Annex DVA, Item A applies.

8.4.3.1 General

a) If the manufacturer has declared a value for the rated impulse 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) According to the rated insulation voltage, the power-frequency withstand test 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).

8.4.3.2 Test arrangement and application of the test voltage

8.4.3.2.1 General

Each test shall be carried out on five adjacent fuse terminal blocks wired with conductors of the rated cross-section and installed on a metal support under the following conditions:

– the conductor ends shall be stripped to a length specified by the manufacturer;

– in case the manufacturer has stated the possibility of using different metal supports, the most unfavourable support shall be used.

8.4.3.2.2 Test A

Gauge no. 3 or no. 6, according to Table A.1, shall be properly inserted as in normal use depending on the size of the fuse terminal block. Indicators, if any, shall be removed or disconnected during this test.

Successively, the impulse withstand test voltage in accordance with the rated impulse withstand voltage U_{imp} at the considered fuse-carrier and the power-frequency withstand test voltage corresponding to the rated insulation voltage of the fuse-carrier shall be applied between the contact elements of each fuse terminal block.

8.4.3.2.3 Test B

Gauge no. 1 or no. 4, according to Table A.1, shall be properly inserted as in normal use depending on the size of the fuse terminal block.

Successively, the impulse withstand test voltage in accordance with the rated impulse withstand voltage U_{imp} at the terminal block base and the power-frequency withstand test voltage corresponding to the rated insulation voltage of the terminal block base shall be applied between

– the live parts of adjacent fuse terminal blocks of the same type and size;

– the live parts of different polarity;

– the live parts connected together and the support.

8.4.3.3 Form and number of impulses

The 1,2/50 µs impulse voltage shall be applied three times with intervals of at least 1 s between the individual pulses for each polarity.

NOTE The output impedance of the pulse generator should not exceed 500 Ω. For the description of the test equipment, see IEC 61180-1 and IEC 61180-2. During these tests there should be no flashover or disruptive discharge. Corona effects or similar phenomena that do not lead to a voltage breakdown are disregarded.

8.4.4 Contact resistance

8.4.4DV D2 *Deletion:*

Subclause 8.4.4 does not apply.

8.4.4.1 General requirements for measurement

The measurements may be carried out in direct or alternating current. In the case of alternating current measurements, the frequency shall not exceed 1 kHz. In case of doubt, the direct current measurements shall govern.

The accuracy of the measuring apparatus shall be within ±3 %

The contact resistance shall be measured after the fuse terminal block has been equipped with gauge no. 2 or no. 5, according to Table A.1.

In the case of fuse terminal blocks with screw-type fuse-carriers, the carrier shall be installed as in normal use with a torque equal to two-thirds of the value specified in Table 1.

Fuse terminal blocks with plug-on type or hinged-type fuse-carriers shall be installed as in normal use and tested in this condition.

8.4.4.2 Measuring cycle and measurement performance

8.4.4.2.1 General

The contact resistance is normally calculated from the voltage drop measured according to Figure 1.

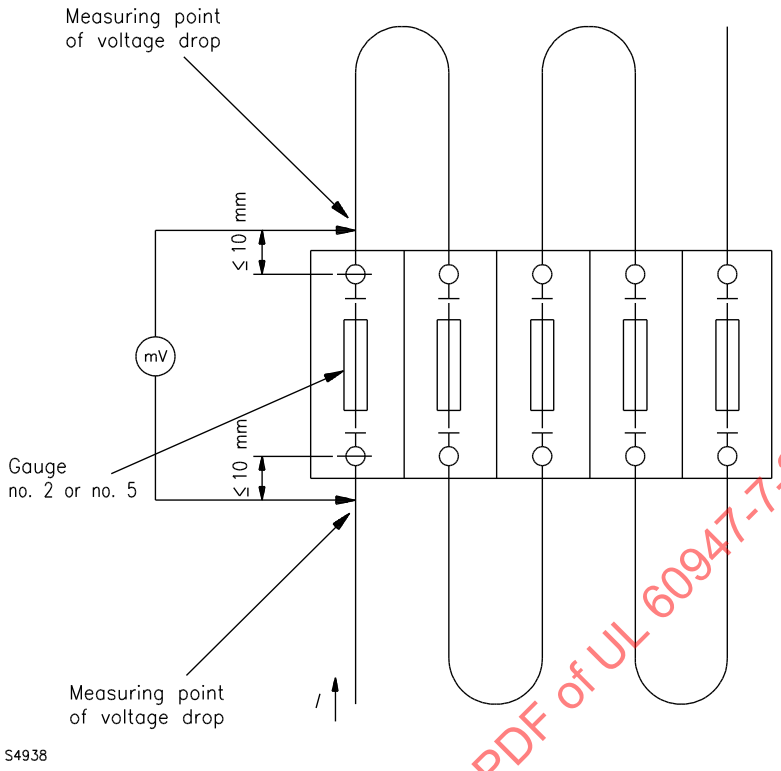


Figure 1

Test arrangement for the verification of the contact resistance

Figure 1DV D2 ***Modify Figure 1 by replacing it with Figure 1DV:***

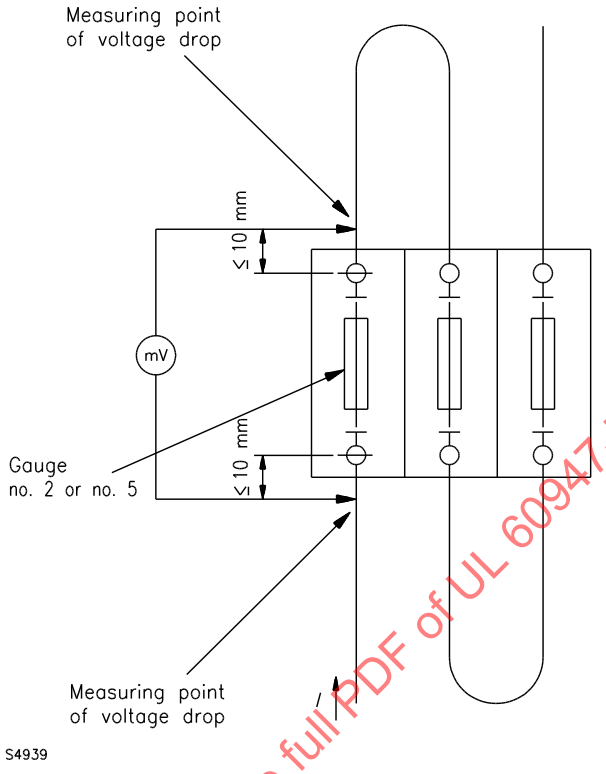


Figure 1DV

Test arrangement for the verification of the contact resistance

The complete measurement. consists of five measuring cycles which shall be carried out successively.

