



**NSAI**  
Standards

Irish Standard  
I.S. EN IEC 60512-9-5:2020

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

**I.S. EN IEC 60512-9-5:2020**

*Incorporating amendments/corrigenda/National Annexes issued since publication:*

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## National Foreword

I.S. EN IEC 60512-9-5:2020 is the adopted Irish version of the European Document EN IEC 60512-9-5:2020, Connectors for electrical and electronic equipment - Tests and measurements - Part 9-5: Endurance tests - Test 9e: Current loading, cyclic

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN IEC 60512-9-5**

July 2020

ICS 31.220.01

Supersedes EN 60512-9-5:2010 and all of its  
amendments and corrigenda (if any)

English Version

**Connectors for electrical and electronic equipment - Tests and  
measurements - Part 9-5: Endurance tests - Test 9e: Current  
loading, cyclic  
(IEC 60512-9-5:2020)**

Connecteurs pour équipements électriques et électroniques  
- Essais et mesures - Partie 9-5: Essais d'endurance -  
Essai 9e: Charge en courant, essai cyclique  
(IEC 60512-9-5:2020)

Steckverbinder für elektrische und elektronische  
Einrichtungen - Mess- und Prüfverfahren - Teil 9-5:  
Dauerprüfungen - Prüfung 9e: Strombelastung, zyklisch  
(IEC 60512-9-5:2020)

This European Standard was approved by CENELEC on 2020-07-14. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

**EN IEC 60512-9-5:2020 (E)****European foreword**

The text of document 48B/2803/FDIS, future edition 2 of IEC 60512-9-5, prepared by SC 48B "Electrical connectors" of IEC/TC 48 "Electrical connectors and mechanical structures for electrical and electronic equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60512-9-5:2020.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2021-04-14
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2023-07-14

This document supersedes EN 60512-9-5:2010 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

**Endorsement notice**

The text of the International Standard IEC 60512-9-5:2020 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

|                        |      |  |
|------------------------|------|--|
| IEC 60352-1:1997       | NOTE | Harmonized as EN 60352-1:1997 (not modified)       |
| IEC 60352-2:2006       | NOTE | Harmonized as EN 60352-2:2006 (not modified)       |
| IEC 60352-3:1993       | NOTE | Harmonized as EN 60352-3:1994 (not modified)       |
| IEC 60352-4:1994       | NOTE | Harmonized as EN 60352-4:1994 (not modified)       |
| IEC 60352-5:2012       | NOTE | Harmonized as EN 60352-5:2012 (not modified)       |
| IEC 60352-6:1997       | NOTE | Harmonized as EN 60352-6:1997 (not modified)       |
| IEC 60352-7:2002       | NOTE | Harmonized as EN 60352-7:2002 (not modified)       |
| IEC 60352-8:2011       | NOTE | Harmonized as EN 60352-8:2011 (not modified)       |
| IEC 60512-14-2:2006    | NOTE | Harmonized as EN 60512-14-2:2006 (not modified)    |
| IEC 60512-14-4:2006    | NOTE | Harmonized as EN 60512-14-4:2006 (not modified)    |
| IEC 60512-14-5:2006    | NOTE | Harmonized as EN 60512-14-5:2006 (not modified)    |
| IEC 60512-14-6:2006    | NOTE | Harmonized as EN 60512-14-6:2006 (not modified)    |
| IEC 60512-14-7:1997    | NOTE | Harmonized as EN 60512-14-7:1998 (not modified)    |
| IEC 60529:1989         | NOTE | Harmonized as EN 60529:1991 (not modified)         |
| IEC 60529:1989/A1:1999 | NOTE | Harmonized as EN 60529:1991/A1:2000 (not modified) |
| IEC 60529:1989/A2:2013 | NOTE | Harmonized as EN 60529:1991/A2:2013 (not modified) |

## Annex ZA

### (normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu).

| <u>Publication</u> | <u>Year</u> | <u>Title</u>  | <u>EN/HD</u>   | <u>Year</u> |
|--------------------|-------------|---|----------------|-------------|
| IEC 60352          | series      | Solderless connections  | EN 60352       | series      |
| IEC 60512-1        | 2018        | Connectors for electrical and electronic equipment - Tests and measurements - Part 1: Generic specification   | EN IEC 60512-1 | 2018        |
| IEC 60512-1-1      | -           | Connectors for electronic equipment - Tests and measurements - Part 1-1: General examination - Test 1a: Visual examination  | EN 60512-1-1   | -           |
| 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        | EN 60512-2-1   | -           |
| IEC 60512-2-2      | -           | Connectors for electronic equipment - Tests and measurements - Part 2-2: Electrical continuity and contact resistance tests - Test 2b: Contact resistance - Specified test current method | EN 60512-2-2   | -           |
| IEC 60512-2-6      | -           | Connectors for electronic equipment - Tests and measurements - Part 2-6: Electrical continuity and contact resistance tests - Test 2f: Housing (shell) electrical continuity              | EN 60512-2-6   | -           |
| IEC 60512-3-1      | -           | Connectors for electronic equipment - Tests and measurements - Part 3-1: Insulation tests - Test 3a: Insulation resistance  | EN 60512-3-1   | -           |
| IEC 60512-4-1      | -           | Connectors for electronic equipment - Tests and measurements - Part 4-1: Voltage stress tests - Test 4a: Voltage proof  | EN 60512-4-1   | -           |

