IEC 60352-6

Edition 2.0 2022-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Solderless connections –
Part 6: Insulation piercing connections – General requirements, test methods and practical guidance

Connexions sans soudure –
Partie 6: Connexions à percement d'isolant – Exigences générales, méthodes d'essai et guide pratique



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SOLDERLESS CONNECTIONS –

Part 6: Insulation piercing connections – General requirements, test methods and practical guidance

FOREWORD

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IEC 60352-6 has been prepared by subcommittee 48B: Electrical connectors, of IEC technical committee 48: Electrical connectors and mechanical structures for electrical and electronic equipment. It is an International Standard.

This second edition cancels and replaces the first edition published in 1997. This edition constitutes a technical revision.

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

a) axial load in 7.2.2 provided in a table in Annex A rather than as percentage of breaking load of the wire;
b) different approach to measure contact resistance provided in 7.3.2.3.

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

Draft	Report on voting
48B/3001/FDIS	48B/3009/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.

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/standardsdev/publications.

A list of all parts in the IEC 60352 series, published under the general title *Solderless connections*, can be found on the IEC website.

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- withdrawn,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

INTRODUCTION

This part of IEC 60352 applies to solderless connections made by insulation piercing (IP) and includes requirements, tests and practical guidance information for such connection technology.

Two test schedules are provided:

– a qualification test schedule that applies to insulation piercing connections which conform to all pre-requisites of Clause 5, which are derived from experience with successful applications of such insulation piercing connections;
– an application test schedule that applies to insulation piercing connections made with suitable IP termination which are integral part of a component and are already fulfilling the pre-requisites of Clause 5.

IEC Guide 109 advocates the need to minimize the impact of a product on the natural environment throughout the product life cycle. IEC 62430 provides principles, requirements and guidance to implement environmentally conscious design.

It is understood that some of the materials permitted in this document may have a negative environmental impact. As technological advances lead to acceptable alternatives to these materials, they will be eliminated from this document.

SOLDERLESS CONNECTIONS –

Part 6: Insulation piercing connections – General requirements, test methods and practical guidance

1 Scope

This part of IEC 60352 is applicable to insulation piercing connections made with stranded wires and tinsel wires, insulated flat conductors and flat flexible circuitries for use in electrical and electronic equipment.

Information on materials and data from industrial experience is included in addition to the test procedures to provide electrically stable connections under prescribed environmental conditions.

The object of this document is to:

– determine the suitability of insulation piercing connections under specified mechanical, electrical, and atmospheric conditions;
– provide a means of comparing test results when the tools used to make the connections, if any, are of different designs or manufacture.

There are different designs and materials for insulation piercing terminations in use. For this reason, only fundamental parameters of the termination, the performance requirements of the conductor and the complete connection are specified in this document.

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 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 60512-1:2018, *Connectors for electrical and electronic equipment – Tests and measurements – Part 1: Generic specification*

IEC 60512-1-1:2002, *Connectors for electronic equipment – Tests and measurements – Part 1-1: General examination – Test 1a: Visual examination*

IEC 60512-1-2:2002, *Connectors for electronic equipment – Tests and measurements – Part 1-2: General examination – Test 1b: Examination of dimension and mass*

IEC 60512-2-1:2002, *Connectors for electronic equipment – Tests and measurements – Part 2-1: Electrical continuity and contact resistance tests – Test 2a: Contact resistance – Millivolt level method*

IEC 60512-2-2:2003, *Connectors for electronic equipment – Tests and measurements – Part 2-2: Electrical continuity and contact resistance tests – Test 2b: Contact resistance – Specified test current method*

IEC 60512-2-5:2003, *Connectors for electronic equipment – Tests and measurements – Part 2-5: Electrical continuity and contact resistance tests – Test 2e: Contact disturbance*

IEC 60512-6-4:2002, *Connectors for electronic equipment – Tests and measurements – Part 6-4: Dynamic stress tests – Test 6d: Vibration (sinusoidal)*