The measurement shall be made under the following conditions:

a) test voltage: the open-circuit voltage of the current source shall not exceed 60 V d.c. or a.c. (peak value), but shall be at least 10 V;

b) test current: 0,1 A;

c) the measurement shall be made within 1 min following the application of the test current;

d) the measurement shall be carried out so that unusual pressure on the contacts being tested and a displacement of the test conductors are avoided.

8.4.4.2.2 Measuring cycle with direct current

One measuring cycle comprises the following:

a) insertion of the gauge in the fuse terminal block;

b) measurement with current flowing in one direction;

c) measurement with current flowing in the opposite direction;

d) removal of the gauge from the fuse terminal block.

8.4.4.2.3 Measuring cycle with alternating current

One measuring cycle comprises the following:

a) insertion of the gauge in the fuse terminal block;

b) measurement;

c) removal of the gauge from the fuse terminal block.

8.4.4.3 Acceptance criteria

The contact resistance shall not exceed the values according to 7.2.2.2.

8.4.5 Temperature rise of clamping units

Five fuse terminal blocks shall be installed side by side on a support according to Figure 1 as in normal use, together with the required accessories and the minimum gauge no. 2 or no. 5 inserted according to Table A.1.

Conductors and test currents shall be in accordance with 8.5.2.4.

The conductors shall be tightened with the torque as specified in table 4 of IEC 60947-1, in accordance with the respective table C.1 of IEC 60947-7-1 for screw-type clamping units with a diameter of threads up to and including 2,8 mm, or with a higher torque as stated by the manufacturer.

The test shall be carried out with single-phase a. c. current and continued until constant temperature values are reached. The temperature-rise limit values according to 7.2.3.3 at the conductor clamping units of the central fuse terminal block shall not be exceeded.

8.4.5DV.1 D2 *Modification by replacing the first paragraph with the following:*

Three fuse terminal blocks shall be installed side by side on a support according to Figure 1DV as in normal use, together with the required accessories and the minimum gauge no. 2 or no. 5 inserted according to Table A.1. A dummy fuse-link made of copper alloy, plated or un-plated, is permissible.

8.4.5DV.2 D2 *Addition:*

A variation of less than 1 K between any two out of three consecutive measurements made at an interval of 5 min is considered as steady temperature.

8.4.6 Void

8.4.7 Ageing test for screwless-type fuse terminal blocks

The test is made simultaneously on five adjacent fuse terminal blocks equipped with gauges no. 2 or no. 5 according to Table A.1, connected in series by conductors as specified in 8.5.2.4, as shown in Figure 1.

For fuse terminal blocks intended for use under “normal service conditions” (maximum 40 °C according to 6.1.1 of IEC 60947-1), PVC insulated conductors shall be used.

For fuse terminal blocks for which the manufacturer has specified “maximum service conditions above 40 °C” (see 6.1.1, note 1 of IEC 60947-1), heat-resistant insulated or non-insulated conductors shall be used.

The minimum length of the conductor bridges shall be 300 mm.

The fuse terminal blocks are placed in a heating cabinet, which is initially kept at a temperature of (20 ± 2) °C and then submitted to the verification of the contact resistance test.

The whole test arrangement, including the conductors, shall not be moved until the contact resistance test has been completed.

The fuse terminal blocks are submitted to 192 temperature cycles as follows.

The temperature in the heating cabinet is increased to 40 °C according to 8.3.3.3.1 of IEC 60947-1 or to the temperature value declared by the manufacturer for "maximum service conditions".

The temperature is maintained within ±5 °C of this value for approximately 10 min.

During this test period the current according to 8.5.2.4 is applied.

The fuse terminal blocks are then cooled down to a temperature of approximately 30 °C, forced cooling being allowed; they are kept at this temperature for approximately 10 min and, if necessary for measuring the voltage drop, it is allowed to cool down further to a temperature of (20 ± 5) °C.

NOTE As a guide, a value for the heating and cooling rate of the heating cabinet of approximately 1,5 °C/min may be taken as a basis.

The contact resistance on each terminal is also determined according to 8.4.4 after each of 24 temperature cycles and after the 192 temperature cycles have been completed, each time at a temperature of (20 ± 5) °C.

In no case the contact resistance shall exceed 15 mΩ or 1,5 times the value measured after the 24th cycle, whichever is less.

If one of the fuse terminal blocks does not withstand the test, the test is repeated on a second set of fuse terminal blocks, all of which shall then comply with the repeated test.

After this test, a visual inspection shall show no changes impairing further use such as cracks, deformations or the like.

Furthermore, the pull-out test according to 8.3.3.3 shall be carried out.

8.4.7DV D2 *Modification by adding the following:*

For Canada and the USA, Subclause 8.4.7DV.1 of Annex DVA, Item A applies.

8.4.8DV D2 *Addition:*

8.4.8DV.1 Temperature-rise for screwless and insulation displacement terminal blocks

Subclause 8.4.7DV.2.2 of Annex DVA, Item A applies.

8.4.9DV D2 *Addition:*

8.4.9DV.1 Ageing test for insulation displacement terminal blocks

Subclause 8.4.7DV.4 of Annex DVA, Item A applies.

