Title **050 20P HDR FOR DCB**

4.12 Insertion force or actuation force for insertion and removal aids

4.13 Visual inspection

PG 9 Insertion inclination/misuse safe (scoop-proofing)

4.14 Visual inspection

PG 12 Current heating, derating

4.15 Visual inspection

PG 13 Housing influence on the derating

4.16 Visual inspection

PG 14 Thermal time constant

4.17 Visual inspection

PG 15 Electrical stress test

4.18 Visual inspection

4.19 Contact Resistance

4.20 Derating without housing

4.21 Temperature/current cycle

4.22 Contact Resistance

4.23 Humid heat

4.24 Contact Resistance

4.25 Temperature/current cycle

4.26 Contact Resistance

4.27 Derating without housing

4.28 Visual inspection

PG 17 Dynamic load

4.29 Visual inspection

4.30 Contact Resistance

4.31 Random vibration

4.32 Contact Resistance

4.33 Visual inspection

4.34 Endurance shocks

4.35 Contact Resistance

4.36 Visual inspection

4.37 Resonance frequency, contact assembly

4.38 Visual inspection

4.39 Contact Resistance

4.40 Salt spray, cyclic

4.41 Contact Resistance

4.42 Visual inspection

PG 20 Climate load of housing

4.43 Visual inspection

4.44 Insulation resistance

4.45 Aging in dry heat

4.46 Humid heat, constant

4.47 Insulation resistance

4.48 Visual inspection

4.49 Low-temperature aging

4.50 Removal and insertion at -20℃

4.51 Visual inspection

PG 21 Long-term temperature aging

4.52 Visual inspection

4.53 Contact Resistance

4.54 Long-temperature aging

4.55 Contact Resistance

4.56 5 x completed locking and completed disconnection

4.57 Visual inspection

PG 22B Chemical resistance

4.58 Visual inspection

4.59 Insulation resistance

4.60 Chemical resistance 48h

4.61 Insulation resistance

4.62 Visual inspection

4.63 Dimensions All parts

PG 23 Water leak tightness

4.64 Visual inspection

4.65 Aging in dry heat

4.66 Temperature shock

4.67 Visual inspection

4.68 Immersion with pressure difference

4.69 Visual inspection

4.70 Thermal shock test

4.71 Visual inspection

4.72 Degree of protection test IP X9K

4.73 Insulation resistance

4.74 Visual inspection

4.75 Dimensions All parts

PG 28A Locking noise

4.76 Visual inspection

4.77 Aging 28h at RT

4.78 Locking noise

4.79 Visual inspection

5 Test matrix

5.1 Test matrix for contacts

5.2 Test matrix for housings

5.3 Test matrix for seals and additional tests

6 History and Approval

1. Scope

This SPEC defines the test method for low voltage connectors (connector) and low voltage terminals (terminal).

2. Quality

The quality of connector must meet each characteristic at column 3 with items of test in table 1.

3. Requirements

NO	Test Description	Acceptance Criteria	Measuring method
PG 0 Inspection of as-received condition			
PG 0-1	Visual inspection	Inspect for defects	4.1
PG 0-2	Contact Resistance	-1.2mm Rr ≤ 15mΩ	4.2
PG 0-3	Insulation resistance	R > 100Mohms @ 500 VDC for 60s	4.3
PG 1 Dimensions			
PG 1-1	Visual inspection	Inspect for defects	4.4
PG 2 Material and surface analysis, contacts			
PG 2-1	Visual inspection	Inspect for defects	4.5
PG 3 Material and surface analysis, housings and single-wire seals			
PG 3-1	Visual inspection	Inspect for defects	4.6
PG 4 Contact engagement length			
PG 4-1	Visual inspection	Inspect for defects	4.7
PG 4-2	Contact engagement length	1.00mm min	4.8
PG 7 Handling and functional reliability of the housing			
PG 7-1	Visual inspection	Inspect for defects	4.9
PG 7-2	Error-proof design of housings	Polarizing efficiency > 3 times the insertion force	4.10
PG 7-3	Retention force, housing locking	100N Min	4.11
PG 7-4	Insertion force or actuation force for insertion and removal aids	Max 75N	4.12
PG 7-5	Visual inspection	Inspect for defects	4.13
PG 9 Insertion inclination/misuse safe (scoop-proofing)			
PG 9-1	Visual inspection	Inspect for defects	4.14
PG 12 Current heating, derating			
PG 12-1	Visual inspection	Inspect for defects	4.15

NO	Test Description	Acceptance Criteria	Measuring method
PG 13 Housing influence on the derating			
PG 13-1	Visual inspection	Inspect for defects	4.16
PG 14 Thermal time constant			
PG 14-1	Visual inspection	Inspect for defects	4.17
PG 15 Electrical stress test			
PG 15-1	Visual inspection	Inspect for defects	4.18
PG 15-2	Contact Resistance	-1.2mm Rr ≤ 15mΩ	4.19
PG 15-3	Derating without housing		4.20
PG 15-4	Temperature/current cycle 40℃/140℃ 360hr		4.21
PG 15-5	Contact Resistance	-1.2mm Rr ≤ 15mΩ	4.22
PG 15-6	Humid heat, Humidity 25℃/55℃, 95%21 Days		4.23
PG 15-7	Contact Resistance	-1.2mm Rr ≤ 15mΩ	4.24
PG 15-8	Temperature/current cycle 40℃/140℃ 360hr		4.25
PG 15-9	Contact Resistance	-1.2mm Rr ≤ 15mΩ	4.26
PG 15-10	Derating without housing		4.27
PG 15-11	Visual inspection	Inspect for defects	4.28
PG 17 Dynamic load			
PG 17-1	Visual inspection	Inspect for defects	4.29
PG 17-2	Contact Resistance	-1.2mm Rr ≤ 15mΩ	4.30
PG 17-3	Random vibration -Body Sealed -Circuit Continuity Monitoring	Resistance>7Ω >1μs	4.31
PG 17-4	Contact Resistance	-1.2mm Rr ≤ 15mΩ	4.32
PG 17-5	Visual inspection	Inspect for defects	4.33
PG 17-6	Endurance shocks	Resistance>7Ω >1μs	4.34
PG 17-7	Contact Resistance	-1.2mm Rr ≤ 15mΩ	4.35
PG 17-8	Visual inspection	Inspect for defects	4.36
PG 17-9	Resonance frequency, contact assembly	Reference	4.37

