
**Road vehicles — Four-pole electrical
connectors with pins and twist lock —
Part 2:
Tests and requirements**

*Véhicules routiers — Connecteurs électriques à quatre contacts avec
broches et verrouillage direct —
Partie 2: Essais et exigences*

[ISO 15170-2:2001](https://standards.iteh.ai/catalog/standards/sist/b869ff43-1e06-46a0-8540-e542891b742e/iso-15170-2-2001)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 15170 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15170-2 was prepared by Technical Committee ISO/TC 22, *Motor vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

ISO 15170 consists of the following parts, under the general title *Road vehicles — Four-pole electrical connectors with pins and twist lock*:

— *Part 1: Dimensions and classes of application* [ISO 15170-2:2001](#)

— *Part 2: Tests and requirements* <https://standards.iteh.ai/catalog/standards/sist/b869ff43-1e06-46a0-8540-e542891b742e/iso-15170-2-2001>

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Road vehicles — Four-pole electrical connectors with pins and twist lock —

Part 2: Tests and requirements

1 Scope

This part of ISO 15170 specifies tests and requirements for electrical connectors and connections with up to four poles and twist lock coupling.

This type of connection is intended for electrical connections in truck, bus and trailer applications (e.g. for components directly mounted on the engine).

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15170. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15170 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 1817:1999, *Rubber, vulcanized — Determination of the effect of liquid*

ISO 4925:1978, *Road vehicles — Non-petroleum base brake fluid*

ISO 6988:1985, *Metallic and other non organic coatings — Sulphur dioxide test with general condensation of moisture*

ISO 7309:1985, *Road vehicles — Hydraulic braking systems — ISO reference petroleum base fluid*

ISO 8092-2:2000¹⁾, *Road vehicles — Connections for on-board electrical wiring harnesses — Part 2: Definitions, test methods and general performance requirements*

ISO 9227:1990, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 15170-1:2001, *Road vehicles — Four-pole electrical connectors with pins and twist lock — Part 1: Dimensions and classes of application*

IEC 60068-2-68:1994, *Environmental testing — Part 2: Tests — Test L: Dust and sand*

IEC 60068-2-75:1997, *Environmental testing — Part 2: Tests — Test Eh: Hammer tests*

1) Corrected and reprinted: 2001.

ISO 15170-2:2001(E)

SAE J311, *Fluid for passenger car type automatic transmissions*

ASTM D975, *Standard specification for diesel fuel oils*

3 General

3.1 Application

The tests and requirements are applicable to

- fixed or free connectors of the device,
- free coupler connectors,
- connectors at the device coupled with the compatible free coupler connector,
- connections fitted with cables as specified or, for fixed connectors, after mounting.

3.2 General requirements

Unless specific requirements allow it, the test samples shall show no changes that could unduly influence their functioning. Cracks shall not be permitted.

3.3 Test conditions and preconditioning

Precondition all test samples for 24 h at $(23 \pm 5)^\circ\text{C}$ and 45 % to 75 % relative humidity (RH) before starting any test sequence.

All tests shall be carried out at an ambient temperature of $(23 \pm 5)^\circ\text{C}$, unless otherwise stated.

Care shall be taken that test samples do not influence each other (e.g. in a heat chamber).

Each test sequence (see Table 1) shall be started with unused, clean and dry test samples manufactured to conform to the dimensions specified in ISO 15170-1.

During the entire test sequence, no lubrication or other additional means on the contact surface shall be used to obtain better test results. Production-related remains of lubricants on the contacts may be ignored.

3.4 Classes of application

With regard to practical working conditions, the classes of application specified in Table 1 of ISO 15170-1:2001 shall be applied.

3.5 Test samples and test sequences

The tests shall be carried out with the sample groups as given in Table 1, in a top-to-bottom sequence, starting with unused samples and with certain tests carried out one after the other without pause (see footnote to Table 1).

The minimum number of test samples in a group shall be

- 10 samples where two contacts are fitted,
- 7 samples where three contacts are fitted, and
- 5 samples where four contacts are fitted.

