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Road vehicles — Connection interface for pyrotechnic devices, two-way and three-way connections —

Part 2: Test methods and general performance requirements

Véhicules routiers — Interface de raccordement pour dispositifs pyrotechniques, deux voies et trois voies —

Partie 2: Méthodes d'essai et exigences des 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 19072-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

ISO 19072 consists of the following parts, under the general title *Road vehicles — Connection interface for pyrotechnic devices, two-way and three-way connections*:

— *Part 1: Pocket interface definition*

— *Part 2: Test methods and general performance requirements*

Introduction

Road vehicles integrate an increasing number of pyrotechnic devices contributing to occupant safety in vehicles, e.g. frontal and side air bag, safety belt pretensioner.

To build the complete system providing the function requires a supply of various components from several different equipment makers. Vehicle manufacturers need to define a common specification to ensure that connectors designed and produced for the various equipment makers meet the same performances criteria and requirements.

In the current design of this vehicle equipment, three areas of connection have been identified:

— connection between the pyrotechnic device (e.g. initiator) and the harness connector;

— connection between the tab holder and the clip holder of the harness connector;

— connection between the harness connector and the electronic control module.

This part of ISO 19072 deals with the connection between the pyrotechnic device and the harness connector, which is the only connection that can be standardized. Due to the location of the safety device in the vehicle, the connector design could be right angle or straight.

Annex A defines a sealed option for the pyrotechnic device/initiator harness connector assembly.

Annex B defines a two-way (without ground) variant of the pyrotechnic device/initiator harness connector assembly.

Annex C defines a variant without retainer of the pyrotechnic device/initiator harness connector assembly.

Road vehicles — Connection interface for pyrotechnic devices, two-way and three-way connections —

Part 2: Test methods and general performance requirements

1 Scope

This part of ISO 19072 defines the performance criteria and requirements of a three-way connection interface, including ground connection, linking the pyrotechnic device and harness connector built into a road vehicle.

Performance criteria and requirements are also defined for a sealed variant of the pyrotechnic device/initiator harness connector assembly, and for a two-way (without ground) variant of the pyrotechnic device/initiator harness connector assembly.

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.

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

ISO 20653, *Road vehicles — Degrees of protection (IP-Code) — Protection of electrical equipment against foreign objects, water and access*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8092-2 and the following apply.

3.1
connector
assembly used to connect several conductors together or a single conductor to an appliance

NOTE A male (female) connector is a housing containing male (female) contacts and accessory items. A male connector can be permanently fixed to a wiring harness or to an appliance, e.g. an electronic control unit (ECU). A female connector is generally permanently fixed to a wiring harness.

3.2
housing
connector without its contacts

3.3
locking device
mechanical system preventing unmating of a connector, which can be released through a deliberate action

3.4
retainer
ring holding a shunt and providing coding and electrical insulation, generally made of plastic

3.5
short-circuit deactivation device
mechanical system used to open the short-circuit

3.6
short-circuited initiator
inert initiator with two pins internally short-circuited and with a shunt, used for testing

3.7
squib holder
part of the pyrotechnic device, holding the initiator and the retainer

4 Functional characteristics of mated connectors

4.1 General

Mated connectors shall conform to the requirements of 4.2 to 4.16.

Unless other specifications are given, the temperature classes to be taken into account for these tests (see ISO 8092-2) are class 2.

4.2 Visual examination

The test and corresponding requirements shall conform to ISO 8092-2.

4.3 Mating and unmating

The test shall be carried out in accordance with ISO 8092-2, by measuring the force applied on the connector.

The connector shall not be locked during the mating and unmating process unless otherwise specified.

The mating/unmating sequence shall conform to that illustrated in Figure 11.

The maximum connecting and disconnecting force measured on the connector shall be less than 40 N.

NOTE The movements of the mating sequence (see Figure 11) can be carried out simultaneously with the same force.

