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Miniature fuses -
Part 7: Miniature fuse-links for special application

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Miniature fuses - Part 7: Miniature fuse-links for special application

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60127-7:2015. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 60127-7 has been prepared by subcommittee 32C: Miniature fuses, of IEC technical committee 32: Fuses. It is an International Standard.

This third edition cancels and replaces the second edition published in 2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) alignment with IEC 60127-1:2023 (third edition);
b) change of the rated current of miniature fuse-links for special application to 125A and provision of relevant requirements;
c) addition of a test board for surface mount fuse-links (Figure 2);
d) addition of test schedules for homogenous series.

This part of IEC 60127 is to be read in conjunction with Part 1. It supplements or modifies the corresponding clauses of Part 1. Where the text indicates an "addition" to or a "replacement" of the relevant provision of Part 1, these changes are made to the relevant text of Part 1. When a particular subclause of Part 1 is not mentioned in this part, that subclause applies as far as is reasonable.

Additional specific provisions to those in Part 1, given as individual clauses or subclauses, are numbered starting from 101.

NOTE The following numbering system is used:

– subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;
– unless notes are in a new subclause or involve notes in Part 1, they are numbered starting from 101, including those in a replaced clause or subclause;
– additional annexes are lettered AA, BB, etc.

The text of this International Standard is based on the following documents:

Draft	Report on voting
32C/679/FDIS	32C/681/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

A list of all parts in the IEC 60127 series, published under the general title *Miniature fuses*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,
– withdrawn, or
– revised.

INTRODUCTION

According to the wish expressed by the users of miniature fuses, all standards, recommendations and other documents relating to miniature fuses ~~should~~ have the same publication number in order to facilitate reference to fuses in other specifications, for example, equipment specifications.

Furthermore, a single publication number and subdivision into parts would facilitate the establishment of new standards, because clauses and subclauses containing general requirements need not be repeated.

The new IEC 60127 series~~, under the general heading *Miniature fuses*,~~ is thus subdivided as follows:

IEC 60127, *Miniature fuses* (general title)

IEC 60127-1, *Miniature fuses - Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links*

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

IEC 60127-3, *Miniature fuses - Part 3: Sub-miniature fuse-links*

IEC 60127-4, *Miniature fuses - Part 4: Universal modular fuse-links (UMF) - Through-hole and surface mount types*

IEC 60127-5, *Miniature fuses - Part 5: Guidelines for quality assessment of miniature fuse- links*

IEC 60127-6, *Miniature fuses - Part 6: Fuse-holders for miniature fuse-links*

IEC 60127-7, *Miniature fuses - Part 7: Miniature fuse-links for special applications*

IEC 60127-8, ~~(Free for further documents)~~ *Miniature fuses - Part 8: Fuse resistors with particular overcurrent protection*

IEC 60127-9, ~~(Free for further documents)~~ *Miniature fuses - Part 9: Miniature fuse-links for special applications with partial-range breaking capacity*

IEC 60127-10, ~~*Miniature fuses – Part 10: User guide for miniature fuses*~~ (withdrawn)

This part of IEC 60127 covers additional requirements, test equipment and standard sheets. The SI system of units is used throughout this document.

1 Scope

This part of IEC 60127 covers requirements for miniature fuse-links for special applications.

This part of IEC 60127 is applicable to fuse-links with a rated voltage not exceeding 1 000 V, a rated current not exceeding ~~20~~ 125 A and a rated breaking capacity not exceeding 50 kA.

NOTE Nominal currents above 20 A are intended for protection of low power electric devices at low voltage and not for energy distribution.

It does not apply to fuses completely covered by the subsequent parts of IEC 60269-1.

It does not apply to miniature fuse-links for appliances intended to be used under special conditions, such as in corrosive or explosive atmospheres.

This part of IEC 60127 applies in addition to the requirements of IEC 60127-1:2023.

Miniature fuse-links for special applications are not intended to be replaced by the end-user of an electrical / electronic appliance.

