



SLOVENSKI STANDARD
oSIST prEN IEC 60512-99-003:2023
01-januar-2023

**Konektorji za električno in elektronsko opremo - Preskusi in meritve - 99-003. del:
Časovni načrt preskušanja vzdržljivosti - Preskus 99c: Načrt preskušanja za
uravnotežene konektorje z enim parom za nenamerni izklop pri električni
obremenitvi**

Connectors for electrical and electronic equipment - Tests and measurements - Part 99-003: Endurance test schedules - Test 99c: Test schedule for balanced single-pair connectors unmating under electrical load

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Connecteurs pour équipements électriques et électroniques - Essais et mesures - Partie 99-003: Programmes d'essais d'endurance - Essai 99c: Programme d'essai des connecteurs à une seule paire symétrique lors du désaccouplement sous charge électrique

Ta slovenski standard je istoveten z: prEN IEC 60512-99-003:2022

ICS:

31.220.10 Vtiči in vtičnice, konektorji Plug-and-socket devices.
Connectors

oSIST prEN IEC 60512-99-003:2023 en



48B/3002/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER:
IEC 60512-99-003 ED1

DATE OF CIRCULATION:
2022-11-11

CLOSING DATE FOR VOTING:
2023-02-03

SUPERSEDES DOCUMENTS:
48B/2963/CD, 48B/2987/CC

IEC SC 48B : ELECTRICAL CONNECTORS	
SECRETARIAT: United States of America	SECRETARY: Mr Jeffrey Toran
OF INTEREST TO THE FOLLOWING COMMITTEES: SC 65C, ISO/IEC JTC 1/SC 25	PROPOSED HORIZONTAL STANDARD: <input type="checkbox"/> Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: <input type="checkbox"/> EMC <input type="checkbox"/> ENVIRONMENT <input type="checkbox"/> QUALITY ASSURANCE <input type="checkbox"/> SAFETY	
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TITLE:

Connectors for electrical and electronic equipment – Tests and measurements – Part 99-003: Endurance test schedules – Test 99c: Test schedule for balanced single-pair connectors unmating under electrical load

PROPOSED STABILITY DATE: 2025

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CONNECTORS FOR ELECTRICAL AND ELECTRONIC EQUIPMENT –
TESTS AND MEASUREMENTS –****Part 99-003: Endurance test schedules – Test 99c: Test schedule for
balanced single-pair connectors unmating under electrical load**

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IEC 60512-99-003 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.

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

Draft	Report on voting
48B/XX/FDIS	48B/XX/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.

94 A list of all parts in the IEC 60512 series, published under the general title *Connectors for*
95 *electrical and electronic equipment – Tests and measurements*, can be found on the IEC
96 website.

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

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

- 104 • reconfirmed,
- 105 • withdrawn,
- 106 • replaced by a revised edition, or
- 107 • amended.

108

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CONNECTORS FOR ELECTRICAL AND ELECTRONIC EQUIPMENT – TESTS AND MEASUREMENTS –

Part 99-003: Endurance test schedules – Test 99c: Test schedule for balanced single-pair connectors unmating under electrical load

1 Scope

This part of IEC 60512 is used for the assessment of connectors within the scope of SC 48B that are used in balanced single-pair communication cabling with remote power, in support of e.g., IEEE 802.3 remote powering applications for point-to-point connections. This standard does not cover multidrop powering applications.

The object of this document is to detail a test schedule to determine the ability of single-pair connectors as defined in the IEC 63171 series to withstand a minimum of 100 mechanical operations with electrical load, where an electrical current is being passed through the connector in accordance with IEC 60512-9-3 during the separation (unmating) step.

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 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 60512-3-1, *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*

IEC 60512-9-3:2011, *Connectors for electronic equipment - Tests and measurements - Part 9-3: Endurance tests - Test 9c: Mechanical operation (engaging and separating) with electrical load*

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

IEC 63171, *Connectors for electrical and electronic equipment - Shielded or unshielded free and fixed connectors for balanced single-pair data transmission with current-carrying capacity - General requirements and tests*

3 Terms, definitions and acronyms

For the purposes of this document, the terms and definitions of IEC 60050-581, IEC 60512-1, and IEC 63171, and the following apply.