4.4 Resistance to tensile and compressive force between the connector and squib holder equipped with initiator and retainer

4.4.1 Test

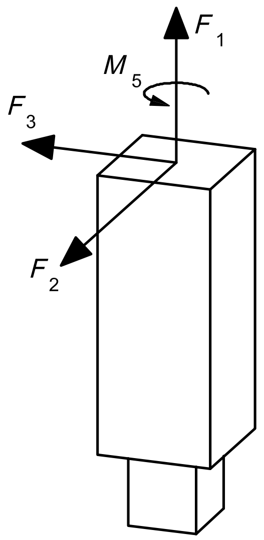
4.4.1.1 General

The connector shall be locked for testing.

This test is a destructive test carried out on an assembly comprising squib holder, initiator with pins and retainer.

4.4.1.2 Straight connectors

The test is carried out on a new sample, applying the forces in the directions shown in Figure 1 on the straight connector without its cable.



Key

F_1 tensile force

F_2, F_3 tensile and compressive forces

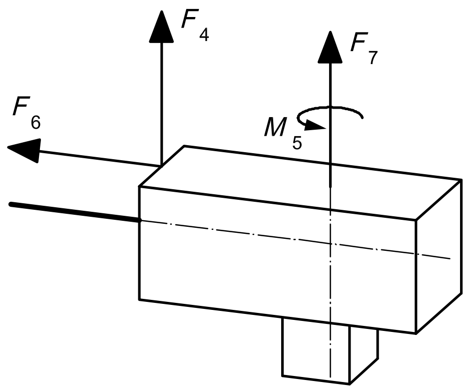
M_5 torque

Figure 1 — Direction of forces applied on straight connectors

4.4.1.3 Right angle connectors

The test is carried out on a new sample, applying the forces F_4 and F_6 on the connector body where the cable exits the connector, in the directions shown in Figure 2.

Apply the force F_7 in the central axis of the connector as shown in Figure 2.



Key

F_4, F_6 tensile and compressive forces

F_7 tensile force

M_5 torque

Figure 2 — Direction of forces applied on right angle connectors

4.4.2 Requirements

4.4.2.1 Straight connectors

Mated straight connectors shall be able to withstand minimum forces and torque indicated in Table 1.

Table 1 — Minimum tensile and compressive force values for straight connectors

Forces/torque applied to straight connectors	Minimum values of tensile/compressive forces or torque for straight connectors
F_1	120 N[a]
F_2	80 N
F_3	80 N
M_5	1,5 Nm

[a] For the test carried out with force F_1, after 10 cycles, the value of the minimum force is 100 N.

4.4.2.2 Right angle connectors

Mated right angle connectors shall be able to withstand minimum forces and torque indicated in Table 2.

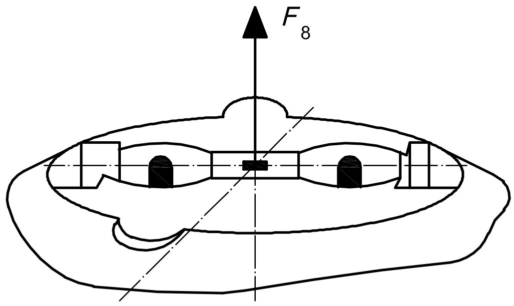
Table 2 — Minimum values of tensile/compressive forces or torque for right angle connectors

Forces/torque applied to right angle connectors	Minimum values of tensile/compressive forces or torque for right angle connectors
F_4	70 N
F_6	80 N
F_7	100 N
M_5	1,5 Nm

4.5 Mechanical strength of the retainer in the squib holder

4.5.1 Test

The test is carried out on a new sample, by applying the forces in the directions shown in Figure 3 on the retainer installed in the squib holder.



Key

F_8 force applied to retainer installed in squib holder

Figure 3 — Direction of forces applied to the retainer installed in the squib holder

4.5.2 Requirements

The retainer installed in the squib holder without mated connector shall withstand minimum force F_8 indicated in Table 3.

Table 3 — Minimum force applied to the retainer installed in the squib holder

Force applied to the retainer installed in the squib holder	Minimum value of force applied to the retainer installed in the squib holder
F_8	10 N

4.6 Combination of temperature/humidity/vibration

4.6.1 Test

Samples from a series application are assembled with a cable, mated and preconditioned for 48 h in a ventilated heat chamber at (65 ± 2) °C.