The object of this part of IEC 60127 is to establish uniform test methods for miniature fuse-links for special applications, so as to allow verification of the values (for example melting time and breaking capacity values) specified by the manufacturer.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60068-2-21:~~2006~~2021, *Environmental testing - Part 2-21: Tests - Test U: Robustness of terminations and integral mounting devices*

IEC 60127-1:~~2006~~2023, *Miniature fuses - Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links*
~~IEC 60127-1:2006/AMD1:2011~~
~~IEC 60127-1:2006/AMD2:2015~~

IEC 60127-4:~~2005~~2026, *Miniature fuses - Part 4: Universal modular fuse-links (UMF) - Through-hole and surface mount types*
~~IEC 60127-4:2005/AMD1:2008~~
~~IEC 60127-4:2005/AMD2:2012~~

IEC 60127-6:~~2014~~2023, *Miniature fuses - Part 6: Fuse-holders for miniature fuse-links*

IEC 60664-1:~~2007~~2020, *Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests*

IEC 60695-2-12:~~2010~~2021, *Fire hazard testing - Part 2-12: Glowing/hot-wire based test methods - Glow-wire flammability index (GWFI) test method for materials*
~~IEC 60695-2-12:2010/AMD1:2014~~

IEC 60695-2-13:~~2010~~2021, *Fire hazard testing - Part 2-13: Glowing/hot-wire based test methods - Glow-wire ignition temperature (GWIT) test method for materials*
~~IEC 60695-2-13:2010/AMD1:2014~~

IEC 60695-4:~~2012~~2021, *Fire hazard testing - Part 4: Terminology concerning fire tests for electrotechnical products*

IEC 61249-2-7:2002, *Materials for printed boards and other interconnecting structures - Part 2-7: Reinforced base materials clad and unclad - Epoxide woven E-glass laminated sheet of defined flammability (vertical burning test), copper-clad*

ISO 3:1973, *Preferred numbers - Series of preferred numbers*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in Clause 3 of IEC 60127-1:~~2006~~2023, except 3.5, and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

– IEC Electropedia: available at https://www.electropedia.org/
– ISO Online browsing platform: available at https://www.iso.org/obp

3.1
miniature fuse-link for special applications
enclosed fuse-link which is not covered in IEC 60127-2, IEC 60127-3 or IEC 60127-4 and of rated breaking capacity not exceeding 50 kA, with a width and height not exceeding 12 mm and a length not exceeding 50 mm

Note 1 to entry: Special precautions may be necessary to ensure that the fuse-links will be replaced by a fuse-link with the same technical parameters.

Note 2 to entry: For fuse-links having a metallic cap at each end, any member of terminals or terminations other than the metallic cap such as wire terminations, pins and bolt-in contacts may not be included in the total length of 50 mm and the width and height of 12 mm.

3.2
t_1 to t_8
limit values for time/current characteristic

3.3
I_{70}
test current for testing at elevated temperature of 70 °C

Note 1 to entry: Preferred values are 0,8 I_N or 1,0 I_N or 1,1 I_N.

3.4
I_{test} (A)
test current for endurance testing according to method A

Note 1 to entry: Preferred values are 1,0 I_N or 1,05 I_N or 1,2 I_N.

3.5
I_{test} (B)
test current for endurance testing according to method B

Note 1 to entry: Preferred values are 0,8 I_N or 1,0 I_N.

3.6
I_{OVL} (A)
test current for measuring the maximum sustained power dissipation according to method A

Note 1 to entry: Preferred values are 1,0 I_N or 1,25 I_N or 1,35 I_N or 1,5 I_N. 1,0 I_N is allowable only for nominal currents above 20 A.

3.7
I_{OVL} (B)
test current for measuring the maximum sustained power dissipation according to method B

Note 1 to entry: Preferred values are 1,0 I_N or 1,25 I_N.

4 General requirements

Clause 4 of IEC 60127-1:~~2006~~2023 applies.

5 Standard ratings

Replace Clause 5 of IEC 60127-1:~~2006~~2023 as follows:

The following ratings shall be agreed upon between the testing house and the manufacturer:

– rated voltage;
– rated current (see standard sheet 1 for preferred ratings);
– rated breaking capacity (AC and/or DC);
– time/current characteristic (at least at 2,0 I_N or 2,1 I_N and 10 I_N).