Table 1 — Test sample groups and test sequences

Tests and requirements according to subclause	Test designation	Test sample group											
		A	B	C	D	E	F	G	H	J	K	L	
4.1	Visual examination	X	X	X	X	X	X	X	X	X	X	X	X
5.2	Connection resistance			X								X	
4.2	Contact retention in housing	X											
4.3	Tensile strength of the conductor attachments to the contacts		X										
4.4	Operating torque for the twist lock			X									X
4.5	Static load resistance of the coupled connection												X
4.6	Static load resistance of the free connector				X								
6.7	Dust		X	X									
6.8	Protection against ingress of water		X	X									
5.3	Withstand voltage			X				X	X	X	X	X	X
5.4	Insulation resistance			X				X	X	X	X	X	X
6.5	Temperature cycling			X								X	
4.7	Vibrations			X									
4.8	Resistance to impact					X							
5.1	Temperature rise						X						
6.3	Industrial climate								X ^a				
6.4	Temperature/humidity cycling									X ^a	X		
6.2	Salt spray							X ^a				X	
6.5	Temperature cycling											X ^a	
6.6	Resistance to liquids												X
6.8	Resistance to ingress of water												X
5.2	Connection resistance		X									X ^a	
5.3	Withstand voltage	X		X				X ^a	X ^a	X ^a	X ^a	X ^a	X
5.4	Insulation resistance	X		X				X ^a	X ^a	X ^a	X ^a	X ^a	X
4.4	Operating torque of the twist lock			X									X
4.5	Static load resistance of the coupled connection												X
4.1	Visual examination	X	X	X	X	X	X	X	X	X	X	X	X

^a The subsequent test shall be performed immediately following this test, without pause (see also 3.5).

4 Mechanical performance

4.1 Visual examination

Perform the visual examination in accordance with ISO 8092-2.

4.2 Contact retention in the housing

4.2.1 Test

Perform the contact retention test in accordance with the test given in ISO 8092-2.

4.2.2 Requirement

The contact tested according to 4.2.1 shall withstand the following forces:

- 100 N in the mating direction;
- 60 N in the opposite direction.

4.3 Tensile strength of the conductor attachment to the contact

4.3.1 Test

Perform the test of tensile strength of the conductor attachment to the contact in accordance with the test given in ISO 8092-2.

4.3.2 Requirement

The tensile strength of the conductor crimp, tested according to 4.3.1, shall withstand the minimum values specified in Table 2. For test sequences, see Table 1.

Table 2 — Minimum tensile strength of conductor crimps

Nominal cross-sectional area of crimped cable mm ²	Minimum tensile strength N
0,5	70
0,75	90
1	115
1,5	155
2	195
2,5	235

The minimum tensile strength of conductor crimp for cables with non-specified nominal cross-sectional area shall be determined by interpolation.

4.4 Operating torque for the twist lock

4.4.1 Test

Mate and unmate the connectors by operating the twist lock using a suitable tool, without jerking and with a rotational speed of 1 rad/s max. Take care to avoid additional axial and radial forces.

4.4.2 Requirement

The operating torque values of the twist lock measured at the first and last operation shall be in accordance with the values given in Table 3.

Table 3 — Operating torque values of twist lock

Class	No. of operations	Torque		
		Locking Nm max.	Unlocking Nm min. Nm max.	
K1	10	1,2	0,5	1,2
K2	10			
K3	20			

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4.5 Static load resistance of the coupled connection

4.5.1 Test

Apply a force, F , of (250^{+5}_0) N, without jerking, to the housing of the free coupler connector in an axial direction, by pulling in the withdrawal direction, as shown in Figure 1, and hold it for (10^{+2}_0) s.

Apply a torque of $(75^{+0,5}_0)$ Nm to the free coupler connector, as shown in Figure 1, and hold it for (10^{+2}_0) s.

4.5.2 Requirements

The connection shall withstand the test conditions specified in 4.5.1.

After performance of the test according to 4.5.1, the general requirements of 3.2 shall be met.

4.6 Static load resistance of the free connector

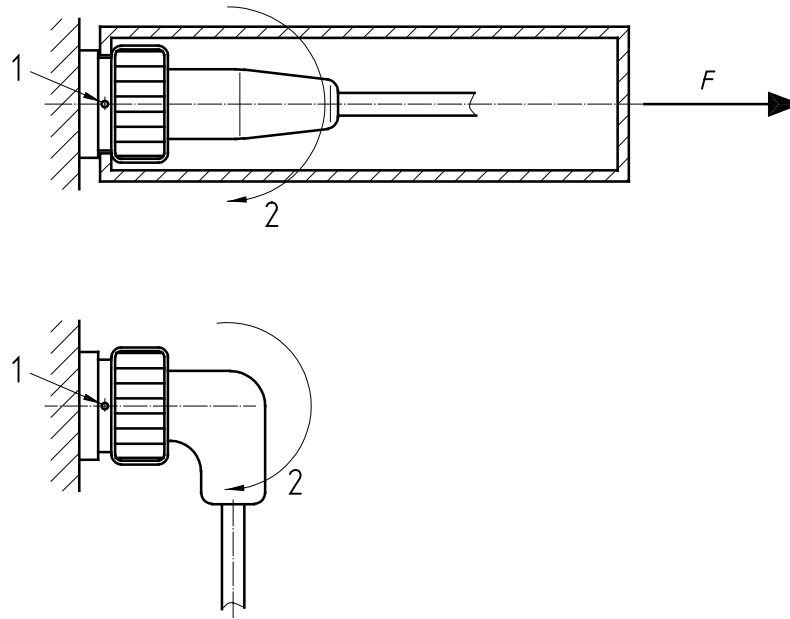
4.6.1 Test

Perform the test on free connectors, uncoupled and without cable attached.

