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Solderless connections - Part 7: Spring clamp connections - General requirements, test methods and practical guidance

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Solderless connections - Part 7: Spring clamp connections - General requirements, test methods and practical guidance

FOREWORD

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IEC 60352-7 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 third edition cancels and replaces the second edition published in 2020. This edition constitutes a technical revision.

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

a) Addition of definition 3.6 contact pressure via insulating material CoPI;
b) Addition of definition 3.7 spring clamp connecting device with CoPI;
c) Addition of a dedicated test group for spring clamp connections made with spring clamp terminations, which achieve contact pressure through insulating material (CoPI), which shall be tested according to Annex B in Subclause 6.1;

d) Addition of test group “CoPI” in Clause 8;

e) Addition of Annex B to detail tests for resiliency in metallic parts to compensate for any shrinkage or yielding of insulating material with regards to contact pressure transmitted through the insulating material (CoPI), referenced in the “Test group CoPI” added in both test schedules.

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

Draft	Report on voting
48B/3177/FDIS	48B/3186/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/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, or

– revised.

INTRODUCTION

This part of IEC 60352 covers spring clamp connections and includes requirements, tests and practical guidance information.

Two test schedules are provided.

a) The basic test schedule applies to spring clamp connections which conform to all requirements of Clause 5. These requirements are derived from experience with successful applications of such spring clamp connections.
b) The full test schedule applies to spring clamp connections which do not fully conform to all requirements of Clause 5, for example which are manufactured using materials or finishes not included in Clause 5.

This approach ensures cost and time effective performance verification using a limited basic test schedule for established spring clamp connections and an expanded full test schedule for spring clamp connections requiring more extensive performance validation.

In this third edition, a dedicated test group providing requirements and tests for spring clamp connections with contact pressure transmitted via insulating material (CoPI) has been added in both test schedules, referring to the new Annex B (normative). In such instance, this provides means to fulfil both the requirement of 6.6.3 of IEC 61984:2008 concerning the design of electrical connections of connectors, and the requirement of 8.2 of IEC 60999-1:1999 concerning the design of clamping units connecting devices.

The values given in this document are minimum values, which are harmonized with other IEC documents. Other standards or the manufacturer's specification can specify other values.

The test procedure for resiliency in metallic parts to compensate for any shrinkage or yielding of insulating material with regards to contact pressure transmitted via insulating material (CoPI) has been derived from IEC 60947-7-4:2019.

1 Scope

This part of IEC 60352 is applicable to spring clamp connections made with stripped wire of the following types and sizes according to IEC 60228 or IEC 60189-3, without further preparation (later described “unprepared”):

– solid conductors (e.g. class 1 of IEC 60228) of 0,32 mm to 3,7 mm nominal diameter (0,08 mm^2 to 10 mm^2 cross-section), or

– stranded conductors (e.g. class 2 of IEC 60228) of 0,08 mm^2 to 10 mm^2 cross-section, or

– flexible conductors (e.g. class 5 or 6 of IEC 60228) of 0,08 mm^2 to 10 mm^2 cross-section,

for use in electrical and electronic equipment and components.

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 spring clamp connections under specified mechanical, electrical and atmospheric conditions.

NOTE IEC Guide 109 advocates the need to minimize the impact of a product on the natural environment throughout the product life cycle. It is understood that some of the materials permitted in this document can have a negative environmental impact. As technological advances lead to acceptable alternatives for these materials, they will be eliminated from 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 60050-581, *International Electrotechnical Vocabulary (IEV) - Part 581: Electromechanical components for electronic equipment*

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

IEC 60189-3, *Low-frequency cables and wires with PVC insulation and PVC sheath - Part 3: Equipment wires with solid or stranded conductor, PVC insulated, in singles, pairs and triples*

IEC 60228, *Conductors of insulated cables*

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

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

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

IEC 60512-2-1, *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, *Connectors for electronic equipment - Tests and measurements - Part 2-5: Electrical continuity and contact resistance tests - Test 2e: Contact disturbance*

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

IEC 60512-9-5, *Connectors for electrical and electronic equipment - Tests and measurements - Part 9-5: Endurance tests - Test 9e: Current loading, cyclic*

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

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

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

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

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

IEC 60512-16-20, *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 terms and definitions given in IEC 60050-581, IEC 60512-1 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
spring clamp termination
part of the contact or terminal to which one single conductor only is connected by means of a spring

3.1.1
universal spring clamp termination
spring clamp termination intended to accept solid, stranded and flexible unprepared conductors

Note 1 to entry: For the meaning of solid, stranded and flexible, see IEC 60228 where conductors are classified as class 1 (solid conductors), class 2 (stranded conductors), class 5 (flexible conductors) and class 6 (flexible conductors which are more flexible than class 5).

3.1.2
non-universal spring clamp termination
spring clamp termination intended to accept conductors of one class only, for example solid conductors only, or conductors of two classes only, for example solid and stranded but not flexible

Note 1 to entry: For the meaning of solid, stranded and flexible, see IEC 60228 where conductors are classified as class 1 (solid conductors), class 2 (stranded conductors), class 5 (flexible conductors) and class 6 (flexible conductors which are more flexible than class 5).

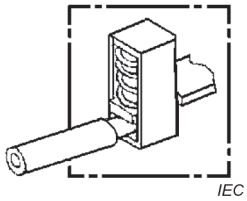
3.1.3
push-in spring clamp termination
spring clamp termination in which the connection is made by pushing in a solid or stranded conductor without the aid of a tool or of an actuating element

Note 1 to entry: For the meaning of solid and stranded, see IEC 60228 where solid conductors are classified as class 1, stranded conductors are classified as class 2.

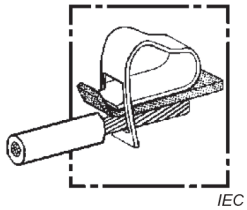
Note 2 to entry: Flexible conductor ends can become solid by e.g. ultrasonic welding according to IEC 60352-9.

3.2
spring clamp connection
solderless connection achieved by clamping a conductor with a spring clamp termination

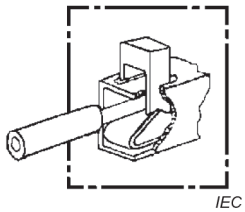
Note 1 to entry: See Figure 1.



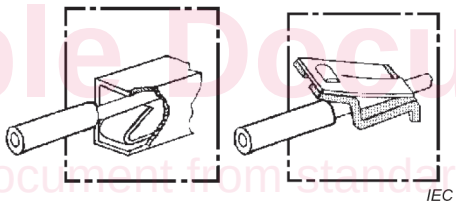
a) Spring clamp connection, operated without a tool



b) Spring clamp connection, operated with a tool



c) Spring clamp connection, operated with an actuating element



d) Spring clamp connections, with a push-in spring clamp termination, with solid wires

Figure 1 – Examples of spring clamp connections

3.3
spring clamp terminal
terminal designed to accept a conductor for the purpose of establishing a spring clamp connection

Note 1 to entry: See Figure 2.