INTERNATIONAL STANDARD

ISO 8092-2

Second edition
1996-02-01

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

Part 2: Definitions, test methods and general performance requirements

Véhicules routiers — Connexions pour faisceaux de câblage électrique embarqués —

Partie 2: Définitions, méthodes d'essai et exigences générales

Reference number
ISO 8092-2:1996(E)

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.

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.

International Standard ISO 8092-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This second edition cancels and replaces the first edition (ISO 8092-2:1988), of which it constitutes a technical revision.

ISO 8092 consists of the following parts, under the general title *Road vehicles — Connections for on-board electrical wiring harnesses*:

— *Part 1: Tabs for single-pole connections — Dimensions and specific requirements*

— *Part 2: Definitions, test methods and general performance requirements*

— *Part 3: Tabs for multi-pole connections — Dimensions and specific requirements*

— *Part 4: Pins for single- and multi-pole connections — Dimensions and specific requirements*

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

Part 2:
Definitions, test methods and general performance requirements

1 Scope

This part of ISO 8092 gives definitions, and specifies test methods and general performance requirements for single-pole and multi-pole connections for on-board electrical wiring harnesses of road vehicles. It applies to connectors designed to be disconnected after mounting in the vehicle for the purposes of repair and/or maintenance only. ISO 8092 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. The requirements are not intended for connections internal to electronic devices.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8092. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8092 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 6722-3:1993, *Road vehicles — Unscreened low-tension cables — Part 3: Conductor sizes and dimensions for thick-wall insulated cables.*

ISO 6722-4:1993, *Road vehicles — Unscreened low-tension cables — Part 4: Conductor sizes and dimensions for thin-wall insulated cables.*

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

IEC 50 (581):1978, *International Electrotechnical Vocabulary — Chapter 581: Electromechanical components for electronic equipment.*

IEC 529:1989, *Degrees of protection by enclosures (IP code).*

3 Definitions

For the purposes of all parts of ISO 8092, the definitions in IEC 50, chapter 581, and the following definitions apply.

3.1 male contact: Electrical contact which can be pushed into a female contact forming an electric connection. (See figure 1.)

EXAMPLES

tab

pin

blade

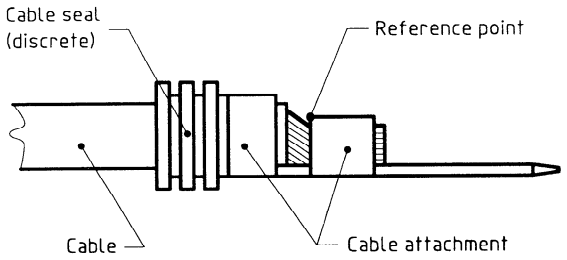


Figure 1 — Male contact

3.2 female contact: Electrical contact which receives the male contact forming an electric connection. (See figure 2.)

EXAMPLES

receptacle

sleeve

socket

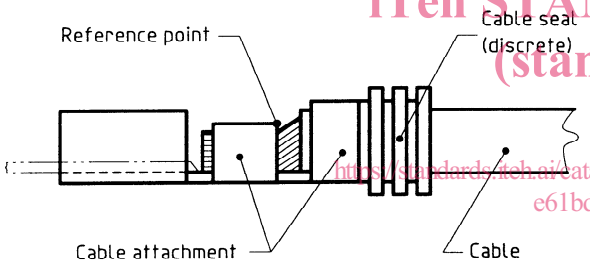


Figure 2 — Female contact

3.3 positive locking female contact: Female contact with automatic positive locking and manual unlocking device engaging a hole or dimple in the male contact.

3.4 detent: Raised portion of the female contact which engages a hole or dimple in the male contact thus providing a latch for the mating parts.

3.5 reference point: Specially identified point used when making electric test measurements. (See figures 1, 2, 6 and 7.)

3.6 connection: Two mated connectors or contacts. (See figure 3 for examples.)