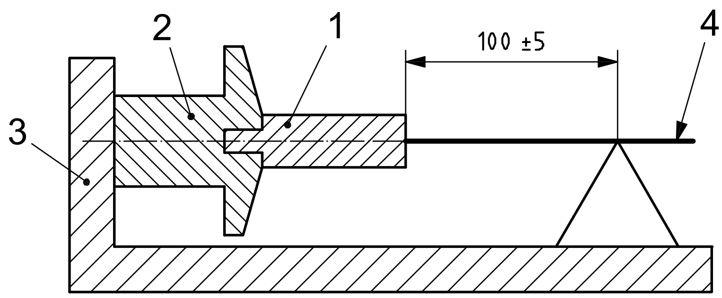
The mated connectors are then secured to a vibrating table with the pins connected in series on the short-circuited initiator side and connected to a direct current source delivering an intensity of 50 mA, so that the variation in contact resistance can be determined throughout the test. Apply the frequency variations indicated in Table 4 to the connection by logarithmic modulation of 1 octave/min for 48 h per axis (i.e. 144 h in total) using the test setup described in Figures 4 and 5.

Table 4 — Test parameters for combined temperature/humidity/vibration test

Frequency, f Hz	Displacement/ acceleration
$5 \leqslant f \leqslant 25$	± 1,2 mm
$25 < f \leqslant 200$	3 g[a]
$200 < f \leqslant 2\,000$	1 g

[a] The conventional value for acceleration due to gravity is 9 806 65 m/s^2.

Dimensions in millimetres



Key

1 straight connector being tested

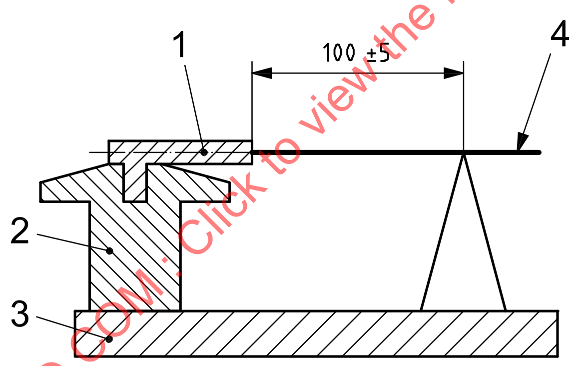
2 short-circuited initiator

3 vibrating table

4 cable fixed without tension force on connector

Figure 4 — Straight connector mounting for combined temperature/humidity/vibration test