NO	Test Description	Acceptance Criteria	Measuring method
PG 18 Coastal climate load			
PG 18-1	Visual inspection	Inspect for defects	4.38
PG 18-2	Contact Resistance	-1.2mm Rr ≤ 15mΩ	4.39
PG 18-3	Salt spray, cyclic Severity 3		4.4
PG 18-4	Contact Resistance	-1.2mm Rr ≤ 15mΩ	4.41
PG 18-5	Visual inspection	Inspect for defects	4.42
PG 20 Climate load of housing			
PG 20-1	Visual inspection	Inspect for defects	4.43
PG 20-2	Insulation resistance	R > 100Mohms @ 500 VDC for 60s	4.44
PG 20-3	Aging in dry heat 130℃, 120h		4.45
PG 20-4	Humid heat, constant 55℃, 95%, 10 Days		4.46
PG 20-5	Insulation resistance	R > 100Mohms @ 500 VDC for 60s	4.47
PG 20-6	Visual inspection	Inspect for defects	4.48
PG 20-7	Low-temperature aging -40℃, 48h		4.49
PG 20-8	Removal and insertion at -20℃	Possible to open and Re-close the connector Even at -20℃	4.50
PG 20-9	Visual inspection	Inspect for defects	4.51
PG 21 Long-term temperature aging			
PG 21-1	Visual inspection	Inspect for defects	4.52
PG 21-2	Contact Resistance	-1.2mm Rr ≤ 15mΩ	4.53
PG 21-3	Long-temperature aging 130℃, 1000h Subsequent 48h at RT		4.54
PG 21-4	Contact Resistance	-1.2mm Rr ≤ 15mΩ	4.55
PG 21-5	5 x completed locking and completed disconnection		4.56
PG 21-6	Visual inspection	Inspect for defects	4.57

NO	Test Description	Acceptance Criteria	Measuring method
PG 22B Chemical resistance			
PG 22-1	Visual inspection	Inspect for defects	4.58
PG 22-2	Insulation resistance	R > 100Mohms @ 500 VDC for 60s	4.59
PG 22-3	Chemical resistance 48h		4.6
PG 22-4	Insulation resistance	R > 100Mohms @ 500 VDC for 60s	4.61
PG 22-5	Visual inspection	Inspect for defects	4.62
PG 22-6	Dimensions All parts		4.63
PG 23 Water leak tightness			
PG 23-1	Visual inspection	Inspect for defects	4.64
PG 23-2	Aging in dry heat 130℃, 120h		4.65
PG 23-3	Temperature shock -40℃/130℃ 72hr		4.66
PG 23-4	Visual inspection	Inspect for defects	4.67
PG 23-5	Immersion with pressure difference -10kPa, 5 min -50kPa, 5 min		4.68
PG 23-6	Visual inspection	Inspect for defects	4.69
PG 23-7	Thermal shock test 120℃, 30min 0℃ water, 15 min, 5 cycle		4.7
PG 23-8	Visual inspection	Inspect for defects	4.71
PG 23-9	Degree of protection test IP X9K		4.72
PG 23-10	Insulation resistance	R > 100Mohms @ 500 VDC for 60s	4.73
PG 23-11	Visual inspection	Inspect for defects	4.74
PG 23-12	Dimensions All parts		4.75
PG 28A Locking noise			
PG 28-1	Visual inspection	Inspect for defects	4.76
PG 28-2	Aging 28h at RT		4.77
PG 28-3	Locking noise	70dB(A) Min. Ambient noise must be at least 7dB(A)	4.78
PG 28-4	Visual inspection	Inspect for defects	4.79

< Table 1 Test List >

4. Requirements Measuring Method

PG0 Inspection of as-received condition
Aim: Basic examination of all contact and housing parts in the unused condition, without prior loads.
Requirement: Determination of deviations from a given target state

4.1 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

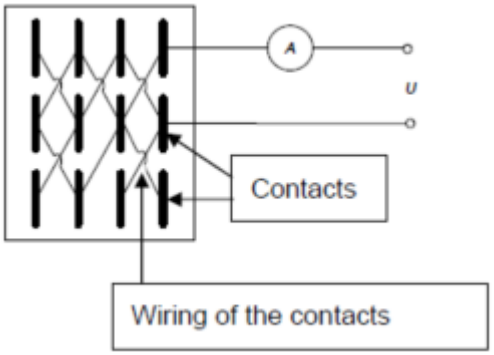
The basic mechanical functions of the connector must be checked as part of the visual inspection.

4.2 Contact resistance (DIN EN 60512-2-1)
- Contact parts: 10 DUTs per variant
- Line cross-section: all cross-sections that occur

The measured values must correspond to the manufacturer's specifications. The limits must be complied with, and the measured values (initial value, final value, standard deviation, and resistance change of the respective DUTs) must be documented accordingly in the test report.

4.3 Insulation resistance (DIN EN 60512-3-1)
- Contact parts: arbitrary
- Housings: 1 housing per injection mold

Insulation resistance between all adjacent contacts



<Figure 4-1>

Requirement:
* Riso > 100 MΩ at U = 500 V, t = 60 s
* Riso = insulation resistance
* U = DC test voltage
* T = read cycle time

PG 1 Dimensions
Aim: Dimensional inspection of all contact parts, housing parts, and single-wire seals
- Batch size: 1 piece per die or mold
- Contact parts: all crimped and non-crimped variants that occur; for permissible double crimps, see Table 4.1
- Housings: all variants that occur
- Single-wire seals: all variants that occur

Possible conductor cross-section combinations for double crimp, solderless connections								
		Conductor 1						
	mm^2	0,35	0,50	0,75	1,0	1,5	2,5	4,0
Conductor 2	0,35	X	X					
	0,50	X	X	X				
	0,75		X	X	X			
	1,0			X	X	X		
	1,5				X	X	X	
	2,5					X	X	X
	4,0						X	X

Only insulation reduced cables with stranded wire conductors must be used.
Solid conductors are not permissible.
The use of double crimps is not permissible with coaxial cables, individual cable sealing systems, or on the engine and gearbox

[Table 4.1 Double crimp]

4.4 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

PG 2 Material and surface analysis, contacts
Aim: Determination of all material parameters of metal parts
- Batch size: 5 pieces
- Test object: all materials and surfaces that occur

4.5 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

PG 3 Material and surface analysis, housings and single-wire seals
Aim: Determination of all material parameters of plastic and silicone parts
- Batch size: 1 component per injection mold
- Housings: all variants that occur
- Single-wire seals: all variants that occur

4.6 Visual inspection (evaluate injection faults, e.g., burrs) (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

PG 4 Contact engagement length
Aim: Documentation of the minimum required contact engagement length under all worst conditions,

including using theoretical studies (e.g., CAD)

- Batch size: 3 housings
  Up to 5-pin, fully equipped; for 6-pin and above, with 5 contacts
- Contact parts: all variants that occur, line cross-section and surface arbitrary
- Housings: all variants that occur, keying and color arbitrary