151 ISO and IEC maintain terminology databases for use in standardisation at the following
152 addresses:

- 153 • IEC Electropedia: available at <https://www.electropedia.org/>
- 154 • ISO Online browsing platform: available at <https://www.iso.org/obp>

155 Additionally, the following acronyms apply:

156

Table 1 – Acronyms

Acronym	Explanation
PoDL	Power over Data Line
PSE	Power Source Equipment
PI	Power Injector
PD	Powered Device

157 **4 General**

158 An application-specific current and the associated open circuit voltage are specified, that
159 correspond with the current and voltage of the supported application. This test schedule is
160 suitable for verification of unmating of connectors under load conditions representative for
161 remote powering applications, (for example, as defined in IEEE 802.3). Although unmating
162 connectors while used for remote powering is a misuse of the connector, it may occur in
163 practice.

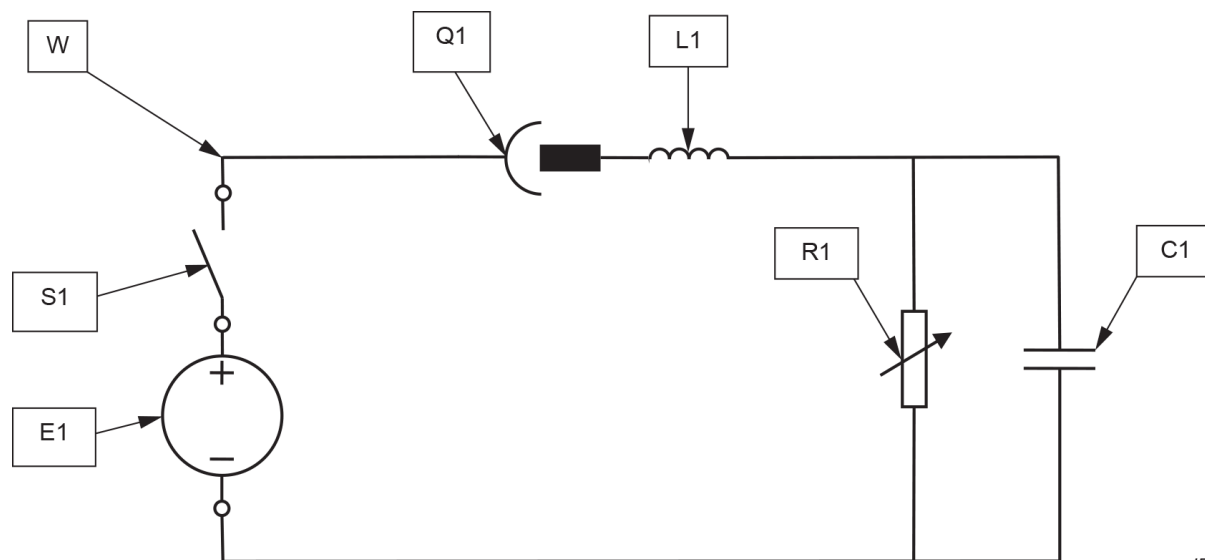
164 **5 Preparation of specimens**

165 The specimen shall consist of a mated connector pair with its terminations. Specimens shall
166 conform to the relevant IEC connector standard. The free connector shall be terminated with 3
167 m (max.) of the maximum conductor size cable for which it is intended to be terminated,
168 according to the appropriate IEC standard(s). Fixed connectors may alternatively be terminated
169 using a printed circuit board which shall not influence the test results.

170 **6 Test circuit requirements**

171 **6.1 General**

172 The values for the circuit components and the details of the test circuit shall be as shown in Figure 1.
173 The elements and the simplification of the test circuit are discussed in Annex B. Annex C (informative)
174 provides further insight of the development of the test circuit.