Dimensions in millimetres



Key

1 right angle connector being tested

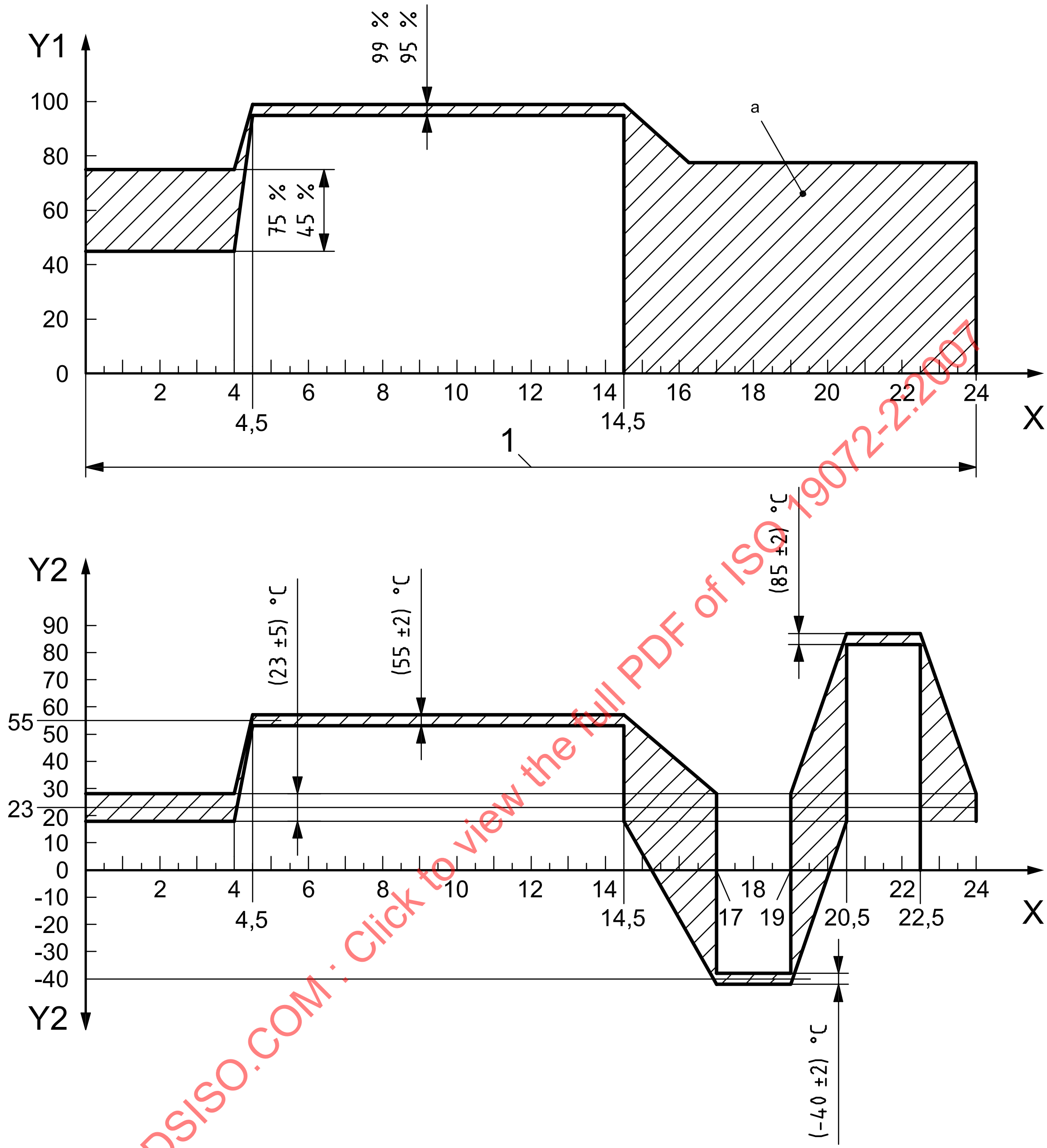
2 short-circuited initiator

3 vibrating table

4 cable fixed without tension force on connector

Figure 5 — Right angle connector mounting for combined temperature/humidity/vibration test

This test is carried out in a heat chamber in which the relative humidity and temperature variation cycle, applied at the same time as the vibration cycle, shall conform to Figure 6.



Key

X time, in hours

Y1 relative humidity, %

Y2 temperature of the test chamber, °C

1 one cycle

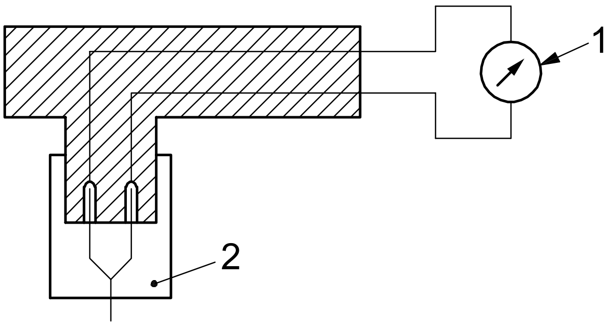
[a] Relative humidity is not monitored in this range for temperatures of less than 0 °C.

Figure 6 — Temperature cycle for the combined temperature/humidity/vibration test

4.6.2 Requirements

Variation of contact resistance is measured continuously during the test. It shall never exceed 50 mΩ. The minimum recording threshold is set at 25 mΩ.

