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

Part 2: Terminology, test methods and general performance requirements

Véhicules routiers — Connexions pour faisceaux de câblage électrique embarqués —

Partie 2: Terminologie, méthodes d'essai et exigences de performances générales

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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 document 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).

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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*.

This fifth edition cancels and replaces the fourth edition (ISO 8092-2:2005), which has been technically revised.

The main changes are as follows:

— adoption of the content according to new technical requirements,

— adoption of the content according to the new version of the ISO guidelines,

— alignment of the content regarding to the referred standards,

— subclause 4.24 "Flowing gas corrosion test" has been removed due to its technical irrelevance,

— former Annex A is adopted as an informative part under 4.1.2,

— Annex B has been removed due to its technical irrelevance.

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.

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

Part 2: Terminology, test methods and general performance requirements

1 Scope

This document provides terminology and specifies test methods for general performance requirements of voltage class A connectors used in electrical wiring harnesses on road vehicles.

This document applies to connectors which, after mounting in the vehicle, are designed to only be disconnected in connection with repair and maintenance.

This document does not apply to internal connections for electronic devices.

This document does not apply to signal communication quality or data integrity.

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 8092-5:2021, *Road vehicles — Connections for on-board electrical wiring harnesses — Part 5: Test methods and general performance requirements for wiring harness connector operation*

ISO 16750-3:2023, *Road vehicles - Environmental conditions and testing for electrical and electronic equipment - Part 3: Mechanical loads*

ISO 16750-4:2023, *Road vehicles - Environmental conditions and testing for electrical and electronic equipment - Part 4: Climatic loads*

ISO 16750-5:2023, *Road vehicles - Environmental conditions and testing for electrical and electronic equipment - Part 5: Chemical loads*

ISO 20653:2023, *Road vehicles — Degrees of protection (IP-code) — Protection against foreign objects, water and access –Electrical equipment*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
voltage class A
classification of an electric component or circuit with a maximum working voltage of ≤ 30 V a.c. (rms) or ≤ 60 V d.c., respectively

[SOURCE: ISO 21498-1:2021, 3.12]

3.2
housing
non-conducting feature for inserting the terminal and providing insulation between terminals

3.3
cable attachment
permanent junction of cable to terminal

Note 1 to entry: Crimp and weld are typical methods.

Note 2 to entry: For terms related to cables, see ISO 19642-1.

3.4
connector
assembly of terminal, *housing* (3.2) and related parts that terminate cable for the purpose of providing connection and disconnection to a suitable mating connector

3.5
connector coding
mechanical feature to provide differentiation, preventing mating of *connectors* (3.4) not intended to be mated

3.6
connector polarization
method or design feature, which prevents *connectors* (3.4) that are intended to mate from mating in an unintended orientation, rotation, or angular position, whilst allowing mating in the intended manner

3.7
CPA
connector position assurance
device that prevents accidental release of the *connector* (3.4) lock and serves as an indicator of full connector mating

3.8
TPA
terminal position assurance
feature installed or seated after the terminals are inserted into their *housing* (3.2) to assure that the terminals are properly positioned, and which reinforces the primary terminal locking mechanism or provides a separate, redundant terminal lock

3.9
socket terminal
terminal, including means for *cable attachment* (3.3), designed for electrical engagement on its inner surface, and to accept entry of a *pin terminal* (3.11), thus forming an electrical connection

Note 1 to entry: See Figure 1 for an example.

Note 2 to entry: Socket terminals are sometimes referred to as female terminals.

a) socket **b) receptacle**

Figure 1 — Example of a socket and a receptacle terminal

3.10
receptacle terminal
terminal, including means for *cable attachment* (3.3), designed for electrical engagement on its inner surface, and to accept entry of a *tab terminal* (3.12), thus forming an electrical connection

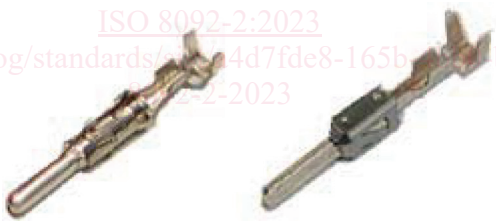
Note 1 to entry: See Figure 1 for an example.

Note 2 to entry: Receptacle terminals are sometimes referred to as female terminals.

3.11
pin terminal
terminal, including means for *cable attachment* (3.3), designed for electrical engagement on its outer surface and to enter a *socket terminal* (3.9), thus forming an electrical connection

Note 1 to entry: Pin terminals are sometimes referred to as male terminals.