The following may be agreed upon on an optional basis:

– test at elevated temperature;
– time/current characteristic (additionally at 2,75 I_N and 4 I_N).

Any additional specified values are given in standard sheet 1. Guidance on ratings to be specified by the manufacturer or to be agreed upon with the testing house is given in Annex AA.

6 Marking

Clause 6 of IEC 60127-1:~~2006~~2023 applies except as follows.

6.1

~~*Replacement:*~~

~~d) Not applicable.~~

Replace a) of Subclause 6.1 as follows:

a) Not applicable.

NOTE A symbol denoting the time/current characteristic cannot be stated, because this part of IEC 60127 does not specify any values for this parameter.

Addition:

e) Type designation.

f) Rated breaking capacity in amperes (A) or in kilo amperes (kA).

6.2

Deletion of NOTE ~~2~~.

6.3

Addition after first paragraph:

Furthermore, the rated breaking capacity in amperes (A) or in kilo amperes (kA) shall be marked on the package label.

6.4

Addition of heading title and replacement of text:

6.4 Colour coding for miniature fuse-links for special applications

Marking of fuse-links by means of colour bands according to IEC 60127-1:~~2006~~2023, Annex A, is not permitted. It is, however, possible to use colour markings that clearly differ from this colour band system. In this case, the manufacturer shall provide the relevant information, for example colour key.

Additional subclause:

6.101 Where marking is impracticable due to space limitations, the relevant information should appear on the smallest package and in the manufacturer's technical literature.

7 General notes on tests

Clause 7 of IEC 60127-1:~~2006~~2023 applies except as follows.

7.~~2~~3 Type tests

7.~~2~~3.1

Replacement:

For testing the individual current ratings of fuses with AC or DC breaking capacity, the number of fuse-links required is 51, of which 12 are kept as spares. For fuse-links with wire terminations six extra samples (E1 to E6) have to be taken by random and not sorted according to voltage drop. If necessary, these samples can be used as additional spares after performing the tests according to 8.3.

The testing schedule is shown in ~~Table 2~~ Table 104.

For testing the individual current ratings of fuses with AC and DC breaking capacity, the number of fuse-links required is 63, of which 9 are kept as spares. For fuse-links with wire terminations six extra samples (E1 to E6) have to be taken by random and not sorted according to voltage drop. If necessary, these samples can be used as additional spares after performing the tests according to 8.3. The testing schedule is shown in ~~Table 3~~ Table 105.

For testing the maximum ~~ampere~~ current rating of a homogenous series with AC or DC breaking capacity the number of fuse-links required is 51, of which 22 are kept as spares. For fuse-links with wire terminations six extra samples (E1 to E6) have to be taken by random and not sorted according to voltage drop. If necessary, these samples can be used as additional spares after performing the tests according to 8.3.

The testing schedule is shown in ~~Table 4~~ Table 106.

For testing the maximum ~~ampere~~ current rating of a homogenous series with AC and DC breaking capacity the number of fuse-links required is 66, of which 32 are kept as spares. For fuse-links with wire terminations six extra samples (E1 to E6) have to be taken by random and not sorted according to voltage drop. If necessary, these samples can be used as additional spares after performing the tests according to 8.3.

The testing schedule is shown in ~~Table 5~~ Table 107.

For testing the minimum ~~ampere~~ current rating of a homogenous series with AC and/or DC breaking capacity the number of fuse-links required is 38, of which 16 are kept as spares.

The testing schedule is shown in ~~Table 6~~ Table 108.

For testing all of the intermediate ~~ampere~~ current rating of a homogenous series with AC and/or DC breaking capacity the number of fuse-links required is 38, of which 16 are kept as spares.

The testing schedule is shown in ~~Table 7~~ Table 109.

7.~~3~~4 Fuse-bases for tests

Addition after first paragraph:

For fuse-links designed for use in a special type of fuse-holder, testing shall be performed in that fuse-holder. Fuse-holder information shall be supplied to users in manufacturer's literature.

For tests that require a printed circuit board for mounting and connection of the fuse-links, a test board according to Figure 1 or Figure 2 shall be used.

The test board according to Figure 1 shall be used for fuse links with wire terminations intended for insertion in suitably designed holes or sockets.