3.7 multi-pole connection: Two mated connectors with more than one contact pair. (See figure 4.)

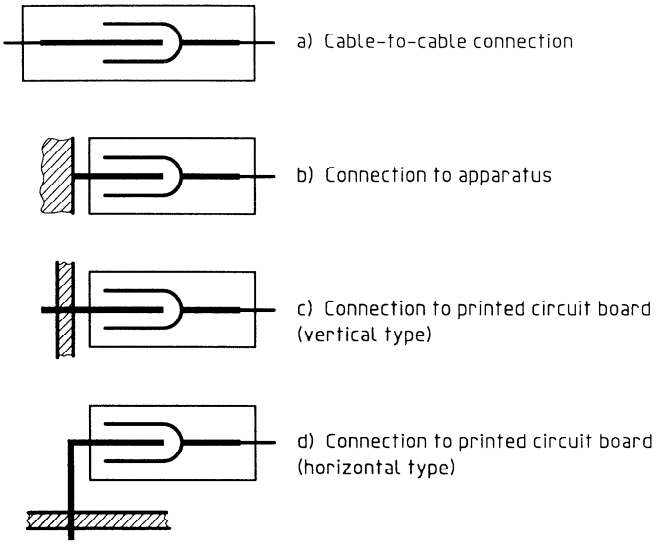


Figure 3 — Typical examples of connections

4 Test procedures and performance requirements

4.1 General

4.1.1 Test methods, general specifications

All test procedures shall be carried out at an ambient temperature of (23 ± 5) °C and a relative humidity between 45 % and 75 %, unless otherwise stated.

Each test sequence (see table 1) shall be started with unused test samples manufactured to conform to the dimensions specified in the applicable part of ISO 8092. Female contacts which have a locking device shall be tested with male contacts with hole or dimple to permit locking.

Contacts (where applicable) shall be fixed to the cable with a crimping tool used in accordance with the manufacturer's recommendations.

Cables shall be in accordance with ISO 6722-3 or ISO 6722-4, and the cable(s) used shall be noted in the test report.

Care shall be taken that test samples do not influence each other, for example in the heat chamber.

NOTE 1 The total number of samples is not specified.