175

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176 **Key**

177	W	Cables in accordance with Clause 5
178	Q1	Specimen under test
179	L1	Inductor, $L = 1,88 \mu\text{H}$
180	R1	Variable resistive load (e.g., $R = 20 \Omega$ to 50Ω)
181	C1	Capacitor, $C = 100 \mu\text{F}$
182	E1	Voltage source (see 6.2)
183	S1	Switch (to mate without voltage on Q1)

184

Figure 1 – Test circuit diagram for one pole

185 A variable resistive load shall be used to adjust the current to the value specified in 6.2. Figure
 186 1 shows the circuit for one pole. Testing of the 2-pole connector required for balanced single-
 187 pair communication with remote powering requires therefore an identical circuit for the second
 188 pole.

189 **6.2 Voltage and current**

190 The variable resistive load in Figure 2 shall be set that the electrical current in the circuit (mated contact)
 191 of the specimen is according to Table 2.

192 During the separation (unmating) step, the open circuit voltage, shall be as given in Table 1 (test
 193 voltage). During the engagement (mating) step, the open circuit voltage shall be 0 V DC by operating
 194 the switch before each connector engagement (mating). The test current has to be set to the values
 195 according to Table 2.

196

Table 2 – Remote Powering test requirements

Test Voltage	Test current
$48 \text{ }_0^{+1} \text{V DC}$	$1,6 \text{ }_0^{+0,05} \text{A}$

197 As the variable resistive load is likely to rise due to heating and due to wear of contacts in the
 198 connector under test, care should be placed in keeping the value of test current within the
 199 specified tolerance range e.g., by means of a suitable feedback control circuit acting on the
 200 value of the variable resistor, see Annex A and Annex B for further guidance.

201 **6.3 Auxiliary equipment**

202 Switches may be used to reverse polarity. However, use of such switches shall not influence
 203 the test parameters.

204 **7 Test methods**205 **7.1 Mechanical operations with electrical load**

206 An electrical load, current and voltage, as detailed in Table 2 of 6.2, shall be applied to the
207 (mated) specimen. For the purpose of this test, one connector shall be fixed and the other
208 separated at a speed of 150 mm/s \pm 10 mm/s.

209 One engagement and one separation constitute one cycle. The test shall be performed
210 according to test 9c of IEC 60512-9-3, but the current shall be applied during the separation
211 step (unmating) only.

212 25 cycles at one polarity of the DC source shall be performed. The polarity of the DC source
213 shall then be reversed and 25 further cycles at the other polarity shall be performed (50 cycles
214 in total).

215 **7.2 Flowing mixed gas corrosion**

216 A flowing mixed gas corrosion test shall be performed according to test 11g of IEC 60512-11-
217 7, method 1, with a test duration of 4 days. During the test, half of the specimens shall be mated
218 and the other half unmated.

219 **8 Test and test schedule – Test group UEL 1**

220 A minimum of 8 specimens shall be prepared for this group; then tested according to Table 3.

221 **Table 3 – Test group UEL 1**

Test Phase	Test			Measurement to be performed		
	Title	IEC 60512 Part No (Test No.)	Severity or condition of test	Title	IEC 60512 Part No (Test No.)	Requirements
UEL 1.1	General examination			Visual examination	1-1 (1a)	There shall be no defects that would impair normal operation
UEL 1.2				Contact resistance- Millivolt level method	2-1 (2a)	As specified in the relevant connector Standard
UEL 1.3			100 V DC Method A Mated connectors	Insulation resistance	3-1 (3a)	500 M Ω minimum
UEL 1.4			Contact to contact 1 000 V DC or 1 000V AC peak All signal contacts to shield and test panel, as applicable 1 500 V DC or 1 500V AC peak Method A Mated connectors	Voltage proof	4-1 (4a)	There shall be no breakdown or flashover