4.7 Visual inspection (DIN EN 60512-1-1)

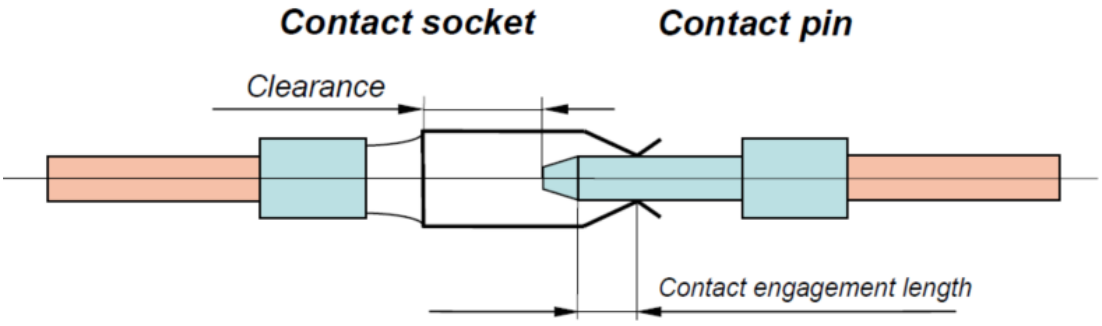
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

4.8 Contact engagement length

The contact engagement length and the required clearance (according to the manufacturer's specifications) from the pin tip to the contact bottom must be documented computationally under all worst conditions of the contacts and housings and their locks (including, e.g., pulling on the line until all locks are at the stop). The contact pin and the contact socket must touch only at the contact points.

Definition of contact engagement length (Figure 4-2)



<Figure 4-2> Contact engagement length of a pin-socket pair

Contact engagement length is defined as the length at which a contact pin penetrates the contact socket with its full cross-section. Measurements are taken from the contact point of the socket contact to the end of the insertion bevel at the full cross-section.

The distance between the pin tip and the contact bottom is called the clearance. This clearance is absolutely required for floating support of the contact in the cavity and must still be present taking into consideration all tolerances of the pin-socket pair.

Requirement:

- Contact engagement length: >1,00 mm (for all contact points)
- Clearance: >0 (in the worst case)
- A tolerance calculation with dimensional specification is required.

PG 7 Handling and functional reliability of the housing

Aim: Housing test, documentation of the holding and actuation forces

- Batch size: at least 10 equipped and unequipped housings;
- New components can be used for each of the following properties tests within this test group.
- Housings: all variants that occur

4.9 Visual inspection (DIN EN 60512-1-1)

- Contact parts: all variants that occur
- Housings: all variants that occur

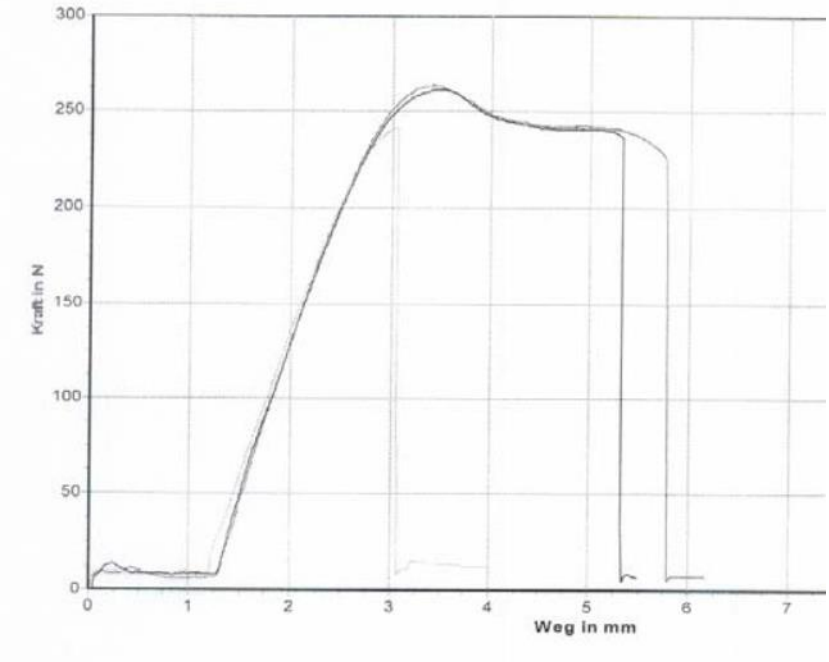
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

4.10 Error-proof design of housings (unequipped housings) (DIN EN 60512-13-5) (keying/polarizing)

4.11 Retention force, housing locking (DIN EN 60512-15-6)

Applicable to housings for inline plug-in connections and device-mounted plug-in connections.
Sample preparation: 10 complete connector couplings without contacts.
If the connector housings have a CPA, the tests must be performed both with the CPA open and with the CPA closed.
The DUTs must be fastened in the tensile testing machine with suitable holders so that the housings are not damaged or deformed. The force must be applied opposite the plugging direction of the housings. The maximum force on the first displacement millimeter is defined as the retention force (see Figure 4-3).



<Figure 4-3> Retention force load-displacement curve

4.12 Insertion force or actuation force for insertion and removal aids (fully equipped housings)

The insertion force in the plugging direction or actuation force of the insertion and removal aid must be measured. The insertion force (including for insertion aids) must always be measured in the actuation direction. The DUTs must be fastened in the tensile testing machine with suitable holders so that the housings are not damaged or deformed.

4.13 Visual inspection (DIN EN 60512-1-1)

- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

PG 9 Insertion inclination/misuse safe (scoop-proofing)

Aim: Documentation for housings that the inclined insertions that occur cannot damage the contact.

- Batch size: Examination is performed using CAD
- Contact parts: all variants that occur, so long as they can affect the insertion inclination
- Housings: all variants that occur, so long as they can affect the insertion inclination

4.14 Visual inspection (DIN EN 60512-1-1)

- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

PG 12 Current heating, derating

Aim: Documentation of the current carrying capacity of contacts

- Batch size: 3 contact-part pairs
- Contact parts: All surfaces are documented.

(Note: It is permissible to measure a surface and to derive the values of the other surfaces from it.)

- Line cross-section: all variants that occur
- Line length: according to DIN EN 60512-5-2
- Housings: without

4.15 Visual inspection (DIN EN 60512-1-1)

Current excess temperature: Loading with current, which must be increased incrementally, and measurement of the current excess temperature.

Note: The limit temperature of the derating graph is documented with the "Electrical stress test" test group one time for each material surface combination of the contact system.

Requirement:

The measured values must correspond to the manufacturer's specifications.

The following must be marked in the derating graph:

- The indication "free in air" must be contained.
- The 80% characteristic curve of the measured values must be represented in the graph (according to DIN EN 60512-5-2). The rated current is the current that can be read from the derating curve at 80 °C ambient temperature.
- The documentation of the results must contain the following:

Photograph of the contact with the temperature sensors and the temperature indications of the respective point. (Note: This is an examination for locating the hottest point.)