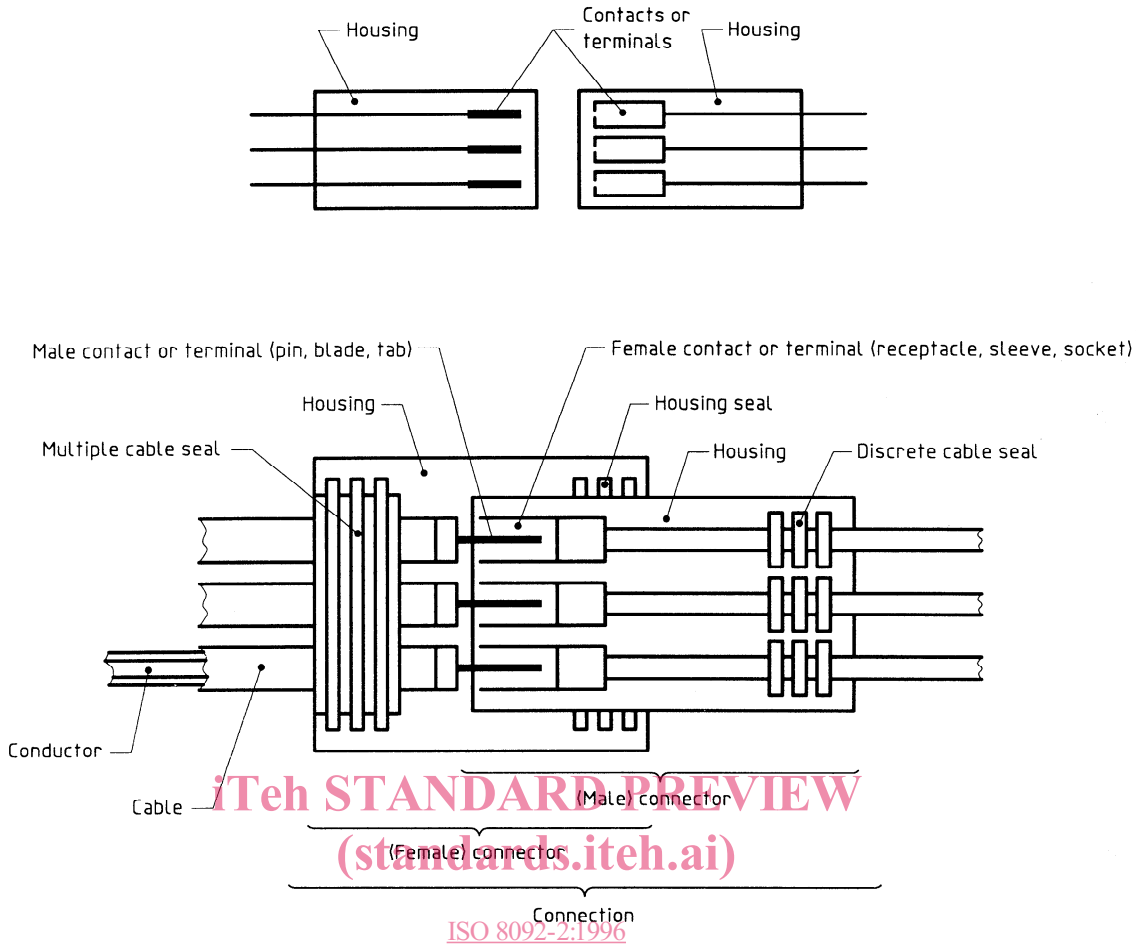


Figure 4 — Multi-pole connectors/connections

4.1.2 General performance requirements

Connectors and/or contacts that allow connections for multiple positions shall meet the requirements in all intended positions.

4.1.3 Test sequences

For each test sample group in table 1, a test sequence is indicated by Xs from top to bottom.

For unsealed connectors, apply tests as in the test sample groups A, B, C, D, E, F, H, I.

NOTE 2 Test sample group G is for sealed connectors and splash-proof connectors only.

For sealed connectors and splash-proof connectors, apply tests as in the test sample groups A, B, C, D, E, G, H, I.

NOTE 3 Test sample group F is for unsealed connectors only.

Each test sample group shall contain at least

20 test samples in the case of single-pole connectors;

10 test samples in the case of 2-pole connectors;

7 test samples in the case of 3-pole connectors;

5 test samples in the case of 4-pole connectors.

A minimum of 20 contacts of each type shall be tested in the case of connectors with mixed types of contacts.

All test samples shall be used for all tests in a test sample group.

Each connector shall have the full complement of contacts fitted, unless otherwise specified in the test method.

Measurements shall be taken on a minimum of four contacts per connector unless otherwise specified in the test methods. For 1-, 2-, and 3-pole connectors, all contacts shall be measured.

Table 1 — Test sequences and performance requirements

Test		Test sample group									Performance requirements subclause
Title	Subclause	A	B	C	D	E	F	G	H	I	
Visual examination	4.2.1	x	x	x	x	x	x	x	x	x	4.2.2
Tensile strength of cable attachment	4.4.1									x	4.4.2
Contact insertion	4.6.1	x									4.6.2
Contact retention	4.7.1	x									4.7.2
First insertion of connector	4.3.1		x								4.3.2
Connection resistance at millivolt level and specified current	4.8.1		x	x	x	x	x				4.8.2
First disconnection to 10th connection of connector	4.3.1		x								4.3.2
Current cycling	4.17.1			x							4.17.2
Insulation resistance	4.12.1				x			x			4.12.2
Dielectric strength	4.13.1				x			x			4.13.2
Temperature/humidity	4.10.1				x						4.10.2
Vibration	4.11.1					x					4.11.2
Ageing	4.18.1							x			4.18.2
Watertightness	4.9.1							x			4.9.2
Temperature rise	4.14.1								x		4.14.2
Polarizing	4.15.1								x		4.15.2
Connection resistance at millivolt level and specified current	4.8.1		x	x		x					4.8.2
Locking device strength	4.5.1		x								4.5.2
Insulation resistance	4.12.1				x			x			4.12.2
Dielectric strength	4.13.1				x		x	x			4.13.2
Salt spray	4.16.1						x				4.16.2
Connection resistance at millivolt level and specified current	4.8.1				x		x				4.8.2
Visual examination	4.2.1	x	x	x	x	x	x	x	x	x	4.2.2