8.5 Verification of thermal characteristics

8.5.1 General

Verification of thermal characteristics includes the following:

– rated value of the power dissipation (8.5.2);

– durability (8.5.3);

– needle-flame test (8.5.4).

8.5.1DV D2 *Modification by adding the following dashed item to the list:*

– thermoplastic insulation stress relief test (8.5.5DV).

8.5.2 Rated power dissipation

8.5.2DV D2 *Modification by adding the following:*

For Canada and the United States, subclause 8.5.2 does not apply.

8.5.2.1 Test arrangements

Two different test arrangements (separate arrangement and compound arrangement) shall be used for ascertaining the rated power dissipation of fuse terminal blocks.

8.5.2.2 Test arrangement for the overload and short-circuit protection

8.5.2.2.1 Separate arrangement

A fuse terminal block, equipped with a dummy fuse-link of the power dissipation value of P_{V1} according to Table 2, acting as central terminal with four feed-through terminal blocks of the same type of construction and size, and with the necessary accessories (cover plate, end-holder, etc.), shall be mounted on a support and connected in series with conductor loops according to 8.5.2.4.

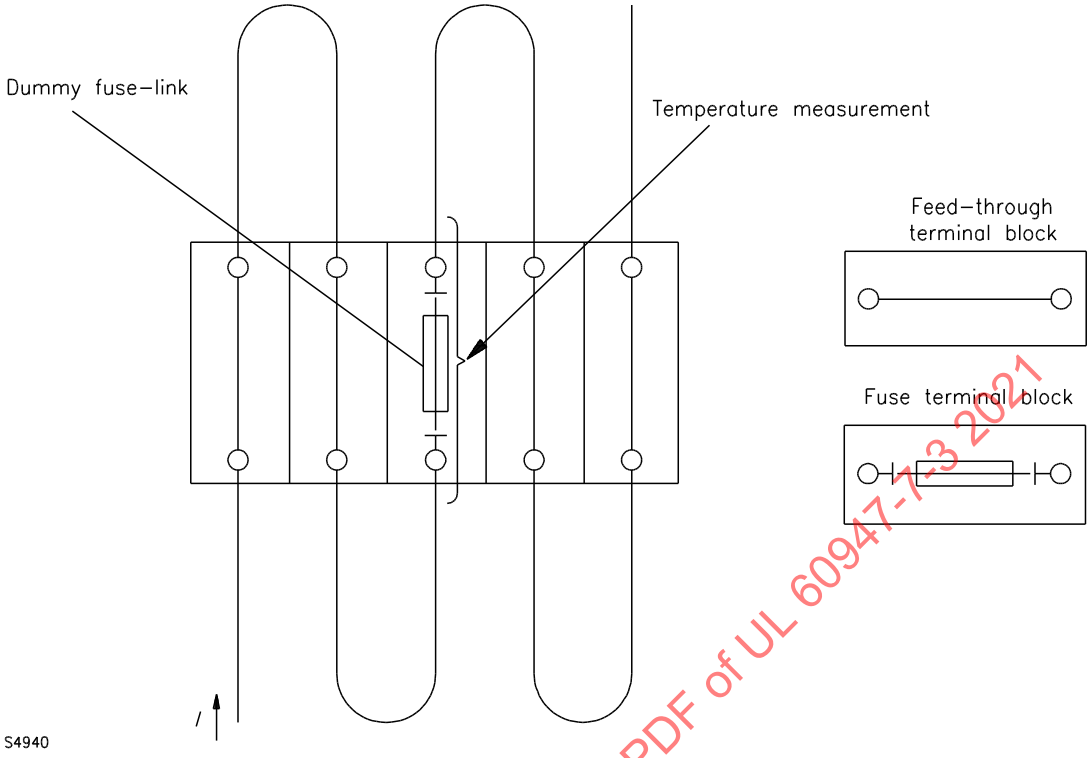


Figure 2

Test arrangement for separate arrangement

8.5.2.2.2 Compound arrangement

Five fuse terminal blocks shall be installed on a support as in normal use together with the necessary accessories.

The wiring shall be made as shown in Figure 3 so that the power dissipation of the central fuse terminal block against the external fuse terminal blocks can be set independently from another by separate current sources.

The fuse terminal blocks shall be equipped with dummy fuse-links of the maximum power dissipation P_{V1}, and P_{V2} in accordance with Table 2.