- The pin contact with which the derating has been determined must be indicated. The geometry, the base material, and the surface must be described. Unless otherwise agreed, the same line must be crimped on the pin contact as on the socket contact.

PG 13 Housing influence on the derating

Aim: Determination of the maximum housing influence on the derating by supplying current to all neighboring contacts at the same time.

- Batch size: 3 fully equipped housings in each case
- Contact parts: All surfaces are documented. (Note: It is permissible to measure a surface and to derive the values of the other surfaces from it.)
- Line cross-section: all cross-sections that occur, same cross section in one DUT
- Line length: according to DIN EN 60512-5-2
- Housings: Sealed or unsealed housings. For sealed housings, all sealing elements must be present. The number of pins

4.16 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

PG 14 Thermal time constant (current excess temperature at n times rated current)

Aim: Evaluation of briefly exceeding the max. current capacity (peaks)
- Batch size: 3 contact parts
- Contact parts: all materials that occur
- Line cross-section: maximum line cross-section
- Line length: according to DIN EN 60512-5-2
- Housings: with or without housings equipped with 1 contact part

4.17 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

PG 15 Electrical stress test

Aim: Functional evaluation of the upper limit temperature of the contact system specified by the manufacturer with current supply, temperature cycling, and humid heat.
- Batch size: at least 10 contact parts
- Contact parts: all materials and surfaces that occur
- Line cross-section: max. cross-section
- Line length: must be decided case-by-case
- Housings: must be decided case-by-case: free contact or unsealed housing

4.18 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

4.19 Contact resistance (DIN EN 60512-2-1)
- Contact parts: 10 DUTs per variant
- Line cross-section: all cross-sections that occur

The measured values must correspond to the manufacturer's specifications. The limits must be complied with, and the measured values (initial value, final value, standard deviation, and resistance change of the respective DUTs) must be documented accordingly in the test report.

4.20 Derating without housing (DIN EN 60512-5-2)

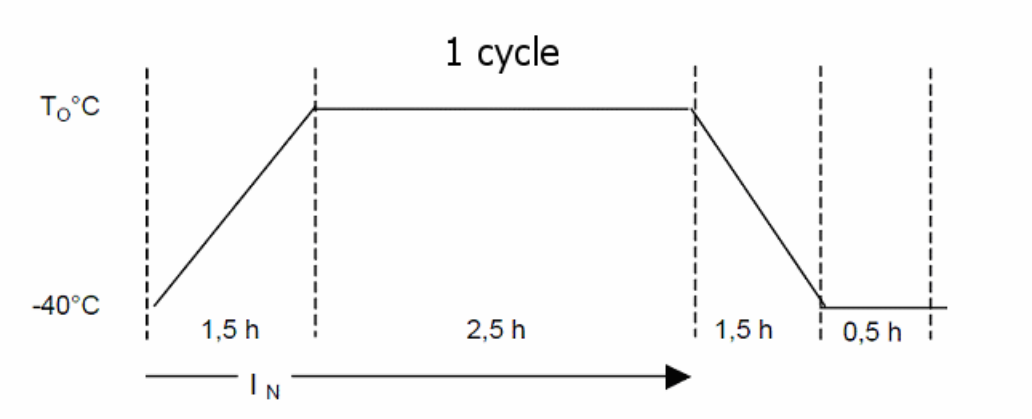
3 DUTs with the greatest contact resistance from the previous Contact resistance loading with test current. Monitoring of the voltage drop on the test specimens, documentation of the resistance on the test specimens.

It must be documented whether the test is performed with or without housings

4.21 Temperature/current cycle (-40℃/140℃ 360hr)
- Number of cycles: 60

Determination of the upper climate chamber temperature (before the start of the test):

T_0 is determined once at the start of the test such that after thermal equilibrium is established, the contact temperature corresponds to the limit temperature.
Description of a test cycle:
Temperature in climate chamber: -40 °C/T_0 (upper temperature in the climate chamber) For course, see graph in Figure 4-4.
Test current I_{test}: Is read from the derating curve at 80 °C ambient temperature. The test current is constant. Current supply according to Figure 4-4.
Contact temperature: The contact temperature is measured with temperature sensors at the contact in the climate chamber and is brought to the limit temperature by changing T_0.



< Figure 4-4. Temperature cycle>

* Temperature cycle with current supply: Temperature cycle with current supply at IN during the heat-up phase and the holding time at To

4.22 Contact resistance
Contact resistance continuous during 4.15 with test current
Measurement frequency: 1 measured value per 5 min

4.23 Humid heat, (Humidity 25℃/55℃, 95%, 21 Days)
- Number of cycles: 60
Determination of the upper climate chamber temperature (before the start of the test):
T_0 is determined once at the start of the test such that after thermal equilibrium is established, the contact temperature corresponds to the limit temperature.
Description of a test cycle:
Temperature in climate chamber: -40 °C/T_0 (upper temperature in the climate chamber) For course, see graph in Figure 4-4.
Test current I_{test}: Is read from the derating curve at 80 °C ambient temperature. The test current is constant. Current supply according to Figure 4-4.
Contact temperature: The contact temperature is measured with temperature sensors at the contact in the climate chamber and is brought to the limit temperature by changing T_0

4.24 Contact resistance
Contact resistance continuous during 4.25 with test current
Measurement frequency: 1 measured value per 5 min

4.25 Temperature/current cycle (-40℃/140℃ 360hr)
- Number of cycles: 60
Determination of the upper climate chamber temperature (before the start of the test):
T_0 is determined once at the start of the test such that after thermal equilibrium is established, the contact temperature corresponds to the limit temperature.
Description of a test cycle:

Temperature in climate chamber: -40 °C/T_o (upper temperature in the climate chamber) For course, see graph in Figure 4-4.

Test current I_{test}: Is read from the derating curve at 80 °C ambient temperature. The test current is constant. Current supply according to Figure 4-4.

Contact temperature: The contact temperature is measured with temperature sensors at the contact in the climate chamber and is brought to the limit temperature by changing T_o

4.26 Contact resistance (DIN EN 60512-2-1)

- Contact parts: 10 DUTs per variant
- Line cross-section: all cross-sections that occur

The measured values must correspond to the manufacturer's specifications. The limits must be complied with, and the measured values (initial value, final value, standard deviation, and resistance change of the respective DUTs) must be documented accordingly in the test report.

4.27 Derating without housing (DIN EN 60512-5-2)

3 DUTs with the greatest contact resistance from the previous Contact resistance loading with test current. Monitoring of the voltage drop on the test specimens, documentation of the resistance on the test specimens.