IEC 60512-9-2:2011, *Connectors for electronic equipment – Tests and measurements – Part 9-2: Endurance tests – Test 9b: Electrical load and temperature*

IEC 60512-11-1:2019, *Connectors for electrical and electronic equipment – Tests and measurements – Part 11-1: Climatic tests – Test 11a - Climatic sequence*

IEC 60512-11-4:2002, *Connectors for electronic equipment – Tests and measurements – Part 11-4: Climatic tests – Test 11d: Rapid change of temperature*

IEC 60512-11-7:2003, *Connectors for electronic equipment – Tests and measurements – Part 11-7: Climatic tests – Test 11g: Flowing mixed gas corrosion test*

IEC 60512-11-9:2002, *Connectors for electronic equipment – Tests and measurements – Part 11-9: Climatic tests – Test 11i: Dry heat*

IEC 60512-11-10:2002, *Connectors for electronic equipment – Tests and measurements – Part 11-10: Climatic tests – Test 11j: Cold*

IEC 60512-11-12:2002, *Connectors for electronic equipment – Tests and measurements – Part 11-12: Climatic tests – Test 11m: Damp heat, cyclic*

IEC 60512-16-20:1996, *Electromechanical components for electronic equipment – Basic testing procedures and measuring methods – Part 16: Mechanical tests on contacts and terminations – Section 20: Test 16t: Mechanical strength (wired termination of solderless connections)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

3.1
conductor
part of the cable or wire intended to carry electric current

Note 1 to entry: The conductor may be

a) solid – made of a single strand of circular cross-section;

b) stranded – made of several strands of circular cross-section assembled either by laying up concentrically or by bunching, and without insulation between them.

Note 2 to entry: The properties of the copper are in accordance with IEC 60228.

[SOURCE: IEC 60189-1:2018, 3.1]

3.2
wire
insulated conductor or assembly of several insulated conductors, laid up together and which may be provided with a screen

Note 1 to entry: The wire may be

a) single – consists of a single insulated conductor;

b) multiple – consists of several insulated conductors.

[SOURCE: IEC 60189-1:2018, 3.2 modified by deleting "low frequency" in the title and the NOTE listing designations.]

3.3
insulation piercing (IP) connection
solderless connection made by metallic protruding elements, which pierce the insulation and are intended to provide contact with the conductor by deforming or penetrating it

[SOURCE: IEC 60050-581:2008, 581-23-34, modified by adding “(IP)” (as abbreviation) and deleting “(for electronic equipment)”.]

3.3.1
integrated insulation piercing (IP) termination for stranded wire or tinsel wire
insulation piercing termination which is integral part of a multipole connector, deemed to be used for IP connection with stranded wire or tinsel wire (see Figure 1).

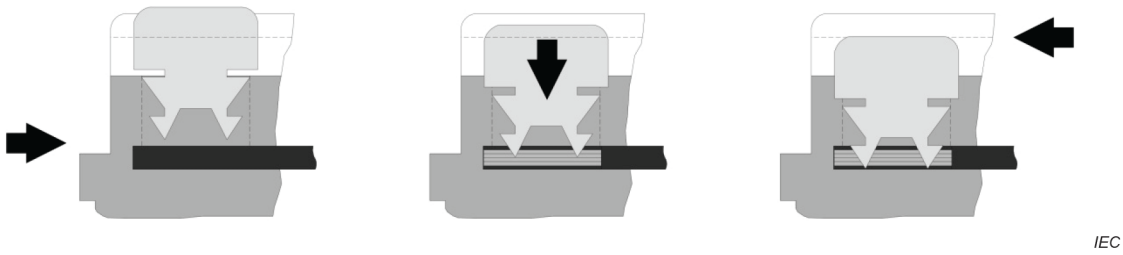


Figure 1 – Example of an integrated insulation piercing connection (one connection shown)

Note 1 to entry: Usually, all IP connections of a connector with integrated IP terminations are made in one step.