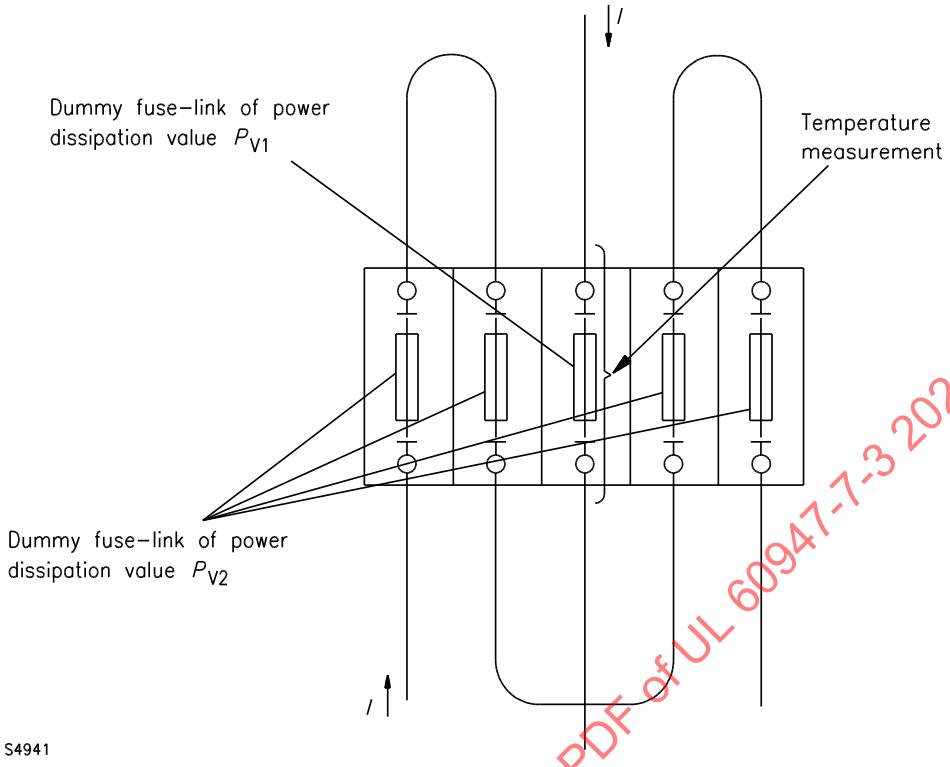


Figure 3

Test arrangement for compound arrangement

8.5.2.3 Test arrangement for exclusive short-circuit protection

8.5.2.3.1 Separate arrangement

Test arrangement according to 8.5.2.2, Figure 2, equipped with dummy fuse-link of power dissipation value P_{V2}.

8.5.2.3.2 Compound arrangement

Five fuse terminal blocks shall be installed on a support as in normal use together with the necessary accessories.

The wiring shall be made as shown in Figure 4. All five fuse terminal blocks shall be equipped with dummy fuse-links of power dissipation value P_{V2} according to Table 2.

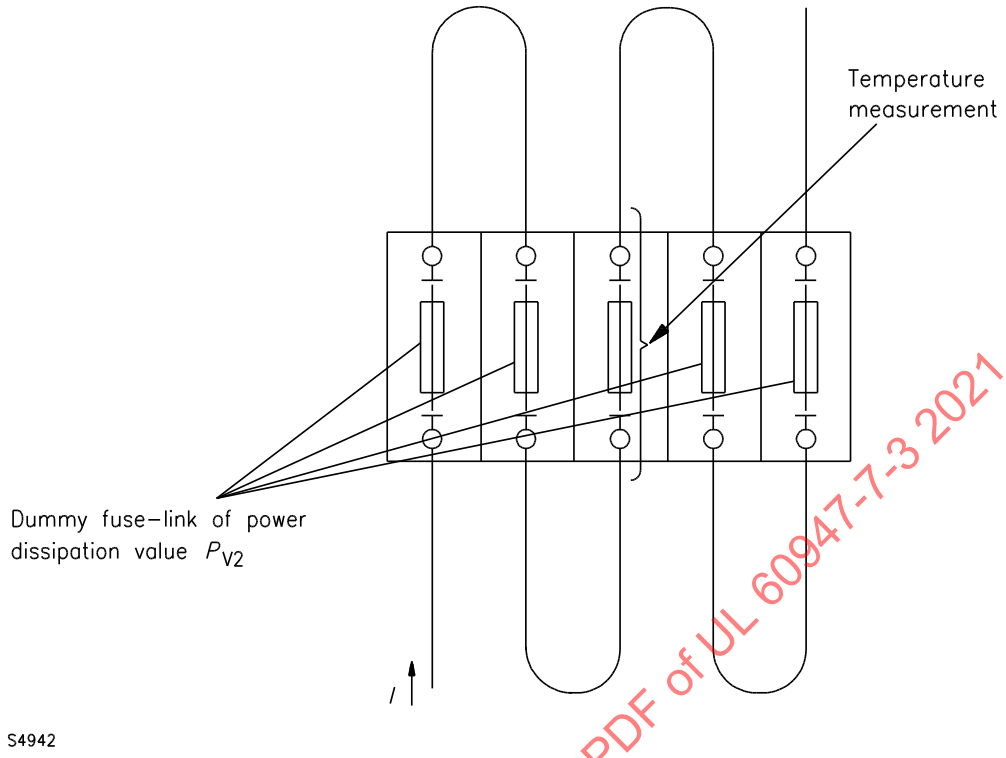


Figure 4

Test arrangement for compound arrangement of short-circuit protection

8.5.2.4 Wiring and test currents

Conductors shall be connected to the fuse terminal blocks or adjacent feed-through terminal blocks as follows:

a) length: 1 m;

b) cross-section of a solid copper conductor:

– 1 mm^2 for fuse terminal blocks designed up to and including 6,3 A, test current 6,3 A;

– 1,5 mm^2 for fuse terminal blocks designed over 6,3 A up to and including 10 A, test current 10 A;

– 2,5 mm^2 for fuse terminal blocks designed over 10 A up to and including 16 A; test current 16 A;

c) insulation: black.

The conductors shall be tightened with the torque as specified in table 4 of IEC 60947-1, in accordance with the respective table C.1 of IEC 60947-7-1 for screw-type clamping units with a diameter of threads up to and including 2,8 mm, or with a higher torque as stated by the manufacturer.

A thermocouple or another measuring method which has no essential influence on the temperature shall be applied for measuring the temperature of the part being tested.

8.5.2.5 Dummy fuse-link for cartridge fuse-links

A dummy fuse-link is a test cartridge fuse-link with a defined resistance according to Table 2 and dimensions within the tolerances for cartridge fuse-links.

End cap material: brass, nickel plated; minimum thickness of nickel plating 2 µm.

Table 2
Dummy fuse-links

Size	Maximum power dissipation values and associated resistance values				Current[c]
	Overload		Nominal load		
	P_{V1} [a]	R_1 [d]	P_{V2} [b]	R_2 [d]	
mm	W	mΩ	W	mΩ	A
5 x 20	1,6	256	0,7	112	2,5
	1,6	40	0,7	18	6,3
	2,5	63	1,0	25	6,3
	4,0	101	1,3	33	6,3
6,3 x 32	1,6	1 600	0,5	500	1,0
	2,5	400	0,6	96	2,5
	4,0	40	2,0	20	10,0

[a] If other values are required, the values from the basic series R10 of ISO 3 should be selected.

[b] For nominal conditions derived from the rated current of the fuse-link multiplied with the voltage drop.