It must be documented whether the test is performed with or without housings

4.28 Visual inspection (DIN EN 60512-1-1)

Requirement:

- The contact opening dimension is documented.
- The resistance limits of the Table 4.2 must not be exceeded.
- For the derating before and after the test, the current carrying capacity at 80 °C ambient temperature may change at most by 20% relative to the derating at the start of the PG.

	Group 1						Group 2					Group 3	
Conductor cross-section in mm2/contact size in mm	0,13	0,22	0,35	0,5	0,75	1,0	1,5	2,5	4	6	10	16	>16
0,63	30	30	15	15	15	-	-	-	-	-	-	-	-
1,2	20	20	15	15	15	15	10	-	-	-	-	-	-
1,5	-	15	15	15	15	15	10	10	-	-	-	-	-
2,8	-	15	15	15	15	10	10	10	5	-	-	-	-
4,8–6,3	-	10	10	8	8	8	5	5	3	3	2	-	-
8	-	-	-	-	-	-	-	3	3	3	2	2	-
9,5–12	-	-	-	-	-	-	-	-	3	2	2	1	1

[Table 4.2 Resistance limits]

PG 17 Dynamic load

Aim: General requirements

- Batch size: at least 10 contact parts, distributed among at least 2 housings
- Contact parts: all variants that occur
- Line cross-section: to be determined on a case-by-case basis
- Housings: sealed/not sealed, to be specified individually
- Lines: The insulation must withstand the test temperature

Line type (from LV 112) must be documented in the test report.

The contact resistance is measured before and after each spatial axis in the clamped and firmly wired state (before it is converted to a new axis). In order to document the freedom from resonance of the clamping device, a resonance analysis must be performed in the designated frequency range before the start of the vibration test (load: 1 g); this is not a component test but rather an examination of the test setup.

4.29 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

4.30 Contact resistance (DIN EN 60512-2-1)
- Contact parts: 10 DUTs per variant
- Line cross-section: all cross-sections that occur

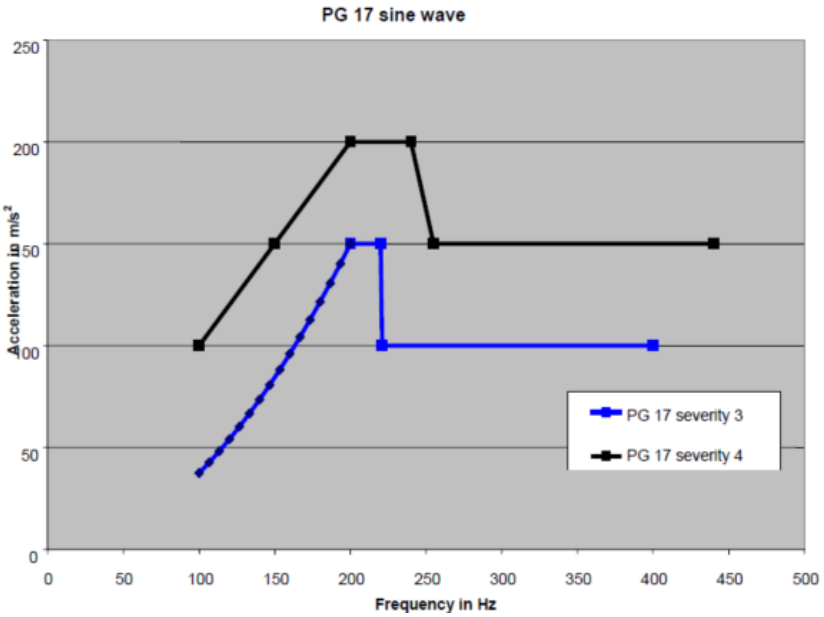
The measured values must correspond to the manufacturer's specifications. The limits must be complied with, and the measured values (initial value, final value, standard deviation, and resistance change of the respective DUTs) must be documented accordingly in the test report.
Contact resistance continuous during 4.31 with test current (100 mA)
- Measurement frequency: 1 measured value per min

4.31 Random vibration (Body Sealed, Circuit Continuity Monitoring) (DIN EN 60068-2-64)
Severity: see Table 4.3

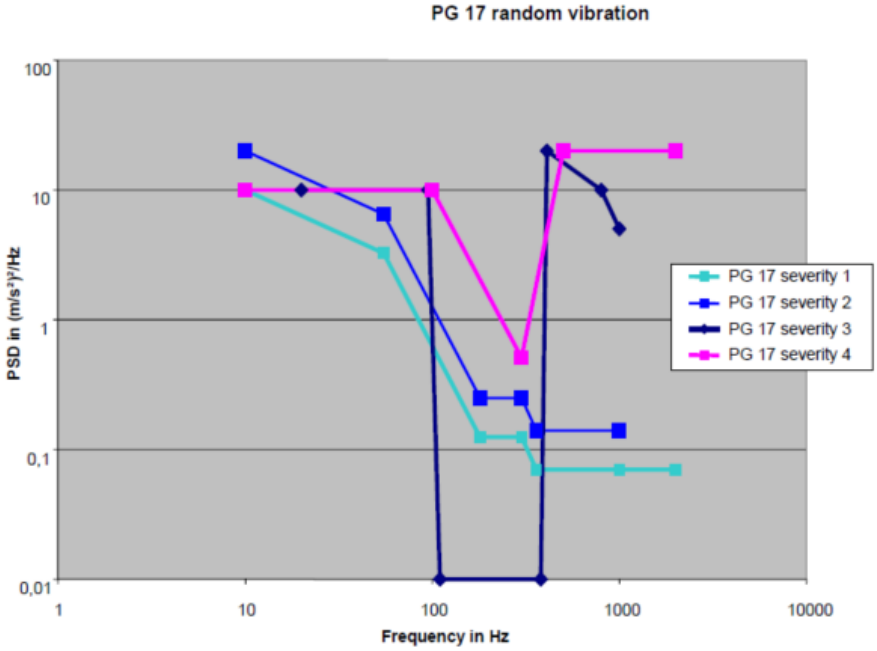
Severity	TC (temperature cycle)	Random vibration with TC		Sine wave with TC	No. of shocks
1) "Body" unsealed	0 min/20 °C 60 min/-40 °C 150 min/-40 °C 300 min/105 °C 420 min/105 °C 480 min/20 °C	8 h per axis RMS value of acceleration 19,7 m/s² Hz 10 55 180 300 360 1 000	 (m/s²)²/Hz 10 3,25 0,125 0,125 0,07 0,07	No sine wave	A = 30 g T = 6 ms sinusoidal half-wave No. of shocks: 6000
2) "Body" sealed	0 min/20 °C 60 min/-40 °C 150 min/-40 °C 300 min/120 °C 420 min/120 °C 480 min/20 °C	20 h per axis RMS value of acceleration 27,8 m/s² Hz 10 55 180 300 360 1 000	 (m/s²)²/Hz 20 6,5 0,25 0,25 0,14 0,14	No sine wave	A = 30 g T = 6 ms sinusoidal half-wave No. of shocks: 6000