The test board according to Figure 2 shall be used for surface mount fuse-links. The test board shall be made of epoxide woven glass fabric copper-clad laminated sheet, as defined in IEC 61249-2-7. The manufacturer must declare the PCB parameters and provide assembled PCBs for the tests.

This test board shall then be mounted on the test fuse-base (Figure 3 or Figure 4).

When two or more fuse-links are tested in series, the fuse-bases shall be located so that there will be a spacing of not less than 50 mm between any two fuse-links under testing. The conductor connecting the fuse-bases together and connecting the fuse-bases to the ammeter and the source of supply shall be insulated copper wire. The length of each conductor shall be 500 mm ~~and the cross-sectional area of the wire shall be approximately 1 mm^2 for fuse-links with rated currents up to and including 6,3 A, and 6 mm^2 for rated currents exceeding 6,3 A~~. The cross-sectional area of the wire shall be according to Table 101.

Table 101 – Cross-sections of conductors

Rated current A	Copper conductor cross sectional area mm^2
Up to and including 5	1
More than 5, and up to and including 10	1,5
More than 10, and up to and including 16	2,5
More than 16, and up to and including 25	4
More than 25, and up to and including 35	6
More than 35, and up to and including 60	35
More than 60, and up to and including 125	50

Dimensions in millimetres

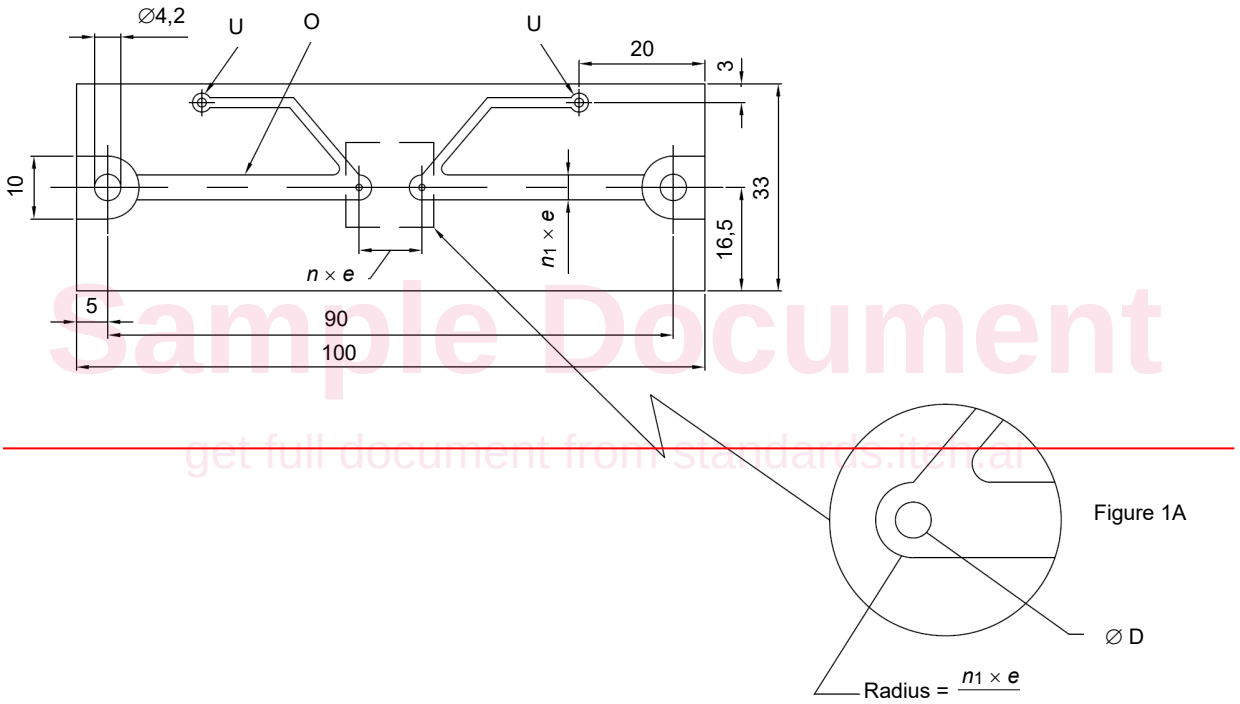


Figure 1A

~~**Key**~~

~~O copper layer; thickness 0,035 mm or 0,070 mm~~

~~U connection for voltage drop measurement~~

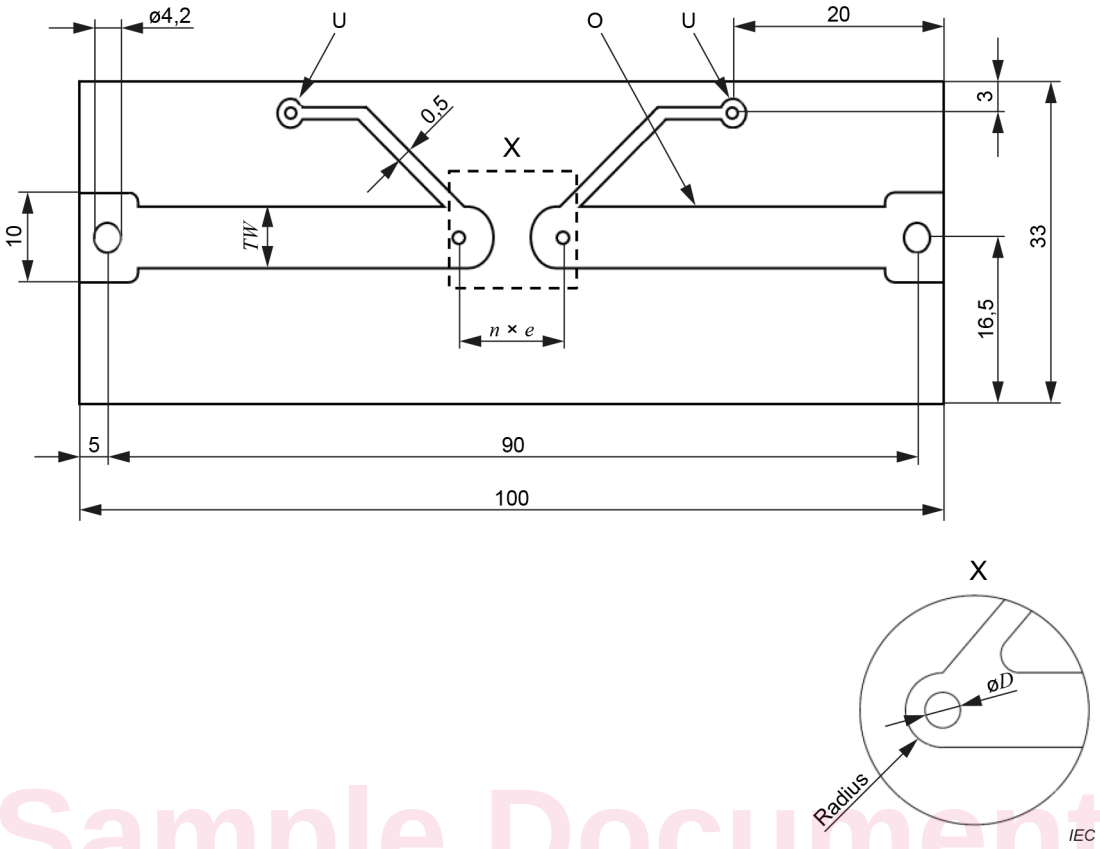
~~D diameter of 1 mm for rated currents up to and including 6,3 A;~~

~~diameter of 1,5 mm for rated currents exceeding 6,3 A.~~

~~*e* 2,5 mm~~

~~n_1 1, 2, 3, 4~~

~~*n* 1, 2, 3 … (to be adapted depending on the length of the fuse-link)~~



Key

O copper layer, refer to Table 102

U connection for voltage drop measurement

D can be any shape. Size shall be as specified by the manufacturer

e 2,5 mm

n 1, 2, 3 … (to be adapted depending on the length of the fuse-link)

TW Track width. 10 mm if TW less than or equal to 10 mm, Equal to TW if greater than 10 mm

