
Road vehicles — Connections for on-board electrical wiring harnesses —

Part 5:

Test methods and general performance requirements for wiring harness connector operation

Véhicules routiers — Connexions pour faisceaux de câblage électrique embarqués —

Partie 5: Méthodes d'essai et exigences générales de performance pour le raccordement du connecteur du faisceau de câblage

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 32, *Electrical and electronic components and general system aspects*.

A list of all parts in the ISO 8092 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Along with the increase of electrical components mounted on a road vehicle, the types and numbers of connectors mounted on the automobile increase and the connector mating work becomes harder in such circumstances. Especially from the viewpoint of ergonomics, this problem is addressed seriously. To comprehend the characteristics of connector mate/unmate operation, their test procedures are specified in this document.

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Road vehicles — Connections for on-board electrical wiring harnesses —

Part 5:

Test methods and general performance requirements for wiring harness connector operation

1 Scope

This document defines terms and specifies test methods and general performance requirements for single-pole and multi-pole connections used with on-board electrical wiring harnesses of road vehicles. This document is applicable to connectors designed to be disconnected after mounting in the vehicle for repair and maintenance only. It does not cover one-part connections, i.e. where one part of the connection has direct contact to the pattern of the printed circuit board. This document is not applicable to internal connections of electronic devices.

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.

ISO 19642 (all parts), *Road vehicles — Automotive cables*

IEC 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications*

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:

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

3.1

male connector

assembly of male *terminal* (3.3) and housing that terminates conductors for the purpose of providing connection and disconnection to a suitable mating connector

3.2

female connector

assembly of female *terminal* (3.3) and housing that terminates conductors for the purpose of providing connection and disconnection to a suitable mating connector

3.3

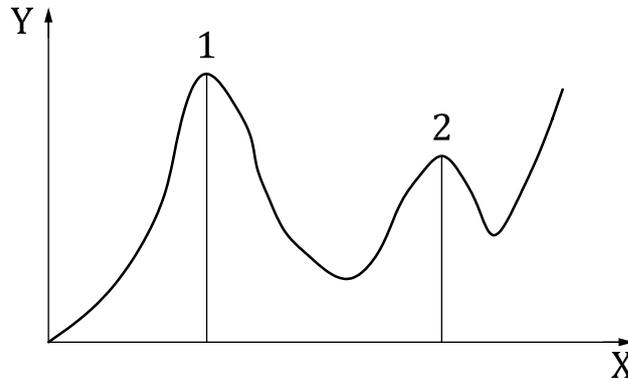
terminal

connector contact connected with a corresponding element of the same purpose, used to form an electric circuit (including wiring parts)

3.4 inertial lock

connector locking mechanism designed so that the lock peak comes before contact is established between male and female *terminal* (3.3) and becomes higher than the terminal connection peak in the connector mating process

Note 1 to entry: It is applicable only to connectors without lever/slider. See [Figure 1](#).



Key

- 1 lock peak
- 2 terminal connection peak
- X mating stroke
- Y mating force

Figure 1 — Inertial lock

4 Tests and requirements

4.1 General

4.1.1 Preconditioning

All test samples shall be preconditioned at (23 ± 5) °C and 45 % to 75 % relative humidity for 24 h before the start of any test sequence.

4.1.2 Measurement condition

All measurements shall be performed with unused samples at (23 ± 5) °C and 45 % to 75 % relative humidity unless otherwise specified. Cables shall be in compliance with applicable part of the ISO 19642 series and cables used shall be noted in the test report.

The cable attachment shall be performed in accordance with the terminal manufacturer's specifications, or as agreed between customer and supplier.

4.2 Mating force measurement and classification

4.2.1 Sample preparation

Prepare a minimum of 10 samples consisting of fully populated male connectors and female connectors.

If a mating connector is not available, a device interface may be used to carry out tests. This shall represent the intended device's interface.

4.2.2 Test procedure

Test procedure is as follows.

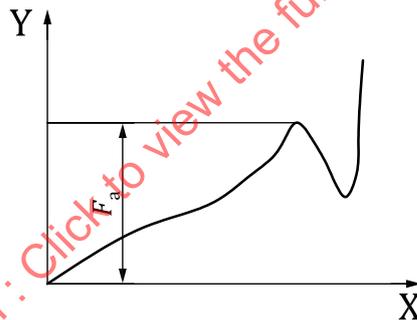
- Mate the connectors at constant speed of 50 ± 10 mm/min, and then record the mating force diagram. (Refer to [Figures 2](#) to [4](#).)
- Write the applied mating speed on the measurement report.
- Repeat steps a) and b) for the samples.