Note 2 to entry: See Figure 2 for an example.



a) pin **b) tab**

Figure 2 — Example of a pin and a tab terminal

3.12
tab terminal
terminal, including means for *cable attachment* (3.3), designed for electrical engagement on its outer surface and to enter a *receptacle terminal* (3.10), thus forming an electrical connection

Note 1 to entry: Tab terminals are sometimes referred to as male terminals.

Note 2 to entry: Tab terminals are sometimes referred to as blade terminals.

Note 3 to entry: See Figure 2 for an example.

3.13
multipole connector
two mated *connectors* (3.4) halves with more than one terminal pair [e.g. one receptacle and one *tab terminal* (3.12)]

4 Test conditions and requirements

4.1 General

4.1.1 Preconditioning for environmental and mechanical durability test

All test samples shall be preconditioned at a standard ambient temperature of (23 ± 5) °C, and (25–75) % relative humidity for 24 h before the start of any test sequence.

4.1.2 Test conditions

All tests shall be carried out at a standard ambient temperature of (23 ± 5) °C and (25–75) % relative humidity unless otherwise stated in the test procedure. This is referred to as room temperature (RT).

A cable in compliance with applicable part of the ISO 19642 series is recommended. The cable or cables used shall be specified in the test report.

The cross-sectional area of the wire mentioned in this specification refers to wires with a copper conductor.

When the wire conductor is of a material other than copper, the cross–sectional area of the wire shall be specified by agreement between customer and supplier.

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

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

Each connector shall have the full complement of terminals fitted unless otherwise specified.

The terminals and connectors used in the test shall be fully assembled unless otherwise specified.

Connectors shall be tested in mated condition unless otherwise stated. In the case of a connector connecting directly to a device, a mating dummy may be used to carry out tests. This dummy shall represent the intended device's interface and electrical properties.

For connector mechanical tests, unless otherwise specified, fix the pin or tab housing of the unmated or mated connector in the appropriate fixture on the tension or force tester. Secure the other side in the appropriate fixture and insert or pull the socket or receptacle housing straight in/out. Straight-in or straight-out engagement is critical to avoid side loads and binding which can affect force measurements.

For terminal mechanical tests, unless otherwise specified, fix the pin or tab terminal of the unmated or mated terminal in the appropriate fixture on the tension or force tester. Secure the other side in the appropriate fixture and insert/pull the socket receptacle terminal straight in/out. Straight-in or straight-out engagement is critical to avoid side loads and binding which can affect force measurements.

Measurements shall be taken on all terminals regardless of the number of poles per connector, unless otherwise specified in the test methods or by agreement between customer and supplier.

Lubrication or other means of attaining better test results shall not be added to any surface unless representative of assembly conditions. Production-related remains of lubricants on the terminals are permitted.

Unless otherwise specified, all forces shall be applied at a constant speed of (50 ± 10) mm/min.

Unless otherwise specified, when a temperature of T_{max} is specified in a test, the applicable "highest value" temperature as per Table 1 shall be used. When a temperature of T_{min} is specified in a test, the applicable "lowest value" temperature as per Table 1 shall be used.

Table 1 — Environmental and test temperatures

Class	Typical application	Environmental temperature range °C		Test temperature Short term thermal ageing °C ±2 °C
		Lowest value Use for T_{min} of chamber ±2 °C	Highest value Use for T_{max} of chamber ±2 °C	
T1 (G)	interior	-40	85	100
T2 (J)	passenger compartment		100	125
T3 (O)	engine compartment		125	150
T4 (R)	engine applications used near hot components		150	175
T5 (N/A)	for use as needed		175	200 [a]

( ) value aligned with ISO 16750-4:2023, Table 1.

[a] or agreed between customer and supplier.

NOTE T_{min} and T_{max} apply to all environmental chamber temperatures where T_{min} and T_{max} are specified as using the applicable environmental temperature range except 7.2.2.1.

4.1.3 Test sequences and sample quantities

Table 2, Table 3, Table 4 and Table 5 list the test sequences. The test groups in the tables apply to sealed and unsealed connectors as noted. New samples shall be used for each test group. The test sequence for each test group shall be performed in accordance with the sequence number defined in the table's rows for each sequence. For each test group, the complete test sequence for the group on each sample shall be performed.