[c] Values 10 A up to 16 A for cartridge fuse-links 5 mm x 20 mm are under consideration.

[d] Tolerance ±10 %.

8.5.2.6 Temperature measuring point

The temperature shall be measured by approximation at the hottest point of the insulating part of the fuse terminal block (T_{S2}) and the surface of the actuating element of the fuse-carrier (T_{S1}). In case of doubt, said points shall be determined by a preliminary test.

8.5.2.7 Test procedure

The dummy fuse-links provided. for the test (separate arrangement and compound arrangement) shall be selected from Table 2 and inserted into the fuse terminal block.

The currents for the fuse terminal blocks being tested shall be so adjusted that the given maximum power dissipation values P_{V1} and/or P_{V2}, according to Table 2, are reached in conformity with the test arrangement of 8.5.2.2 and 8.5.2.3. The rated values shall remain constant during the whole testing duration.

The test shall be continued until the temperature balance is reached.

The temperature balance is reached when three successive readings, which shall be made at an interval of at least 5 min, do not show any further temperature rise. The measured results, determined at ambient temperature, shall be rectified to a reference temperature of 23 ° C by means of a derating curve corresponding to the example shown in annex B.

8.5.2.8 Acceptance criteria

The temperature values measured shall not exceed the two values specified in 7.2.3.1.

8.5.3 Durability

Fuse terminal blocks shall be resistant to heat and mechanical stresses which are liable to occur in normal use. Moreover, the requirements of 8.5.2 shall be taken into consideration.

Compliance with these requirements is checked by the following test.

The fuse terminal block shall be subjected to the test for separate arrangement according to 8.5.2.2.1 or 8.5.2.3.1, as applicable. The rated current related to the corresponding dummy fuse-link according to Table 2 shall be passed through the test arrangement (see examples below). The test shall be carried out continuously over a period of 168 h.

EXAMPLE 1 For an overload and short-circuit protection P_V declared 2,5 W, 5 mm x 20 mm fuse-link: use a dummy fuse-link with 6,3 A and a power dissipation of 2,5 W.

EXAMPLE 2 For an exclusively short-circuit protection P_{VK} declared 2,5 W, 5 mm x 20 mm fuse-link: use a dummy fuse-link with 6,3 A and a power dissipation of 1 W.

After the test, the fuse terminal block shall show no changes impairing its function as in normal use. The following requirements shall be met:

– dielectric test according to 8.4.3;

– contact resistance test according to 8.4.4; the mean value shall not exceed 10 mΩ and the value of an individual measurement shall not exceed 15 mΩ;

– compatibility test between fuse terminal block and fuse-link according to 8.3.4.

8.5.3DV D2 *Modification by adding the following:*

For Canada and the United States, subclause 8.5.3 does not apply.

8.5.4 Needle flame test

The test is carried out according to IEC 60695-2-2 successively in the area of the fuse-link of three fuse. terminal blocks.

The test room shall be substantially draught-free with dimensions sufficient to ensure an adequate supply of air.

Before the test, the fuse terminal blocks are stored for 24 h in an atmosphere having a temperature between 15 °C and 35 °C and a relative humidity between 45 % and 75 %.

After this preconditioning, the fuse terminal block is mounted on its appropriate support and fixed with suitable means so that one lateral insulation wall lies parallel to the layer placed below it (see Figure 5).

Conductors are not connected.

The layer placed below, which consists of an approximately 10 mm thick pinewood board covered with a single layer of tissue paper (grammage between 12 g/m^2 to 30 g/m^2 according to 6.86 of ISO 4046), is positioned at a distance of (200 ± 5) mm below the fuse terminal block.

The test flame, adjusted in accordance with figure 1a) of IEC 60695-2-2, is guided under an angle of 45° to the lateral insulation wall.

The tip of the flame shall make contact with the insulation wall in the area of the fuse-link (see Figure 6).

The flame is applied for 10 s. For insulation walls <1 mm and/or an area <100 mm^2, the flame is applied for 5 s.

After the flame is removed, the duration of burning in the case of ignition is measured.

Duration of burning denotes the time interval from the moment the flame is removed until flames or glowing of the fuse terminal block have extinguished.

The fuse terminal blocks are considered to have passed the test if the duration of burning is <30 s in case of ignition.

Moreover, the tissue paper on the pinewood board shall not ignite if burning or glowing particles fall from the fuse terminal block.