4.2.3 Classification

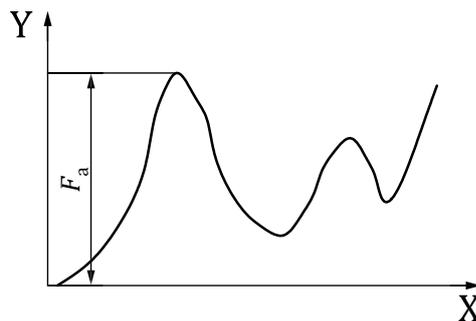
- For the mating force, use the maximum mating force (F_a), which is defined in [Figure 2](#) a) and b), and classify it in accordance with [Table 1](#).

Table 1 — Mating force

Class	Value of F_a (N)
1	$F_a \leq 45$
2	$45 < F_a \leq 70$
3	$F_a > 70$



a) Normal lock



b) Inertial lock

Key

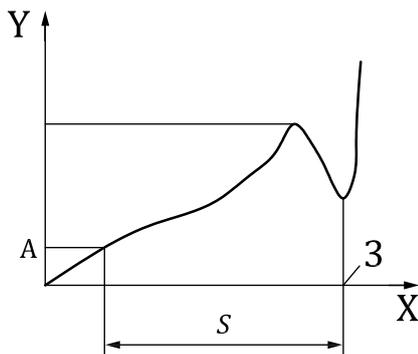
- X stroke (mm)
Y mating force (N)

Figure 2 — Maximum mating force (F_a)

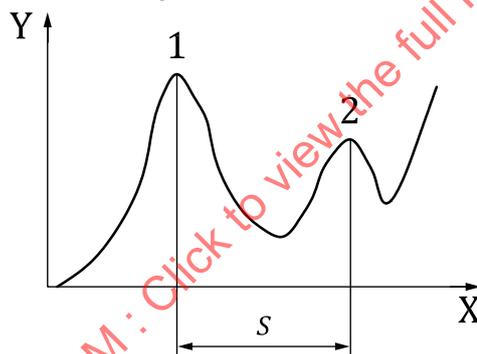
- For the mating stroke, use the stroke (S), which is defined in [Figure 3](#) a) and b), and classify it in accordance with [Table 2](#).

Table 2 — Mating stroke

Class	Mating stroke (mm)
1	$S < 4,5$
2	$4,5 \leq S < 5,5$
3	$5,5 \leq S < 6,5$
4	$S \leq 6,5$



a) Normal lock



b) Inertial lock

Key

- 1 lock peak
- 2 terminal connection peak
- 3 completion of mating
- A 10 (N)
- X stroke (mm)
- Y mating force (N)

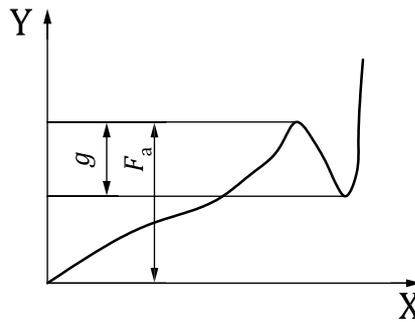
Figure 3 — Mating stroke (S)

c) For the mating force gap (R), using the values defined in Figure 4 a) and b), divide the mating completion force gap (g) by the maximum mating force (F_a) to calculate the percentage [see Formula (1)], and classify it in accordance with the Table 3.

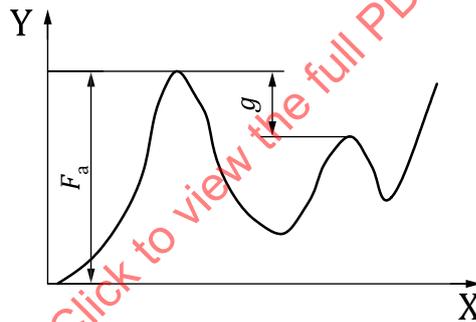
$$R = (g/F_a) \times 100 \tag{1}$$

Table 3 — Mating force gap

Class	Value of R (%)
1	$20 \leq R$
2	$10 \leq R < 20$
3	$5 \leq R < 10$
4	$R < 5$



a) Normal lock



b) Inertial lock

Key

X stroke (mm)

Y mating force (N)

Figure 4 — Mating force gap

4.3 Connector mating sound**4.3.1 Purpose**

This test determines the intensity of the sound made when a connector is fully mated. Studies show that assembly plant workers depend on audible feedback to indicate full seating of electrical connectors.