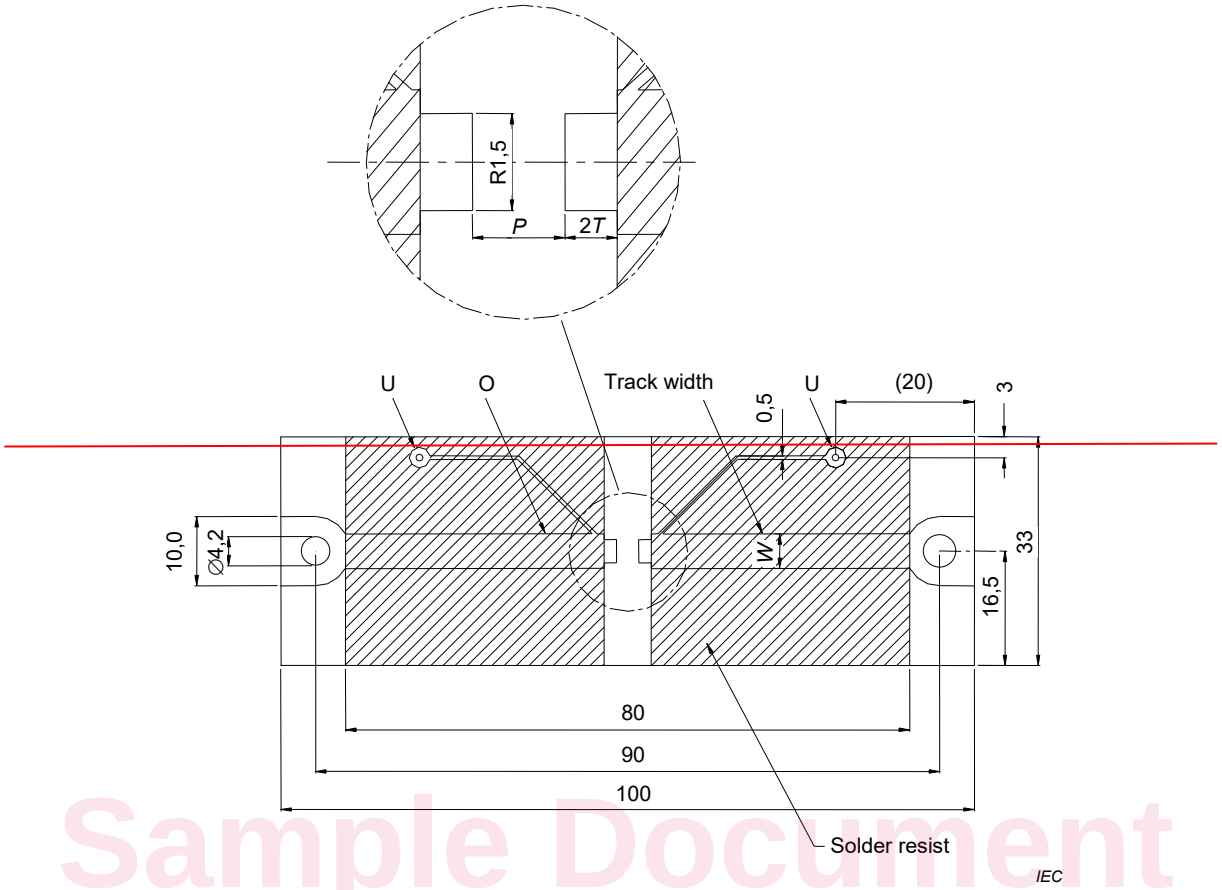
Radius only used for rounded through-hole shaped terminations. Size as specified by Manufacturer

Figure 1 – Standard test board for fuse-links with wire terminations

This test board shall be mounted on the fuse-base according to Figure 3a).

Figure 1 displays an example for through-hole (round terminations). Other termination types and shapes are acceptable.