Severity	TC (temperature cycle)	Random vibration with TC		Sine wave with TC		No. of shocks
3) "Applications close to powertrain"	0 min/20 °C 60 min/-40 °C 150 min/-40 °C 300 min/120 °C 420 min/120 °C 480 min/20 °C	22 h per axis RMS value of acceleration 105,5 m/s²		22 h per axis		
		Hz	(m/s²)²/Hz	Hz	mm	
		20	10	100	0,095	
		95	10	Hz	m/s²	
		110	0,01	200	150	
		380	0,01	220	150	
		410	20	221	100	
		800	10	400	100	
		1 500	5			
4) "Engine-mounted parts" Requirement B	0 min/20 °C 60 min/-40 °C 90 min/-40 °C 240 min/140 °C 420 min/140 °C 480 min/20 °C	22 h per axis RMS value of acceleration 181 m/s²		22 h per axis		
		Hz	(m/s²)²/Hz	Hz	m/s²	
		10	10	100	100	
		100	10	150	150	
		300	0,51	200	200	
		500	20	240	200	
		2 000	20	255	150	
				440	150	

[Table 4.3 Severity]



< Figure 4-5. Sine wave test profile>



< Figure 4-5. Random vibration test profile>

Note

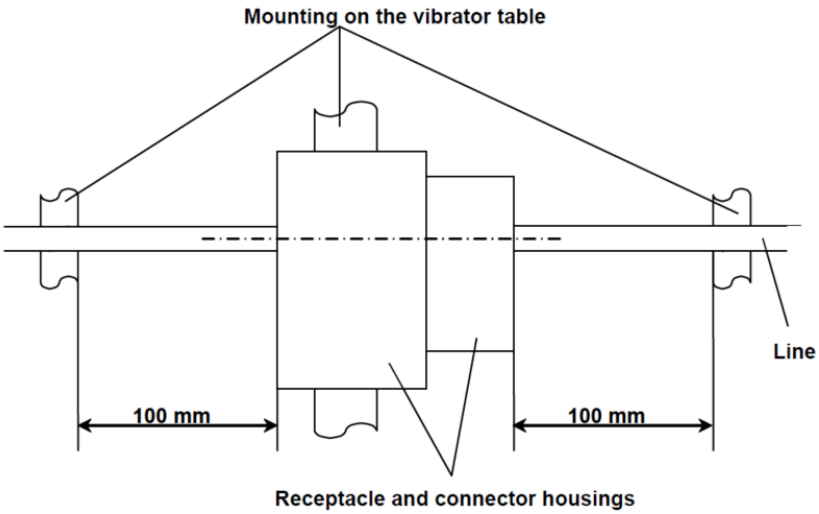
DUTs mounted on the vibration generator according to Figure 4-6 or Figure 4-7

For especially critical installation conditions, special agreements must be made between the manufacturer and user.

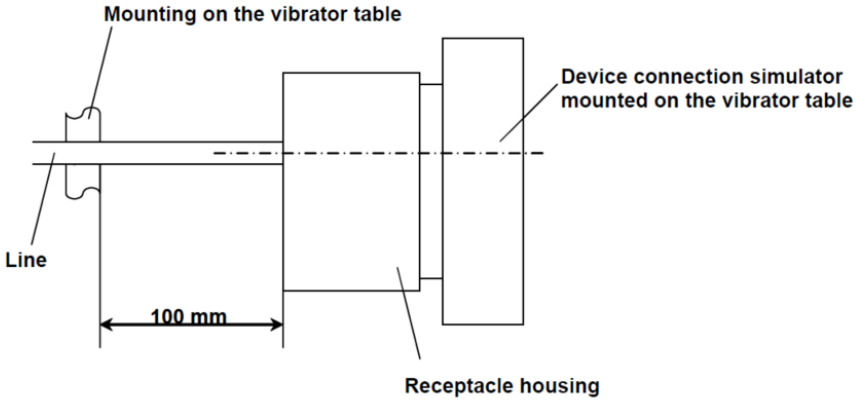
Requirement:

The maximum values of the Table 4-1 must not be exceeded.

Documentation of the tested profile and results in the specified form (e.g., form, customer drawing, and possibly in OEM-specific databases required).



< Figure 4-6. Mounting on vibrator table, coupling>



< Figure 4-7. Mounting on vibrator table, device connection>

4.32 Contact resistance (DIN EN 60512-2-1)
- Contact parts: 10 DUTs per variant
- Line cross-section: all cross-sections that occur

The measured values must correspond to the manufacturer's specifications. The limits must be complied with, and the measured values (initial value, final value, standard deviation, and resistance change of the respective DUTs) must be documented accordingly in the test report.
Contact resistance continuous during 4.33 with test current (100 mA)
- Measurement frequency: 1 measured value per min

4.33 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

4.34 Endurance shock test (DIN EN 60068-2-27)
Severity: see Table 4.3

4.35 Contact resistance (DIN EN 60512-2-1)
- Contact parts: 10 DUTs per variant
- Line cross-section: all cross-sections that occur

The measured values must correspond to the manufacturer's specifications. The limits must be complied with, and the measured values (initial value, final value, standard deviation, and resistance change of the respective DUTs) must be documented accordingly in the test report.

4.36 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

4.37 Resonance frequency of the contact assembly

Determination of the resonance frequency of the housing parts including contacts and lines under sinusoidal vibration

Vibration transducers of the smallest dimensions must be affixed to the housing, which is not screwed fast to the vibrator table.

Dynamic load, sinusoidal (DIN EN 60068-2-6)
- Sweep speed: 1 oct./min
- a = 10 m/s²
- f = 5 Hz – 2 000 Hz – 5 Hz

Requirement:

The vibration responses of the housing must also be recorded and documented as a graph together with the excitation profile in the test report

PG 18 Coastal climate load

Aim: Test for metal parts (test for sea transport or use near the coast)
- Batch size: 10 contact parts in unsealed housing(s)
- Contact parts: all materials and surfaces that occur
- Housings: open (not sealed), plugged in, average number of pins
- Line cross-sections: arbitrary
-

4.38 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

4.39 Contact resistance (DIN EN 60512-2-1)
- Contact parts: 10 DUTs per variant
- Line cross-section: all cross-sections that occur

The measured values must correspond to the manufacturer's specifications. The limits must be complied with, and the measured values (initial value, final value, standard deviation, and resistance change of the respective DUTs) must be documented accordingly in the test report.