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**IEC 60512-9-5**

Edition 2.0 2020-06

# **INTERNATIONAL STANDARD**

## **NORME INTERNATIONALE**

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

**Connecteurs pour équipements électriques et électroniques –  
Essais et mesures –  
Partie 9-5: Essais d'endurance – Essai 9e: Charge en courant, essai cyclique**



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**IEC 60512-9-5**

Edition 2.0 2020-06

# **INTERNATIONAL STANDARD**

## **NORME INTERNATIONALE**

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

**Connecteurs pour équipements électriques et électroniques –  
Essais et mesures –  
Partie 9-5: Essais d'endurance – Essai 9e: Charge en courant, essai cyclique**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### CONNECTORS FOR ELECTRICAL AND ELECTRONIC EQUIPMENT – TESTS AND MEASUREMENTS –

#### Part 9-5: Endurance tests – Test 9e: Current loading, cyclic

#### FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). 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. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60512-9-5 has been prepared by subcommittee 48B: Electrical connectors, of IEC technical committee 48: Electrical connectors and mechanical structures for electrical and electronic equipment.

This second edition cancels and replaces the first edition published in 2010. This edition constitutes a technical revision.

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

- added method B and renamed the former test method as method A, to provide an alternative with more adjustable time “ON” and “OFF” for products with larger thermal mass;
- added introduction to provide background of this revision;

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

| FDIS          | Report on voting |
|---------------|------------------|
| 48B/2803/FDIS | 48B/2819/RVD     |

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60512 series, published under the general title *Connectors for electrical and electronic equipment – Tests and measurements*, 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 "<http://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

The object of this document is to detail a standard method for subjecting solderless connections to a thermal stress conditioning by cyclic current loading, in order to verify the right combination of conductor material, termination material and tool application – if any is required, in view of any possible creep phenomena that might lead to a reduction of performance of the solderless connection.

Although requiring electric power to apply the specified current loading, this test is an endurance test by thermal conditioning, whose aim is to submit specimens of connectors using solderless connections or of solderless connections to a repeated cycling between ambient temperature (normal laboratory conditions) and the upper limiting temperature (ULT) specified for the connector or solderless connection, either by the detail product specification or the manufacturer specification, or by the default values provided in the relevant part of IEC 60352 series.

The way the solderless connection under test acts is affected both by the solderless termination design and material and the attached conductor size and material, as well as by any tool applied to produce the connection, with all relevant settings and accessories as specified for the particular combination of termination and conductor.

Time “ON” represents the “heating” interval necessary to reach the ULT from ambient temperature, time “OFF” represents the “cooling” interval, necessary to cool down the specimen to ambient temperature. The sum of these intervals represents a cycle. Due to the various nature of a solderless connection in terms of size and thermal inertia of the termination and of the attached conductor, the traditional method with fixed duty cycle duration it is not always suitable.

For this reason, two methods are now provided to perform this test:

- method A is the traditional one, with time “ON” of 45 min and time “OFF” of 15 min, that has proven suitable for small-sized solderless connections, e.g. connections employing conductors with cross-sectional area less than or equal to 10 mm<sup>2</sup>. However, even in such cases, depending on the thermal mass of the termination or the conductor (e.g. for a crimped connection), method B may be preferable;
- method B is with time “ON” or time “OFF” to be determined experimentally by the first test cycle. Moreover, heating time by current load may be even abbreviated by increasing and controlling the current load, whereas cooling may be accelerated too, by forced air cooling. Because the number of repeated cycles is the primary factor affecting the severity of this test, long duration times at ULT (highest temperature) and ambient temperature (lowest temperature) may not be necessary for the purpose of this test. This method is suitable for large-sized solderless connections, e.g. connections employing conductors with cross-sectional area larger than 10 mm<sup>2</sup>.

## **CONNECTORS FOR ELECTRICAL AND ELECTRONIC EQUIPMENT – TESTS AND MEASUREMENTS –**

### **Part 9-5: Endurance tests – Test 9e: Current loading, cyclic**

#### **1 Scope**

This part of IEC 60512, when required by the detail product specification, is used for testing connectors or solderless connections within the scope of technical committee 48. It may also be used for similar devices when specified in a detail product specification.

The object of this document is to detail a standard method for subjecting solderless connections to thermal stress conditioning by cyclic current loading.

#### **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 60352 (all parts), *Solderless connections*

IEC 60512-1:2018, *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 60512-2-1, *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, *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 60512-2-6, *Connectors for electronic equipment – Tests and measurements – Part 2-6: Electrical continuity and contact resistance tests – Test 2f: Housing (shell) electrical continuity*

IEC 60512-3-1, *Connectors for electronic equipment – Tests and measurements – Part 3-1: Insulation tests – Test 3a: Insulation resistance*

IEC 60512-4-1, *Connectors for electronic equipment – Tests and measurements – Part 4-1: Voltage stress tests – Test 4a: Voltage proof*

#### **3 Terms and definitions**

For the purposes of this document, the terms and definitions given in IEC 60512-1 apply.

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



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