Table 2 — Mechanical test sequences groups A through H

Test group identification		A	B	C	D	E	F	G	H
u=apply test if samples are un- sealed		u	u	u	u	u	u	u	u
s=apply test if samples are sealed		s	s	s	s	s	s	s	s
Minimum test quantity of terminals/connectors		10	10	10	10	10	10	10	10
Sample cable length (mm)		-	-	-	-	-	-	-	-
Sample cable size	Maximum	-	-	-	-	-	-	-	-
	Minimum	-	-	-	-	-	-	-	-
4.2 Visual examination		1, 3	1, 3	1,3	1, 3	1, 3	1, 3	1,3	1,4
5.1 Connection and disconnection		2[a]							
5.2 Mating force – measurement and classification			2						
5.3 Unlocking force – measurement and classification				2					
5.4 Unmating force – measurement and classification					2				
5.5 Locking device strength						2			
5.6 Unintentional lever release force							2		
5.7 Locking force for CPA function								2	2
5.8 Disengage force for CPA function									3

[a] Perform force measurement for first mate and first unmate with part held in force tester.

Remaining mate and unmate cycles can be either hand mated or using the mechanized force test machine.

\- Cells containing "-" are to be defined between supplier and customer. Selection typically does not matter to test result.

Table 3 — Mechanical test sequences groups I through P

Test group identification		I	J	K	L	M	N	O	P
u=apply test if samples are unsealed		u	u	u	u	u	u	u	u
s=apply test if samples are sealed		s	s	s	s	s	s	s	s
Minimum test quantity of terminals/connectors		10[a]	10[a]	10	10	20[a]	10[a]	10[a]	10[b]
Sample cable length (mm)		-	-	-	-	-	-	-	>50
Sample cable size	Maximum	-	-	-	-	10	10	10	[c]
	Minimum	-	-	-	-	10	-	-	[c]
4.2 Visual examination		1, 3	1, 4	1, 3	1, 3	1, 4	1, 3	1, 3	1, 3
5.9 Locking force for TPA		2	2						
5.10 Disengage force for TPA			3						
5.11 Effectiveness of connector coding and polarization				2					
5.12 Connector engagement sound					2				
5.13 Terminal insertion force (TPA disengaged)						2			
5.14 Terminal insertion force (TPA engaged)							2		
5.15 Terminal insertion force with incorrect orientation								2	
5.16 Terminal extraction force						3			
5.17 Tensile strength of connection between terminal and wire									2

[a] Use unmated wire harness connector; the mating (header) connector is not used in the test.

[b] Sample is made from terminal and cable only.

[c] Test quantity is per terminal/cable combination; each combination shall be validated with a 10-piece sample, minimum.

- Cells containing "-" are to be defined between supplier and customer. Selection typically does not matter to test result.

Table 4 — Environmental and electrical test sequence groups Q through W

Test group identification		Q	R	S	T	U	V	W
u=apply test if samples are unsealed		u	u	u	u	u	u	
s=apply test if samples are sealed		s	s	s	s[g]	s	s	s[g]
Minimum test quantity of connectors		5[c]	10	5[c]	5	5	5	5
Sample cable length (mm)		500	-	min. 500	min. 150	-	1 250	min. 150
Sample cable size	Maximum	[f]	all	all		all		
	Minimum				all		all	all
4.2 Visual examination		1	1, 6	1, 8, 10	1, 10, 14	1, 8	1, 3	1, 7
5.1 Connection and disconnection		2	2	2	2	2		
5.3 Unlocking force – measurement and classification					12[a]			
5.6 Unintentional lever release force					12[a]			
5.8 Disengage force for CPA function					11			
5.16 Terminal extraction force				9				
6.1 Connection resistance (voltage drop)			3, 5	3, 6	3, 7, 13	3, 5, 7		2, 5
6.2 Temperature rise		3[d]		(4), 7				
6.4 Insulation resistance					4, 8			
6.5 Withstand voltage					5, 9			3, 6
7.1 Thermal shock			4					
7.2 Thermal aging				5				
7.3 Temperature / humidity					6[e]			
7.4 Vibration with thermal cycling						6[b]		
7.5 Mechanical shock						4[b]		
7.6 Drop							2	
7.10 Salt spray								4

[a] Perform either 5.3 or 5.6 as applicable.

[b] It is allowed to apply each shock/vibration direction directly before the vibration test for this direction. Take intermediate resistance measurements between testing for each axis.

[c] Samples require thermocouples to measure or monitor temperature rise.

[d] This test is to estimate initial current in test part.

[e] Perform insulation resistance during condensation phase.

[f] Test all cable sizes that are applicable.

[g] Seal cable on far end.

( ) It is possible to omit this step by agreement between customer and supplier.

- Cells containing "-" are to be defined between supplier and customer. Selection typically does not matter.