4.40 Salt spray, cyclic (DIN EN 60068-2-52)
- Severity 3

4.41 Contact resistance (DIN EN 60512-2-1)

- Contact parts: 10 DUTs per variant
- Line cross-section: all cross-sections that occur

The measured values must correspond to the manufacturer's specifications. The limits must be complied with, and the measured values (initial value, final value, standard deviation, and resistance change of the respective DUTs) must be documented accordingly in the test report.

4.42 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

PG 20 Climate load of housing

Aim: Test for connector housings/general requirement
- Batch size: 5 housings. Up to 5-pin, fully equipped; for 6-pin and above, with 5 contacts
- Contact parts: any type
- Housings: all variants that occur (keying, color arbitrary)
- Lines: insulation must withstand the test temperature

Increased requirements (e.g., temperatures) must be agreed upon with the OEM.

4.43 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

4.44 Insulation resistance (DIN EN 60512-3-1)
- Contact parts: arbitrary
- Housings: 1 housing per injection mold

Insulation resistance between all adjacent contacts
Requirement:
* Riso > 100 MΩ at U = 500 V, t = 60 s
* Riso = insulation resistance
* U = DC test voltage
* T = read cycle time

4.45 Aging in dry heat (DIN EN 60068-2-2)
Test B
- Duration: 120 h
- Temperature: 130 °C

4.46 Humid heat, constant (DIN EN 60068-2-30)
- Duration: 10 days
- Temperature: 40 °C
- Relative humidity: 95 %

After conclusion of test B 20.2, the insulation resistance must be measured at the earliest after 30 min and at the latest after 60 min.

4.47 Insulation resistance (DIN EN 60512-3-1)
- Contact parts: arbitrary
- Housings: 1 housing per injection mold

Insulation resistance between all adjacent contacts
Requirement:
* Riso > 100 MΩ at U = 500 V, t = 60 s
* Riso = insulation resistance
* U = DC test voltage
* T = read cycle time

4.48 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

4.49 Low-temperature aging (DIN EN 60068-2-1)
- Duration: 48 h
- Temperature: -40 °C

4.50 Removal and insertion at -20 °C

4.51 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

PG 21 Long-term temperature aging

Aim: Test of the long-term stability of the housings and the contact parts
- Batch size: 2 groups, 5 housings per group
- Housings: Group 1 unequipped
  Group 2 per contact size: Up to 5-pin, fully equipped; for 6-pin and above, with 5 contacts
- Contact parts: as agreed upon, but at least 10 contact pairs for contact resistance measurements
- Single-wire seals: all variants that occur
- Lines: insulation must withstand the test temperature
- Conductor cross-section: lines with max. conductor cross-section
- Housings: all

4.52 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.

4.53 Contact resistance (DIN EN 60512-2-1)
- Contact parts: 10 DUTs per variant
- Line cross-section: all cross-sections that occur

The measured values must correspond to the manufacturer's specifications. The limits must be complied with, and the measured values (initial value, final value, standard deviation, and resistance change of the respective DUTs) must be documented accordingly in the test report

4.54 Long-term aging in dry heat (all parts) (DIN EN 60068-2-2)
Test B
- Duration: 1 000 h
- Temperature: 130 °C

- Subsequent aging 48 h at RT

4.55 Contact resistance (DIN EN 60512-2-1)
- Contact parts: 10 DUTs per variant
- Line cross-section: all cross-sections that occur

The measured values must correspond to the manufacturer's specifications. The limits must be complied with, and the measured values (initial value, final value, standard deviation, and resistance change of the respective DUTs) must be documented accordingly in the test report

4.56 5 x completed locking and completed disconnection

Functional test with both groups:
Actuation: Connection of the connector housings until complete latching, Opening of the lock and complete disconnection of the connector housings
- Number of cycles: 5

Contact pull-out forces of all contacts of group 2,
The value for secondary locks from PG 8 applies as the limit, even if the primary and secondary locks are closed here

4.57 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection.
Requirement:
- After completion of the test, there must be no functional impairments detected on the housings. Cracking or delamination that affect the function are not permissible.
- Contact resistance: The limits from the Table 4.2 must be complied with.
- Contact pull-out force: The limits for locking from the requirement table 4.4 must be complied with.

Blade width	F_{prim} (latching pin)	F_{prim} (clean body)	F_{sec}
0,63/1,2	>55	>40	>55
1,5 to 2,8 mm	>80	>60	>80
>2,8 to 6,3 mm	>120	>80	>120
>6,3 to 8,0 mm	>180	>110	>180
>8,0 mm	>200	>150	>200

[Table 4.4 Contact pull-out forces]

PG 22B Chemical resistance

Aim: Test of the chemical resistance of the housings
- Batch size: 2 fully equipped housings per test fluid
- Contact parts: any type

4.58 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection

4.59 Insulation resistance (DIN EN 60512-3-1)
- Contact parts: arbitrary
- Housings: 1 housing per injection mold

Insulation resistance between all adjacent contacts
Requirement:
* Riso > 100 MΩ at U = 500 V, t = 60 s
* Riso = insulation resistance
* U = DC test voltage
* T = read cycle time

4.60 Chemical resistance 48h

Test procedure:
DUTs must be exposed to the fluids (for chemicals and method, see Table 4.5) and aged for 48 h at the required aging temperature.
After the test is complete, the DUTs must be rinsed thoroughly with water and dried

No.	PG	Chemical agent	Description	Application			Aging temp. °C
				Dousing	Rubbing in	Spraying	48 h
1	22 A	Cold-cleaning agent/cockpit cleaning agent	Commercially available			x	50
2	22 A	Penetrating oil	Commercially available			x	50
3	22 A	Undiluted washer fluid anti-freeze	Commercially available	x			50
4	22 A	Isopropanol	Commercially available	x			RT
5	22 A	Grease	High melting point grease		x		50
6	22 B	Brake fluid	DOT 4/DOT 5	x			50
7	22 B	FAM test fuel (gasoline/premium)	Commercially available	x			RT
8	22 B	Diesel	DIN EN 590	x			RT
8	22 B	Biodiesel	DIN EN 14214	x			RT
8	22 B	Diesel additive AdBlue	DIN 70070	x			RT
9	22 B	Engine oil 5W-30	Fully synthetic	x			50
10	22 B	Power steering fluid	According to re-quirement	x			50
10	22 B	Automatic transmission fluid	Fully synthetic	x			50
11	22 B	Radiator antifreeze	Stable to -40 °C	x			50
12	22 B	Battery fluid: Relevant only for DUTs that can come into con-tact with battery fluid	Diluted sulfuric acid; density 1,28 g/ml	x			50
13	22 B	Road salt solution	Mixture PG18C	x			50

Dousing: At least 100 ml (according to DIN EN ISO 175 at least 8 ml/cm² surface)
Rubbing in: damp cotton cloth
Spraying: approx. 1 s per side

[Table 4.5 Media list]

4.61 Insulation resistance (DIN EN 60512-3-1)
- Contact parts: arbitrary
- Housings: 1 housing per injection mold

Insulation resistance between all adjacent contacts
Requirement:
* Riso > 100 MΩ at U = 500 V, t = 60 s

* Riso = insulation resistance
* U = DC test voltage
* T = read cycle time

4.62 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection

4.63 Dimensions (DIN EN 60512-1-2)

Requirement:
- No functionally significant structural or dimensional change
- Deviations from the original state must be documented
- Insulation resistances >100 MΩ
- The DUT must remain fully functional.