NOTE — The arrows between the Xs indicate that the subsequent test shall be performed without interruption.

4.2 Visual examination

4.2.1 Test method

Carry out the visual examination with the naked eye, at normal strength of vision and normal colour perception, at the most favourable viewing distance, and with suitable illumination.

4.2.2 Performance

Visual examination as detailed in 4.2.1 shall allow identification, appearance, workmanship and finish of the item to be checked against the relevant specification.

If the connector has a cable insulation support, the insulation grip shall not cut through the insulation and shall firmly enclose the cable.

Both insulation and the cable conductor shall be visible between the conductor crimp and the insulation support on the male and female contacts, as shown in figure 5, except for insulation displacement connections.

Conductors shall protrude from the conductor attachment but shall not interfere with the mating part. All wire strands shall be enclosed by the conductor attachment. There shall be no damaged wire strand(s).

During visual examination, after tests as in the test sample groups A to I, special care shall be taken to ensure that as a minimum requirement no cracking, discoloration, deformation, and no water ingress (for test sample group G only), is in evidence.

4.3 Connection and disconnection

4.3.1 Test method

Perform connection and disconnection of connectors as intended or as specified in the particular product specification.

Use a rate for connection and disconnection of a constant speed between 50 mm/min and 150 mm/min. The applied speed shall be noted in the test report.

Subject the connectors to test 4.3.1.1 or 4.3.1.2 as appropriate.

4.3.1.1 Female contacts (without positive locking)

Subject the connector to 10 connections and disconnections. Measure the force necessary at

first connection;

first disconnection;

10th disconnection.

4.3.1.2 Positive locking female contacts

Perform 11 cycles of connection and disconnection as follows.

Perform the first 10 cycles operating the locking device at each cycle in accordance with the manufacturer's instruction and normal use.

Measure the force necessary at

first connection;

first disconnection;

10th disconnection.

Perform the 11th cycle with the locking device engaged for the locking device strength test as in 4.5.1.2.

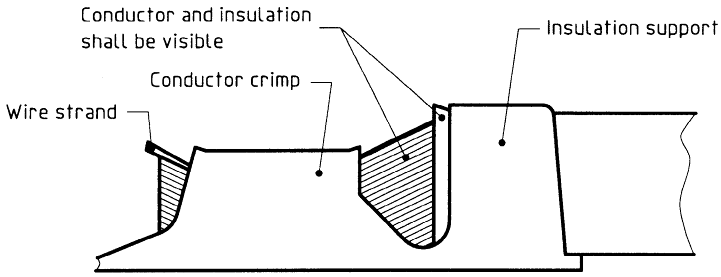


Figure 5 — Conductor and insulation crimp

4.3.2 Performance requirements

Connectors for single-pole connections, tested as in 4.3.1, shall conform to the requirements specified in the applicable part of ISO 8092.

In the case of connectors for multi-pole connections, the connection and disconnection forces, tested as in 4.3.1, shall be as in the particular specification of the user or supplier, or of the applicable part of ISO 8092.

4.4 Tensile strength of cable attachment

4.4.1 Test method

Test the tensile strength of the cable attachment by using suitable test apparatus at a constant speed within the range of 50 mm/min to 150 mm/min. The applied speed shall be noted in the test report.