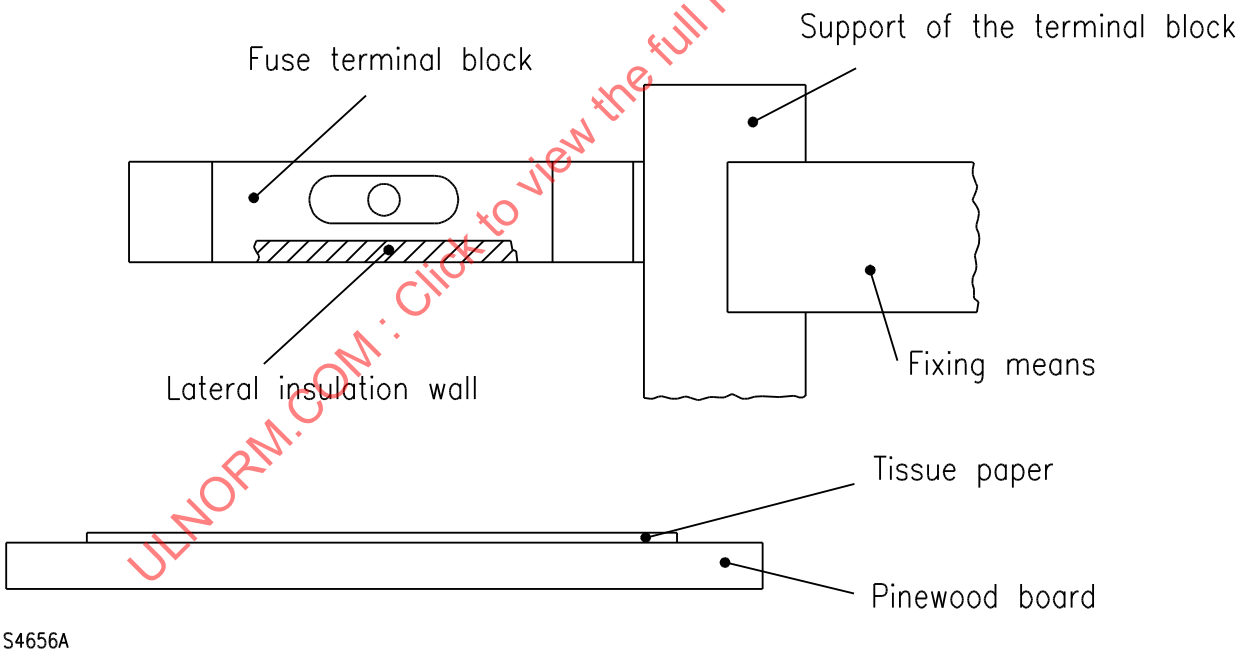


Figure 5

Test arrangement for the needle flame test

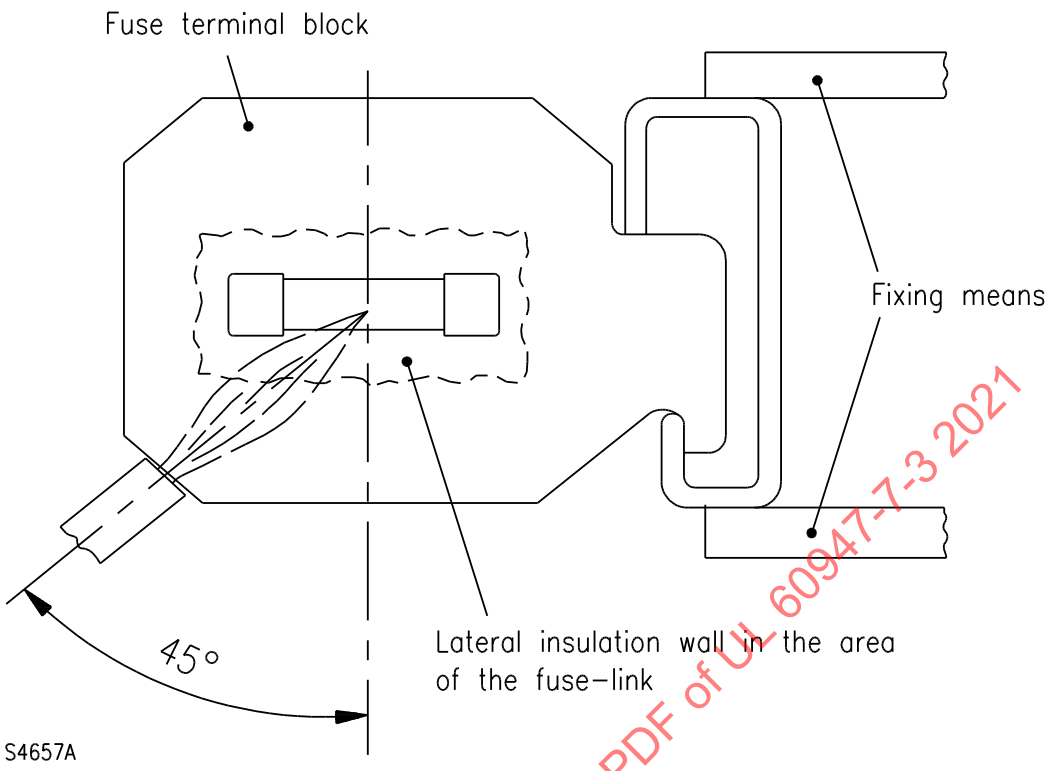


Figure 6

Point of test flame contact (view from the layer placed below the fuse terminal block)

8.5.4DV D2 *Modification by adding the following:*

For Canada and the United States, subclause 8.5.4 does not apply.

8.5.5DV D2 *Addition:*

8.5.5DV.1 Thermoplastic insulation stress relief test

Subclause 8.7DV of Annex DVA, Item A applies.

8.6 Verification of EMC characteristics

Subclause 8.6 of IEC 60947-7-1 applies.

Annex A
(normative)