Note 2 to entry: An example for the application is the free connector according to IEC 60603-7.

3.3.2
insulation piercing connection with insulated flat conductor or flat flexible circuitry
insulation piercing connection formed by lances which pierce and penetrate the insulated flat conductor or flexible circuitry (see Figure 2)

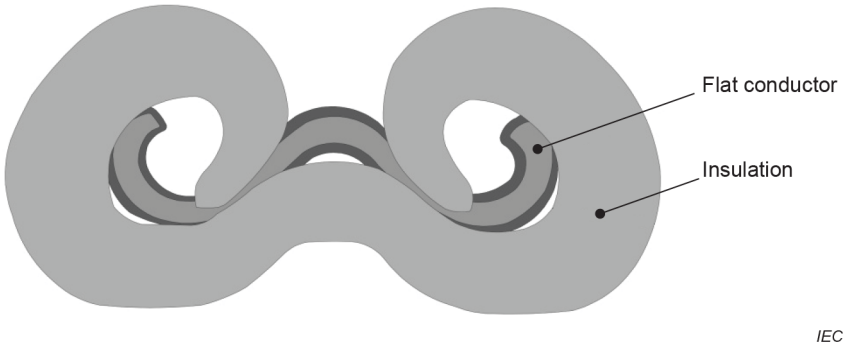


Figure 2 – Example of an insulation piercing connection with insulated flat conductor

3.3.3
insulation piercing barrel connection with stranded wire or tinsel wire
insulation piercing connection made by lances in a barrel which pierce the insulation, and make contact with the conductor strands (see Figure 3)



Figure 3 – Example of an insulation piercing connection in a barrel with stranded wires

3.4
insulation piercing termination
termination to accept different types of insulated conductors for the purpose of establishing an insulation piercing connection

[SOURCE: IEC 60050-581:2008, 581-23-54]

3.5
insulation piercing zone
portion of the contact designed and intended to effect the piercing of the insulation and provide contact with the conductor

[SOURCE: IEC 60050-581:2008, 581-23-44]

3.6
tinsel conductor
conductor comprising one or more elements stranded together, each element consisting of one or more thin metal tapes helically wound on, and supported by a textile thread

[SOURCE: IEC 60050-461:2008, 461-01-18]

3.7
tinsel wire
tinsel conductor jacketed with an insulating layer

4 Requirements

4.1 Workmanship

The manufacturer of insulation piercing connections or of a component using such connections shall provide an instruction for the assembly of insulation piercing connections.

The insulation piercing connections shall be processed in a careful and workmanlike manner, in accordance with good current practice.

Annex A (informative) provides practical guidance and may constitute a benchmark for the assessment of workmanship.

4.2 Tools

Tools shall be used and inspected according to the instructions given by the manufacturer(s) of the tool and/or the connector.

The tools shall be able to make uniformly reliable insulation piercing connections during their lifetime.

The tools shall be designed to operate in such a manner that unacceptable damage to the insulation piercing termination and/or conductors is avoided.

Hand tools shall be provided with a full cycle mechanism.

Automatic tools shall be provided with a full cycle mechanism or equivalent safeguard. Tools are evaluated by testing insulation piercing connections made with the tools to be evaluated.

5 Pre-requisites for the qualification test schedule

5.1 Insulation piercing terminations

5.1.1 Materials

– Metallic parts

  Suitable grades of copper or copper alloy such as copper-tin (bronze), copper-zinc (brass) or beryllium copper shall be used.

– Insulating parts

  For integrated insulation piercing connections according to 3.3.1 the component housing material shall be polycarbonate or similar plastic material.

  For insulation piercing barrel connections according to 3.3.3 the wire insulation shall be PVC or another material appropriate for this connecting technique.

5.1.2 Dimensions

The quality of an insulation piercing connection depends on the dimensions of the insulation piercing termination. The dimensions shall be suitable for stranded wires including tinsel wires, insulated flat conductors or flat flexible circuitries, as specified in 5.2.