Attach each test sample to the corresponding cable(s) as specified by the connector manufacturer.

If the connector has a cable insulation support, it shall be rendered mechanically ineffective.

When more than one cable is attached, apply the force specified in table 2 to each cable by using separate samples.

4.4.2 Performance requirements

The tensile strength of the crimped connection, tested as in 4.4.1, shall withstand the minimum values specified in table 2.

Table 2 — Minimum tensile strength of crimped connections

Nominal cross-sectional area of cable mm^2	Minimum tensile strength N
0,22	40
0,35	50
0,5	70
0,75	90
1	115
1,5	155
2	195
2,5	235
3	260
4	320
5	360
6	400
10	600

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

NOTE 4 Other types of cable attachment are under consideration.

4.5 Locking device strength

The purpose of this test is to check the ability of locked connectors to withstand a specific and static actual load. Subject connectors for single- and multi-pole connections to the test in 4.5.1.1 or 4.5.1.2 as appropriate.

4.5.1 Test method

4.5.1.1 Connectors for single- and multi-pole connections with locking devices integral with housing (without positive locking female contacts)

Carry out the procedure:

a) with empty connectors; and

b) with the full complement of contacts fitted.

Make a fixture which can be secured to the connectors to be tested. The securing of this shall not distort either of the connectors during testing. Mount the housing on the fixture(s) with the locking device engaged. Apply the force to the fixture in the disconnection direction and hold it constant for (10 $^{+2}_{0}$) s.

4.5.1.2 Connectors for single- and multi-pole connections with positive locking female contacts

After the 11th connection specified in 4.3.1.2, apply the force on the test sample with the locking device engaged in the disconnection direction and hold it constant for (10 $^{+2}_{0}$) s.

4.5.2 Performance requirements

Connectors for single-pole connections with locking devices tested as in 4.5.1 shall conform to the requirements specified in the applicable part of ISO 8092.

The locking device of connectors for multi-pole connections, tested as in 4.5.1, shall withstand a force of (100 $^{+2}_{0}$) N.

4.6 Contact insertion force

4.6.1 Test method

Test the insertion force of the contact into the cavity by using the minimum and maximum size of cable which can be attached, applying it in the insertion di-

rection via a test fixture, to be positioned as close as possible to the cable attachment.

Care shall be taken that the contact under test is locked as intended.

Use a rate for insertion of a constant speed between 50 mm/min and 150 mm/min. The applied speed shall be noted in the test report.

4.6.2 Performance requirements

The contact insertion force, tested as in 4.6.1, shall be a maximum of 15 N for contacts with cables attached with a nominal cross-sectional area of up to and including 1 mm^2. For contacts with a cable of larger nominal cross-sectional area, the force shall be a maximum of 30 N.

In the case of sealed connectors or splash-proof connectors, the force imposed by the seal shall be included.

4.7 Contact retention in housing

4.7.1 Test method

Carry out the test for contact retention forces using a suitable test apparatus. The contacts shall have all locking devices effective. Apply a constant force to the front and/or back of the contact in an axial direction and hold it for (10 $^{+2}_{0}$) s. The constant force applied shall be noted in the test report.

4.7.2 Performance requirements

The contacts, tested as in 4.7.1, shall withstand 60 N. Higher forces may be required according to connection or disconnection forces, material and design.

4.8 Connection resistance (voltage drop)

4.8.1 Test method

4.8.1.1 Measurements at millivolt level

The test voltage shall not exceed 20 mV d.c. or peak voltage a.c., even in open circuit, in order to prevent the breakdown of possible insulating films of the contacts. The flow of the test current shall not exceed 50 mA.

Measure the connection resistance using the test arrangements shown in figures 6 and 7.

The resistance of the conductor(s) associated shall be subtracted from measured values.