Gauges

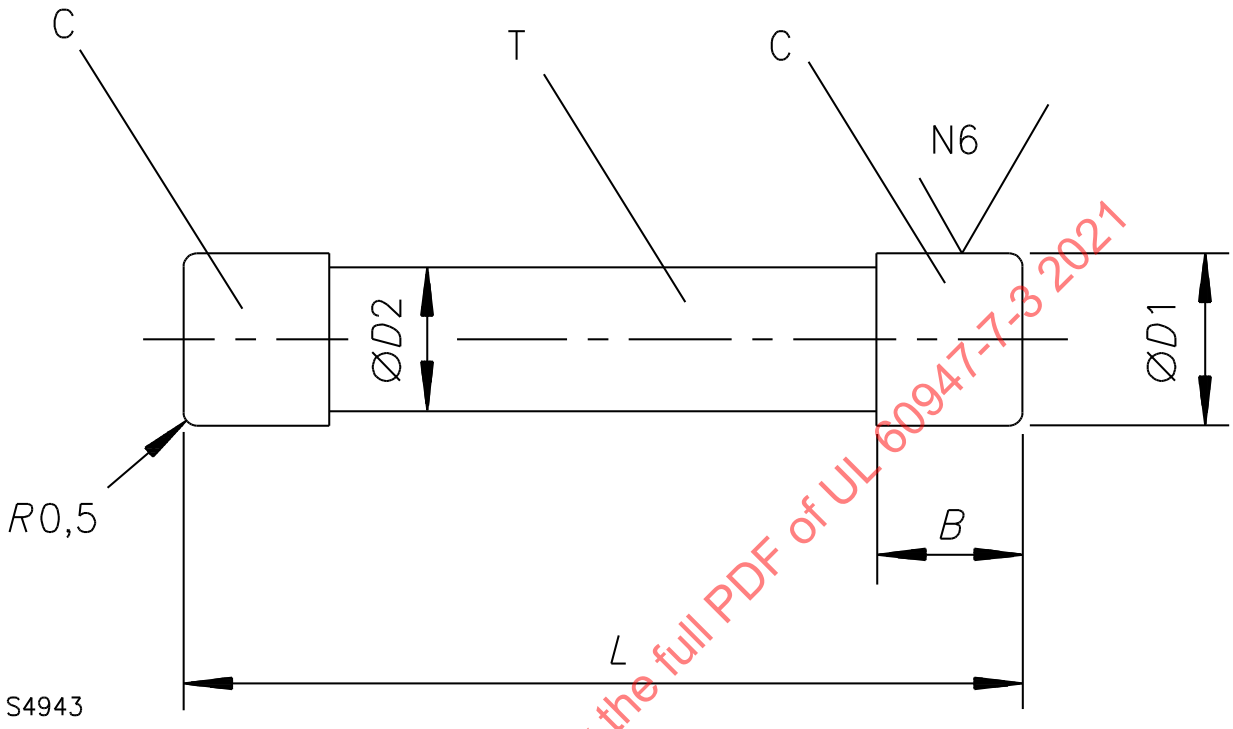


Figure A.1

Outline of the gauges

Table A.1
Dimensions and materials for gauges for fuse-links according to IEC 60127-2

Type of cartridge fuse-link	Gauge No.	Size	*L*	*D1*	*D2*	*B*	Weight approx.	Material of part	
mm			mm	mm	mm	mm	g	C	T
5 x 20	1	Max.	$20{,}54\ ^{0}_{-0{,}04}$	$5{,}3\ ^{+0{,}01}_{0}$	4,2 ± 0,1	$5\ ^{+0{,}1}_{0}$	–	Steel[a]	
	2	Min.	$19{,}46\ ^{+0{,}04}_{0}$	$5{,}0\ ^{0}_{-0{,}01}$	4,2 ± 0,1	$5\ ^{+0{,}1}_{0}$	2,5	Brass[b]	
	3	–	$20{,}54\ ^{0}_{-0{,}04}$	$5{,}3\ ^{+0{,}01}_{0}$	4,2	$6{,}2\ ^{+0{,}1}_{0}$	–	Brass end caps[b]	Glass or ceramic tube
6,3 x 32	4	Max.	$32{,}64\ ^{0}_{-0{,}04}$	$6{,}45\ ^{+0{,}01}_{0}$	5,5 ± 0,1	$6\ ^{+0{,}1}_{0}$	–	Steel[a]	
	5	Min.	$30{,}96\ ^{+0{,}04}_{0}$	$6{,}24\ ^{0}_{-0{,}01}$	5,5 ± 0,1	$6\ ^{+0{,}1}_{0}$	6	Brass[b]	
	6	–	$32{,}64\ ^{0}_{-0{,}04}$	$6{,}45\ ^{+0{,}01}_{0}$	5,5	$8{,}3\ ^{+0{,}1}_{0}$	–	Brass end caps[b]	Glass or ceramic tube

NOTE All test gauges are without a melting element.

[a] Hardened.

[b] Copper content from 58 % to 70 %.

NOTE This table is taken from IEC 60127-6.

The gauges or their parts made from brass shall be coated with a nickel layer of 8 µm and a gold layer of 4,5 µm.

The end of the gauges shall have no holes.

The gauges shall have a homogenous composition, except for gauges no. 3 and no. 6

Annex B
(informative)

Power dissipation values P_V and P_{VK}

B.1 Ascertainment of the rated power dissipation values P_v and P_{VK} of fuse terminal blocks

The ascertainment of the rated power-dissipation for the exclusive short-circuit protection of P_{VK} takes into consideration the fact that fuse terminal blocks in circuits where no overload is liable to occur are loaded only with the maximum power dissipation of the cartridge fuse-link under nominal conditions of P_{V2}.

The assignment of a rated power dissipation of the fuse terminal block in the event of short circuit P_{VK} to the maximum power dissipation value P_{V1} of the cartridge fuse-links is necessary because only the maximum sustained power dissipation value of P_{V1} is defined in IEC 60127-2 for cartridge fuse-links under overload conditions.

B.2 Design of the derating curves

The surface temperatures T_{S1} and T_{S2} of the sample, determined during the test, and the ambient temperature T_A during the test are taken as a basis for the design of the derating curve.

An auxiliary line is plotted in parallel to the X-axis of a coordinate system at the level of the maximum power dissipation (P_{V1}) of the dummy fuse-link.

Also in the case of the test for the exclusive short-circuit protection, an auxiliary line (P_{V1}) is plotted in parallel to the X-axis for the correlated P_{V2}-value according to Table 2 instead of an auxiliary line (P_{V2}).

The ambient temperature T_A, the reference temperature of 23 °C, the maximum surface temperature of the accessible parts of 85 °C according to 7.2.3.1 and the RTI value of the insulating material are marked on the X-axis.

During the test according to 8.5.2 the temperature rise $\Delta T_{S1} = T_{S1} - T_A$ is measured, with T_{S1} = maximum measured temperature at the accessible parts, measured at an arbitrarily selected ambient temperature T_A (example in the drawings T_A = 22 °C).

The maximum permissible ambient temperature T_1, at which the maximum permissible temperature of the accessible parts (85 °C) will not be exceeded, if the fuse terminal block is operated with the full power defined by the used dummy, is now calculated by subtraction of the measured ΔT_{S1} value from that maximum permissible temperature of the accessible parts (85 °C):

$$T_1 = 85\,°C - \Delta T_{S1} = 85\,°C - (T_{S1} - T_A)$$

A vertical line through T_1 cuts the auxiliary line P_{V1} at that point X1, from which a straight line is drawn to the 85 °C point on the X-axis. The area below this line defines the operating conditions at which the maximum permissible temperature of the accessible parts (85 °C) will not be exceeded.