Contact resistance shall be measured using the test setup shown in Figure 7. The resistance of the wires and pins, except the contact resistance, shall be subtracted from the measurement.



Key

1 resistance monitoring unit in accordance with ISO 8092-2

2 short-circuited initiator

Figure 7 — Test setup used to measure contact resistance

4.7 Coding

4.7.1 Test

The test consists of carrying out a mating test (see 4.3) between a connector and a counter-part of different coding.

4.7.2 Requirements

It shall be impossible to make electrical connection with a force less than or equal to 100 N.

It shall be impossible to open the shorting bar with a force less than or equal to 150 N.

4.8 Polarization

4.8.1 Test

The test consists of carrying out a mating test (see 4.3) between a connector and a counter-part in all positions other than the correct position.

4.8.2 Requirements

It shall be impossible to make electrical connection with a force less than or equal to 100 N.

It shall be impossible to open the shorting bar with a force less than or equal to 200 N.

4.9 Contact resistance (voltage drop), millivolt test

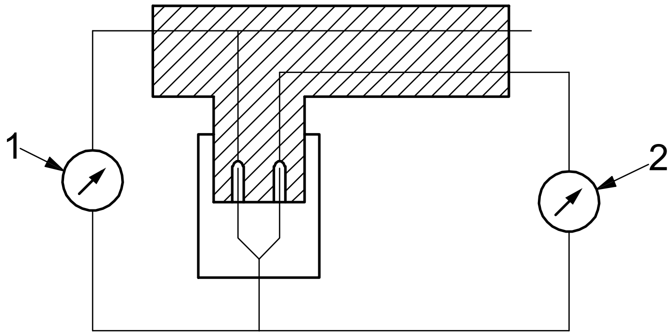
4.9.1 Test

4.9.1.1 General

The test voltage shall not exceed 20 mV under direct current, or 20 mV peak voltage under alternating current in open circuit. The intensity of the test current shall not exceed 100 mA.

4.9.1.2 Signal contact resistance

Signal contact resistance shall be measured using the test setup shown in Figure 8.



Key

1 resistance monitoring unit 1 in accordance with ISO 8092-2

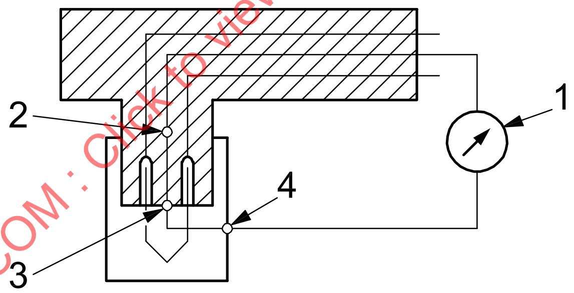
2 resistance monitoring unit 2 in accordance with ISO 8092-2

Figure 8 — Test setup used to measure signal contact resistance (millivolt test)

4.9.1.3 Ground contact resistance

Ground contact resistance shall be measured using the test setup shown in Figure 9.

Ground contact resistance does not include internal resistance of the squib holder and cable.



Key

1 resistance monitoring unit 1 in accordance with ISO 8092-2

2 retainer – connector 3rd way contact

3 retainer – squib holder contact

4 measurement point on squib holder outer surface

Figure 9 — Test setup used to measure ground contact resistance (millivolt test)

4.9.2 Requirements

4.9.2.1 Maximum signal contact resistance

Maximum signal contact resistance shall conform to the values given in Table 5.

Signal contact resistance does not include internal resistance of the initiator and cable.

Table 5 — Maximum signal contact resistance

Pin category	Signal contact resistance	
	Initial maximum value	Maximum value after tests
∅ 1 mm	6 mΩ	Initial value + 4 mΩ

4.9.2.2 Maximum contact resistance between ground and squib holder

Maximum contact resistance between ground and squib holder shall conform to the values given in Table 6.

Table 6 — Maximum contact resistance between ground and squib holder

Maximum contact resistance between ground and squib holder	
Initial maximum value	Maximum value after tests
100 mΩ	500 mΩ

4.10 Insulation resistance

The test and corresponding requirements shall conform to ISO 8092-2.