Dimensions in millimetres



Key

O copper layer, thickness 0,035 mm or 0,070 mm

U connection for voltage drop measurement

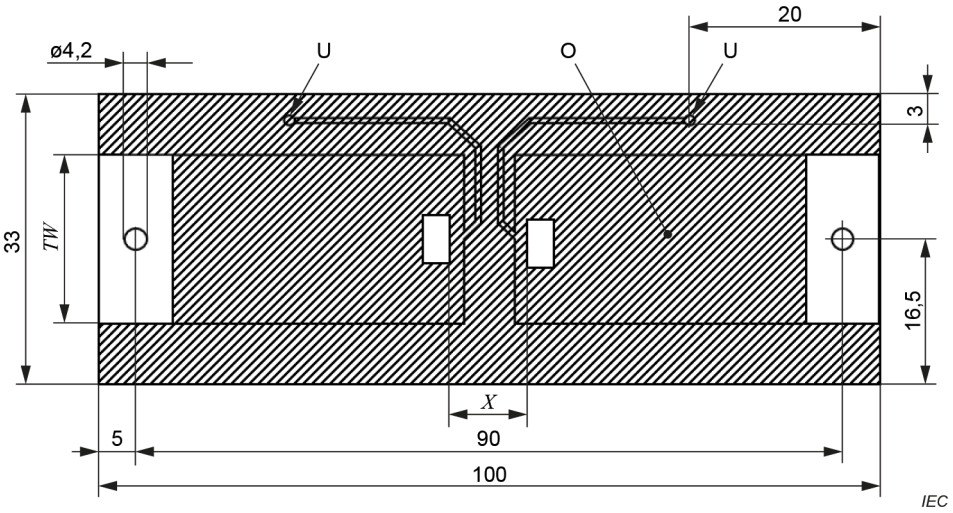
W tracking width equals n_1 x *e* referring to Figure 1. For small devices, it may be necessary to use reduced track widths, representing normal use of these devices. This should be recorded in the test report and in the manufacturer's literature.

P terminal spacing

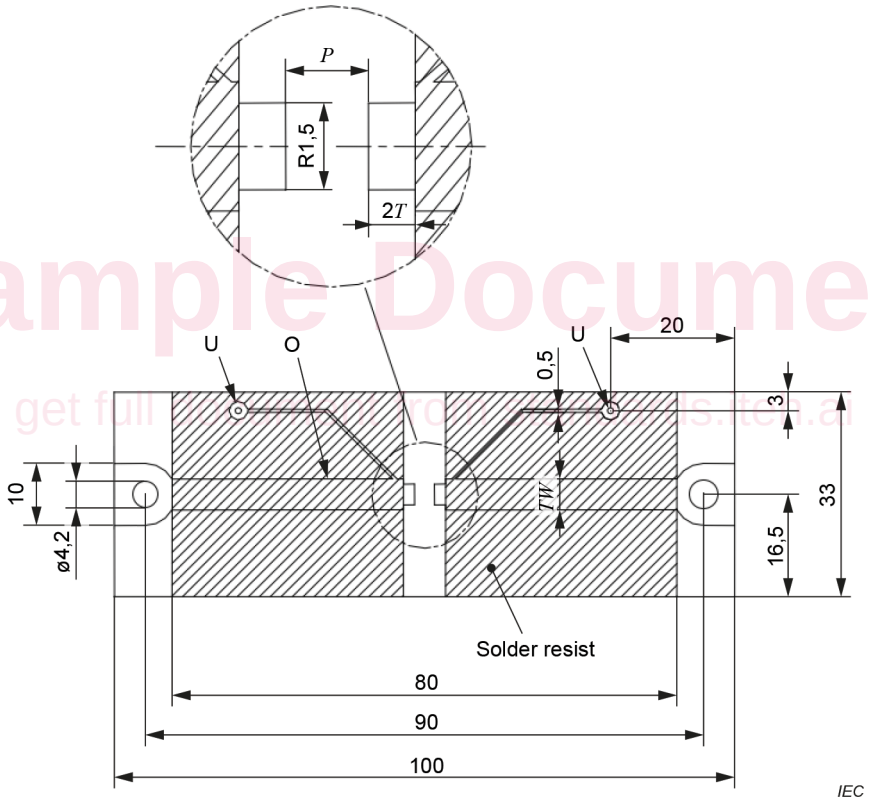
R refer to standard sheet 1, page 1

T refer to standard sheet 1, page 1

NOTE 1 Solder resist to be applied in hatched areas.



a) test board A



b) test board B