It is proceeded by analogy with the ascertained maximum surface temperature of the insulating material (T_{S2}).

The maximum permissible ambient temperature

$$T_2 = RTI - \Delta T_{S2} = RTI - (T_{S2} - T_A)$$

is obtained from the measured maximum surface temperature T_{S2} of the insulating material, the RTI value dependent on the insulating material and the ambient temperature T_A. A straight line between the RTI

value on the X-axis and T_2 on the auxiliary line (cutting point X2) defines the operating conditions below which the maximum permissible temperature of the insulating material will not be exceeded.

B.3 Evaluation

The area below the bold-type limit lines in the examples defines the area in which are found the acceptable values of the maximum sustained dissipation (according to IEC 60127-1) of the cartridge fuse-link installed in the fuse terminal block.

The test, that correctly defines limit lines, uses a maximum power dissipation of a dummy fuse-link, which leads to surface temperatures as close as possible to RTI value for T_{S2} and to 85 °C for T_{S1}. Several tests may be necessary to find the dummy fuse-link defined in Table 2.

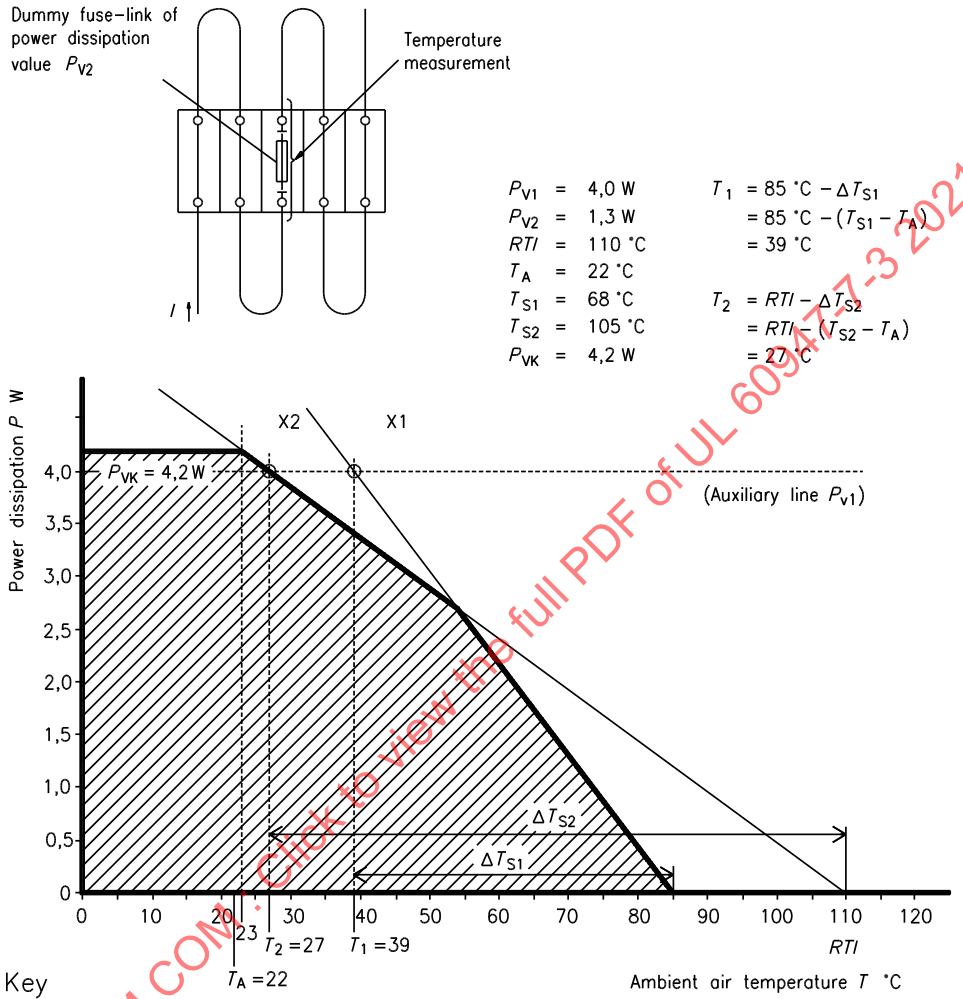
If one of the limit lines intersects the auxiliary line (P_{V1}) beyond 23 °C (reference temperature), the test is then repeated with a dummy fuse-link of the next smaller value of the maximum power dissipation.

If the intersections of the limit lines with the reference temperature of 23 °C lie, however, far above the auxiliary line (P_{V1}), it may be checked, where applicable, whether the fuse terminal block meets the requirements of a dummy fuse-link with the next higher value of the maximum power dissipation.

B.4 Examples

B.4.1 Example 1 – Field of application: exclusive short-circuit protection (P_{VK})

B.4.1.1 Separate arrangement



Key

P_{V1} Maximum power dissipation of the cartridge fuse-link under overload conditions

P_{V2} Maximum power dissipation of the cartridge fuse-link under rated conditions

RTI Relative temperature index

T_A Ambient temperature

T_{S1} = T_A + ΔT_{S1} (measured temperature at the accessible insulation material surface)

ΔT_{S1} Measured temperature rise at the accessible insulation material surface

T_{S2} = T_A + ΔT_{S2} (measured temperature at the hottest point of the insulation material surface)

ΔT_{S2} Measured temperature rise at the hottest point of the insulation material surface

P_{VK} Excessive short-circuit protection (see 4.2.2)

T_1 Maximum permissible ambient temperature, at which the maximum permissible temperature of the accessible parts (85°C) will not be exceeded if the fuse terminal block is operated with the full power as defined by the used dummy

T_2 Maximum permissible ambient temperature, at which the maximum permissible temperature of the insulation material (RTI) will not be exceeded if the fuse terminal block is operated with the full power as defined by the used dummy

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Figure B.1

Derating curve in the case of exclusive short-circuit protection for a separate arrangement