Dimensions in millimetres

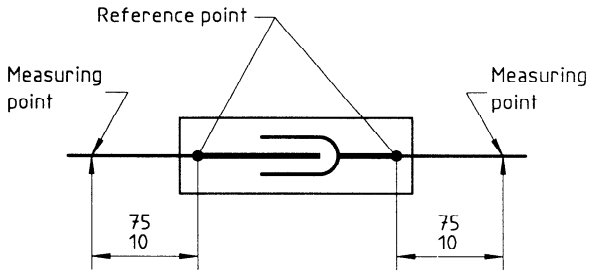
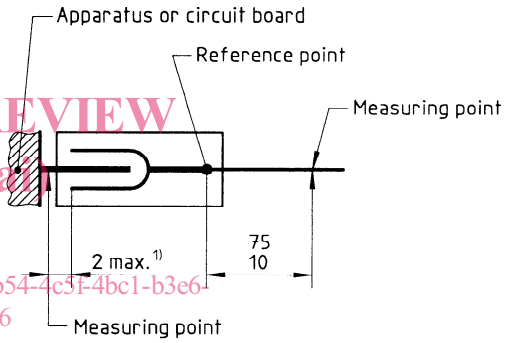


Figure 6 — Connection resistance, cable-to-cable connection

Dimensions in millimetres



1) This dimension may be increased as agreed between manufacturer and user, when 2 max. is not obtainable.

Figure 7 — Connection resistance, connection on apparatus

4.8.1.2 Measurements at specified test current

Measurements shall be taken after thermal equilibrium at a current density of 5 A/mm^2 nominal cross-sectional area of attached cable(s) unless otherwise stated.

If the measuring cables are soldered at the measuring points, they shall not influence the connections.

4.8.2 Performance requirements

The connection resistance, tested as in 4.8.1, shall conform to the requirements specified in the applicable part of ISO 8092.

4.9 Watertightness

Watertightness is verified for two cases:

a) sealed connectors (see 4.9.1.1);

b) splash-proof connectors (see 4.9.1.2).

Assemble the connectors with the full complement of contacts fitted. The cables attached shall be of the minimum and maximum overall diameter that the connector sealing system allows. The cable ends shall be sealed.

Precondition the test sample (mated connectors) in a temperature chamber at the test temperature as for the designated class in table 3, for 4 h.

Dimensions in millimetres

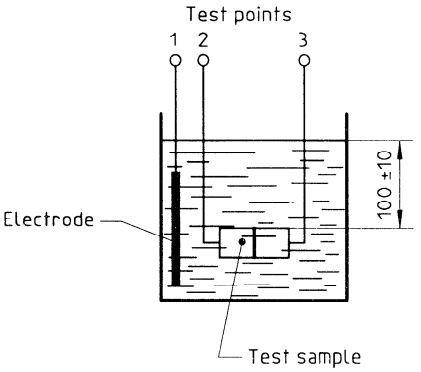


Figure 8 — Watertightness test

Table 3 — Class environmental and test temperatures

Class	Environmental temperature °C	Test temperature °C
1	– 40 to + 70	85
2	– 40 to + 85	100
3	– 40 to + 100	125
4	– 40 to + 125	155
5	– 40 to + 155	175

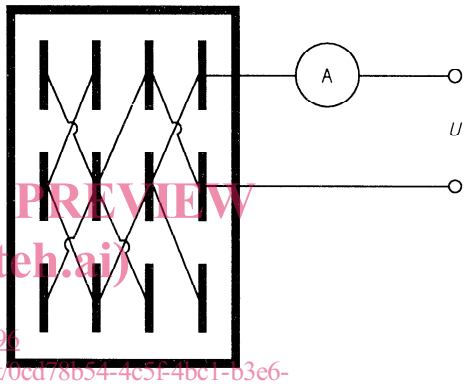


Figure 9 — Leakage current measurements between adjacent contacts (example)

4.9.1 Test method

4.9.1.1 Sealed connectors

Immerse the test sample (mated sealed connectors) immediately after preconditioning in a liquid of deionized water with a mass fraction of 5 % NaCl, and 0,1 g/l wetting agent added. The liquid temperature shall be (23 ± 5) °C.