This test measures the level of sound generated when two connectors are mated. Connectors are mated by hand for this test, rather than being clamped into a fixture which could dampen or amplify the sound.

This test is applicable only for connectors intended to produce a sound on connection.

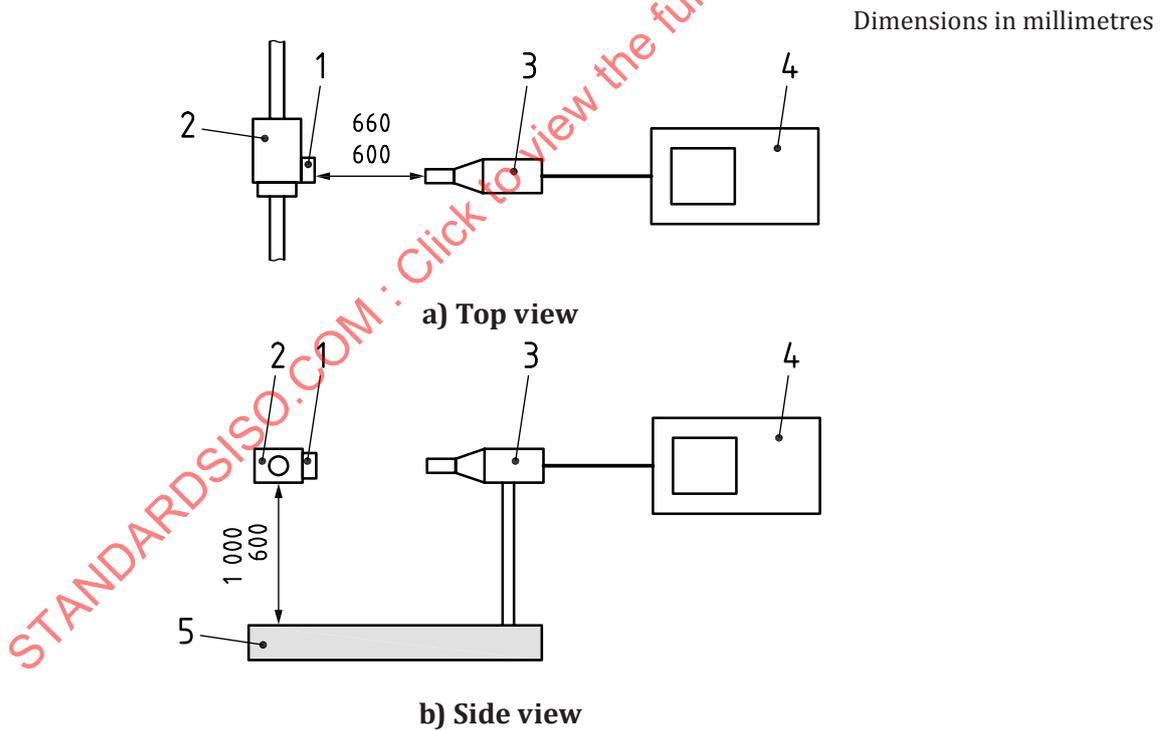
4.3.2 Sample preparation

Prepare measurement samples as described in [4.2.1](#).

4.3.3 Test procedure

The application of this test shall be agreed between customer and supplier.

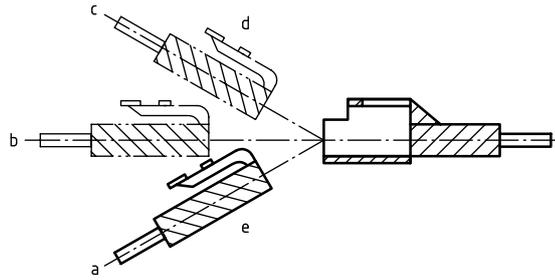
- a) Prepare a sound level meter as per IEC 61672-1, paragraph 2, to be able to measure sound of frequency range 20 Hz to 20 kHz, frequency characteristic A, and time weighting F. Calibrate the sound level meter before measurement.
- b) Prepare a measurement room where the ambient sound is 50 dB maximum. Place sound absorbing material such as a carpet under the connectors to be mated and sound level meter.
- c) Hold the parts of the connector to be mated at a position 600 mm to 660 mm from the sound level meter at a height of 600 mm to 1 000 mm from the sound absorbing material, facing them toward the sound level meter as shown in Figure 5. Mate the connector 4 times at the different insertion angles of approximately 30°, horizontal, approximately 30° opposite from the first time, and the same as the first time as shown in Figure 6.
- d) When mating connectors, hold connectors with cotton work gloves (to match worst-case assembly conditions). Assure fingertips do not touch the connector lock. Measure each of the 5 samples (measurement direction and quantity may be changed by agreement between customer and supplier).
- e) Record the generated sound levels.
- f) Analyse measurement results using a 1/3 octave analyser.