Insert the connector between two plane, parallel plates which completely cover the connector. Apply a force of (350^{+5}_0) N vertically to the plates, without jerking, for a duration of (10^{+2}_0) s.

4.6.2 Requirements

The connector shall withstand, lying in all possible stable positions, the test according to 4.6.1, and shall fulfil the general requirements of 3.2.



- Key**
- 1 Pivot
 - 2 Torque

Figure 1 — Application of force and torque
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4.7 Vibrations

[ISO 15170-2:2001](https://standards.iteh.ai/catalog/standards/sist/b869ff43-1e06-46a0-8540-e542891b742e/iso-15170-2-2001)

4.7.1 Test

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Use mated connectors with cables attached according to the specification of the user.

Fix these connectors on the vibration table as shown in Figure 2 and Figure 3, accordingly. Connect the power supply to the cable ends or the contacts so that the vibration load is influenced only to the minimum.

Perform the test in all three perpendicular directions, starting with the main axis of the test arrangement, then laterally and finally in vertical directions parallel to gravity, with the following parameters:

- amplitudes and accelerations according to Table 4 (Figure 4 illustrates the relation of acceleration versus frequency);
- a frequency variation of 1 octave/min;
- test durations and test temperatures for each direction of 100 h [50 h at (23 ± 5) °C and 50 h at (120 ± 5) °C].

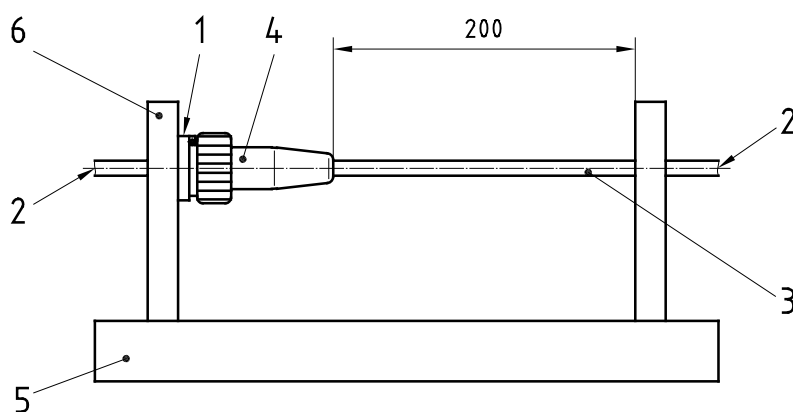
Monitor the contact resistance of each connection (mated contact pair) during the entire duration of the vibration test by applying a current of (100 ± 2) mA to the contacts.

4.7.2 Requirements

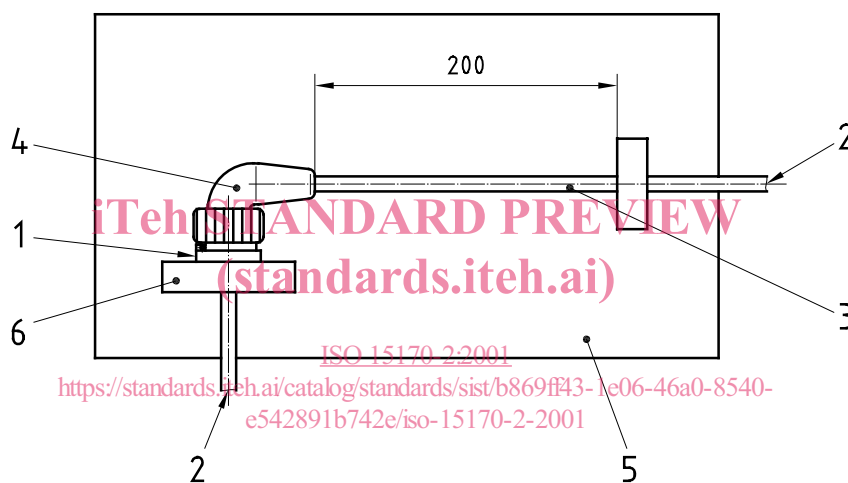
During the vibration test, the connection resistance monitored shall not exceed 7 Ω for periods of more than 1 μs during the entire test duration of 300 h (see Figure 5 and Figure 6).

After the vibration test, the test samples shall fulfil the requirements of the subsequent tests listed in Table 1.

Dimensions in millimetres



a) Fixed connector and free coupler connector with straight cable outlet



b) Fixed connector and free coupler connector with angular cable outlet

Key

- | | |
|--|------------------------------------|
| 1 Fixed connector | 4 Free coupler connector |
| 2 To power supply | 5 Vibration table |
| 3 Two- to four-core cable (depending on number of contacts fitted) | 6 Dummy enclosure of a test sample |

Figure 2 — Test arrangement for vibration test with fixed connector