Include a dye so that ingress of liquid into the test sample can be visually checked after the electrical test.

Immerse the test sample as shown in figure 8 for 1 h.

Take leakage current measurements of the test sample immersed in the liquid. Take the measurements between each contact and the electrode, and with a different test sample between every two adjacent contacts, for example as shown in figure 9.

4.9.1.2 Splash-proof connectors

Submit the test sample (mated splash-proof connectors) immediately after preconditioning to splash-proof test IPX4 as specified in IEC 529:1989. The smallest tube arc shall be applied.

Other equipment may be used provided that it leads to the same end results. In case of a dispute between user and supplier, the test according to IEC 529 IPX4 shall be used.

It is recommended to add a dye to the water, to distinguish between water ingress and condensation.

4.9.2 Performance requirements

4.9.2.1 Sealed connectors

The leakage current measured as in 4.9.1.1 shall not exceed 50 µA at 48 V applied voltage.

4.9.2.2 Splash-proof connectors

The splash-proof connections tested as in 4.9.1.2 shall fulfil subsequently performed tests required by table 1.

4.10 Temperature/humidity

4.10.1 Test method

Carry out the temperature/humidity cycling test using cable-to-cable connections (see figure 6) with the housing having the full complement of contacts. Also carry out this test with connections on apparatus (see figure 7), if required by the user.

Test the connector with cables assembled of the minimum and maximum cross-sectional areas that the contact system allows.

Subject the test samples (mated connectors), in a suitable test chamber, to 10 cycles of 24 h of the following test sequence. The class of temperature is taken from table 3 as a function of environmental conditions.

a) Hold the chamber at temperature, t_c, equal to (23 ± 5) °C and 45 % to 75 % relative humidity (RH) for 4 h.

b) Raise t_c to (55 ± 2) °C at 95 % to 99 % RH within 0,5 h.

c) Hold t_c at (55 ± 2) °C at 95 % to 99 % RH for 10 h.

d) Lower t_c to (– 40 ± 2) °C within 2,5 h.

e) Hold t_c at (– 40 ± 2) °C for 2 h.

f) Raise t_c to class test temperature ± 2 °C within 1,5 h from (– 40 ± 2) °C.

g) Hold t_c at class test temperature ± 2 °C for 2 h.

h) Allow to return to room temperature (23 ± 5) °C within 1,5 h.

NOTES

5 During periods d), e), f), g) and h), the humidity is uncontrolled.

6 If the chamber needs more than 1,5 h to reach class test temperature, the duration of period f) may be extended. In this case, period a) is reduced accordingly.

7 See figure 10 for graphic test cycles.

At the end of a cycle, the test may be interrupted. During the interruption test samples shall remain at the ambient conditions as defined in a). Interruption time shall be noted in the test report.

4.10.2 Performance requirements

The connection tested as in 4.10.1 shall fulfil subsequently performed tests required by table 1.

4.11 Vibration

4.11.1 Test method

Carry out the vibration with mated connectors suitably mounted on a vibration table as shown in figure 11. The mounting method(s) (1, 2, 3 or 4 in figure 11) used shall be noted in the test report.

Wire all contacts in series and connect them to a d.c. source allowing a current flow of 100 mA to monitor connection resistance variation during the entire test (see test arrangement in figure 12). While the variation is being monitored, subject the connection to a simple harmonic motion. The parameters shall be as follows:

10 Hz to 55 Hz at ± 0,75 mm amplitude;

55 Hz to 500 Hz at 100 m/s^2 acceleration;

frequency variation carried out by logarithmic sweepings of 1 octave/min;

motion applied for a period of 16 h on each of the three mutually perpendicular directions (total test time 48 h).

NOTE 8 In addition the test sample can be subjected to a measured vehicle vibration profile for the same duration.