Key

- 1 lock
- 2 connector
- 3 sound level meter
- 4 frequency analyser
- 5 sound absorbing material such as carpet

Figure 5 — Placement for mating sound measurement



- a 1st and 4th time.
- b 2nd time.
- c 3rd time.
- d Oblique insertion angle of approximately 30°.
- e Oblique insertion angle of approximately 30°.

Figure 6 — Connector mating direction

4.3.4 Requirement

- a) The peak sound level: L_p at > 5 kHz frequency shall be 60 dB minimum.
- b) Overall value (L_{0A}) shall be 70 dB minimum.

4.4 Locking latch releases force measurement and classification

4.4.1 Sample preparation

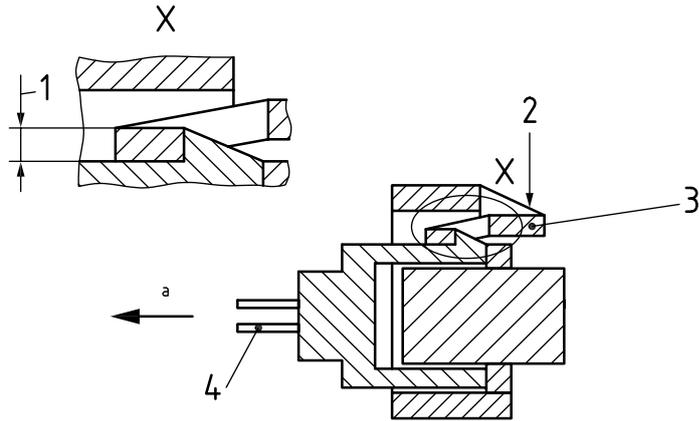
Prepare samples as follows.

- a) Prepare 5 samples of male housing and female housing without terminal.
- b) Bore a hole on the lock projection-side housing to attach a tension jig. However, if it is difficult to bore a hole for structural reason, it is allowed to attach the terminal with which a cable is wired to the housing and pull the cable.
- c) In the case of pulling the cable, insert the terminal with which the cable is wired on the pulling side only in order to prevent the influence of terminal unmating force (or mating force).

4.4.2 Test procedure

Prepare samples as follows.

- a) Mate one set of male and female housing and fix the lock lever-side housing securely using a fixing jig. When fixing the housing, take care not to allow the housing to be deformed during measurement.
- b) Securely fix the other half of the mated housings, and measure the force required to have zero locking overlap.
- c) If it is difficult to check the locking overlap, apply the force to the lock lever while pulling the lock projection-side housing as shown in [Figure 7](#), and measure the force required to release the locking.
- d) Perform the measurement for each of the 5 mated housing sets and record the unlock load (F_b).



- Key**
- 1 lock making allowance
 - 2 load point
 - 3 lock lever
 - 4 cable
 - a Pull.

Figure 7 — Instruction of unlock force measurement

4.4.3 Sample preparation

Classify the unlock force (F_b) measured in accordance with [Table 4](#).

Table 4 — Unlock force

Class	Value of F_b (N)
1	$F_b \leq 30$
2	$30 < F_b \leq 45$
3	$F_b > 45$

4.5 Unmating force measurement

4.5.1 Sample preparation

Prepare samples as follows

- a) Prepare measurement samples as described in [4.1.1](#) and [4.2.1](#).
- b) For the connector with lock mechanism, cut the lock or take other means to deactivate the lock.
- c) Bore a hole on one connector to attach a tension jig. However, if it is difficult to bore a hole for structural reason, it is allowed to pull the cable.

4.5.2 Test procedure

Test procedure is as follows.

- a) Mate one set of male and female housing and fix the connector with no tension jig on the measurement table. When fixing the connector, take care not to allow the connector to be deformed during measurement.