4.11 Withstand voltage

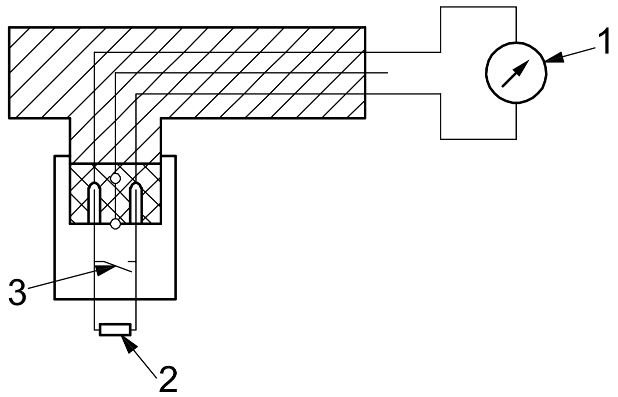
The test and corresponding requirements shall conform to ISO 8092-2, except for the test measurement voltage, which is set at 750 V for alternating current and 1 000 V for direct current.

4.12 Thermal ageing

The test and corresponding requirements shall conform to ISO 8092-2.

4.13 Opening and closing of the short-circuit

The test setup used to detect ground and short-circuit is shown in Figure 10.



Key

1 resistance monitoring unit 1 in accordance with ISO 8092-2

2 test resistance of (10 ± 0,1) Ω

3 retainer short-circuit

Figure 10 — Test setup used to detect ground and short-circuit

Functional sequence requirements for the opening and closing of the short-circuit are illustrated in Figure 11. This sequence shall be observed regardless of the connector orientation.

Connector mating phases 1 and 2 may be realised in 1 or 2 operations.

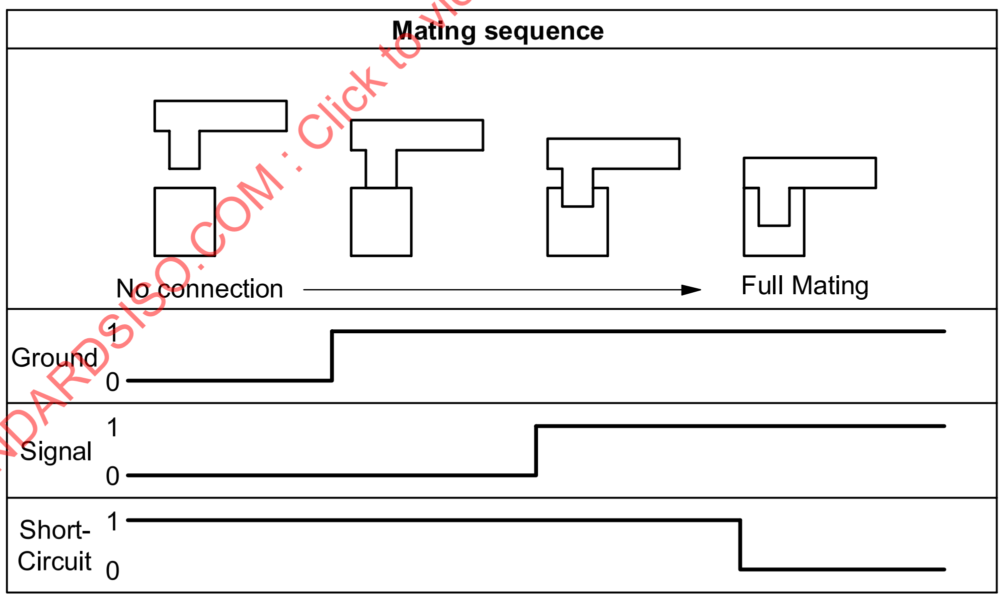
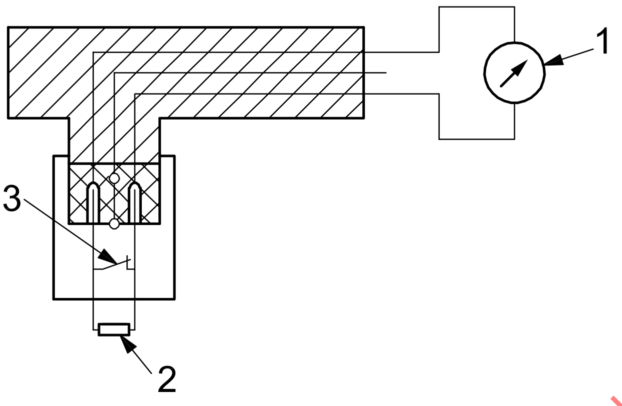


Figure 11 — Mating sequence

4.14 Short-circuit resistance

4.14.1 Test

The test setup shown in Figure 12 shall be used to create the short-circuit and measure electrical resistance on the resistance monitoring unit.



Key

1 resistance monitoring unit in accordance with ISO 8092-2

2 opened initiator (R1)

3 short-circuit electrical connection (R2)

NOTE R1 > R2.

Figure 12 — Test setup used to measure short-circuit resistance

4.14.2 Requirements

Before and after environment tests, the resistance shall be measured no more than 300 mΩ.

4.15 Rapid change of temperature (thermal shock)

The test and corresponding requirements shall conform to ISO 8092-2.

4.16 Chemical fluids

The test and corresponding requirements shall conform to ISO 8092-2.

5 Test sequences

The test sequences for each group of samples are shown in Table 7.

Each group shall contain at least 10 samples.

Unless other specifications are given, all the samples in a test group shall be used for the test.

Table 7 — Test sequences and requirements

Test		Group of test samples																	Requirement
Title	Sub-clause	A		B		C		D			E		F		G		H		Sub-clause
Visual examination	4.2	1[a]	3[a]	1[a]	6[a]	1[a]	5[a]	1[a]		9[a]	1[a]	3[a]	1[a]	6[a]	1[a]	6[a]	1[a]	6[a]	4.2
Mating and unmating First operation	4.3			2[a]													3[a]		4.3
Mating and unmating Tenth operation	4.3							3[a]							2[a]		4[a]		4.3
Resistance to tensile and compressive force between the connector and squib holder equipped with initiator and retainer	4.4.1			5[a]															4.4.2
Mechanical strength of the retainer in the squib holder	4.5.1														5[a]				4.5.2
Combination of tempera-ture/humidity/vibration	4.6.1					3[a]							3[a]						4.6.2
Coding	4.7.1	2[a]																	4.7.2
Polarization	4.8.1										2[a]								4.8.2
Contact resistance (voltage drop), millivolt test Signal contact Ground contact	4.9.1			3[a]				2[a]	4[a]	6[a]			2[a]	4[a]					4.9.2
Insulation resistance	4.10							7[a]											4.10
Withstand voltage	4.11							8[a]					5[a]				5[a]		4.11
Thermal ageing	4.12														4[a]				4.12
Opening and closing of the short-circuit	4.13														3[a]				4.13
Short-circuit resistance	4.14.1			4[a]		2[a]	4[a]												4.14.2
Rapid change of temperature (thermal shock)	4.15							5[a]											4.15
Chemical fluids	4.16																2[a]		4.16

[a] Numbers indicate the order in which the tests are carried out, for each group of samples.

Annex A
(normative)

Sealed variant of the pyrotechnic device/initiator harness connector assembly

A.1 Functional characteristics of mated connectors

A.1.1 General

For the sealed design, Clauses 2 to 5 are applicable with the exception of Table 7, which is replaced by Table A.1.

Unless otherwise agreed between customer and supplier, the temperature classes to be taken into account for these tests (see ISO 8092-2) are class 3.

A.1.2 Mating and un-mating

The maximum connecting and disconnecting force measured on the connector shall be less than 60 N.

A.2 Validation tests

Test IPX9K as described in ISO 20653 shall be used.

A.3 Test sequences

The test sequences for each group of samples are shown in Table A.1.

Each group shall contain at least 10 samples.

Unless other specifications are given, all the samples in a test group shall be used for the test.