PG 23 Water leak tightness

Aim: Test of the leak tightness of sealed connector housings, blind plugs, and single-wire seals
- Group 1: connector housings with blind plugs
- Group 2: connector housings with single-wire seals
- Batch size: Group 1: 2 housings
  Group 2: 5 fully equipped housings
- Contact parts: arbitrary
- Housings: all water-tight designs
- Line cross-section: smallest and largest permissible conductor cross-sections per sealing element
- Lines: insulation must withstand the test temperature

The ends of all stranded wires of the cables are sealed pressure-tight.

For sealing systems without single-wire seals, the contacts must be removed and reinserted once before the load.

4.64 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection

4.65 Aging in dry heat (all groups, plugged state) (DIN EN 60068-2-2)

Test B
- Duration: 120 h
- Temperature: 130 °C

4.66 Temperature shock (all groups) (DIN EN 60068-2-14)

Test Na
- Duration: 144 cycles
- Temperature -40 °C/130 °C 15 min respectively
- Acclimatization period: max. 10s

4.67 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection

4.68 Immersion with pressure difference (all groups) (DIN EN 60512-14-5, DIN EN 60068-2-13)

Both groups are pressurized using suitable means. The remaining contact cavities are closed using blind plugs or sealed line ends.
Subsequently, pressure values differing from the surrounding pressure (normal pressure) are set in the interior of the contact housing.
The specified holding times apply once the required pressure values (a–d) are maintained.
- Medium: low surface-tension 5% Knack solution
  a) Normal pressure
  b) - 10 kPa, holding time 5 min
  c) - 50 kPa, holding time 5 min
  d) Normal pressure
- Change in pressure: 10 kPa/min

4.69 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection

4.70 Thermal shock test (all groups)
- Medium: low surface-tension 5% NaCl solution
- Air temperature: 120 °C Duration: 30 min each
- Water temperature 0 °C Duration: 15 min each
- Number of cycles: 5

4.71 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection

4.72 Degree of protection test/pressure washer test (all groups) (DIN 40050-9)
- Severity: IP X9K
- All three sides of the DUT must be exposed to the steam jet. The jet must also be directed
- especially at the sealing elements of the DUT.
- Test duration per side: 15 s
- Distance, nozzle-DUT: (100 – 150) mm
- Pressure: 80 bars
- Temperature: 80 °C
- The test is performed 3 times.

4.73 Insulation resistance (DIN EN 60512-3-1)
- Contact parts: arbitrary
- Housings: 1 housing per injection mold

Insulation resistance between all adjacent contacts
Requirement:
* Riso > 100 MΩ at U = 500 V, t = 60 s
* Riso = insulation resistance
* U = DC test voltage
* T = read cycle time

4.74 Visual inspection (DIN EN 60512-1-1)
- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection

4.75 Dimensions (DIN EN 60512-1-2)

Requirement:

No medium must penetrate into the connector (possible use of water finding paste).

The insulation resistance must be >100 MΩ.

The function of the locking and releasing elements must remain fully intact.

The dimensions of the housings must correspond to the release drawing before and after the tests.

PG 28A Locking noise

Aim: All locks to be actuated in vehicle assembly must produce an audible locking feedback.

- Batch size: 2 fully equipped housings per injection mold
- Housings: all variants that occur, does not apply to housings with mounting aids

4.76 Visual inspection (DIN EN 60512-1-1)

- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

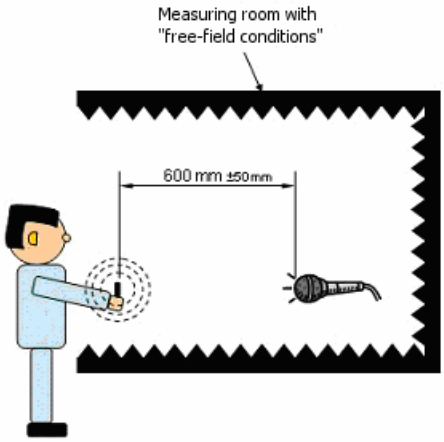
The basic mechanical functions of the connector must be checked as part of the visual inspection

4.77 Aging

24 h at RT

4.78 Locking noise

- Distance to measuring microphone: (600 ± 50) mm
- Actuation of the lock: by hand, with the least possible contact,
- Avoidance of falsifying reflections by underlying structures (table) or near walls (see Figure 4-8)



< Figure 4-8. Schematic of the measurement setup "volume measurement">

4.79 Visual inspection (DIN EN 60512-1-1)

- Contact parts: all variants that occur
- Housings: all variants that occur
- Single-wire seals: all variants that occur

The basic mechanical functions of the connector must be checked as part of the visual inspection

Requirement:

- The measured dB(A) values must be documented.
- For this purpose, the signal-to-noise ratio between the locking noise and ambient noise
- must be at least 7 dB(A).
- The locking noise must be at least LA peak ≥ 70 dB(A).

L Apeak: peak level of the sound level with frequency weighting A

5. Test matrix

5.1 Test matrix for contacts

		Contacts									
PG	Tests acc. to LV 214	New part	Tool duplication	Tool relocation	New surface material	New contact base material	New conductor crimp (cross-section area)	Optimized conductor crimp	New insulation (single-wire seal) crimp	Not-original crimp tools	Specific additional test
0	Inspection of as-received condition										
1	Dimensions (incl. dimensions from Crimp Standard Team)										
2	Material and surface analysis, contacts										
3	Material and surface analysis, housing										
4	Contact engagement length										
5	Mechanical and thermal relaxation behavior		H	H	B						
6	Interaction between contact and housing	A							D		
7	Handling and functional reliability of housing										
8	Insertion and retention forces of the contact parts in the housing					3			E		
9	Pin insertion inclination/misuse safe (scoop-proofing)										
10	Contacts: conductor pull-out strength				1	2					
11	Contacts: Insertion and removal forces, mating cycle frequency					C	F	O			
12	Current heating, derating										
13	Housing effect on derating	P									
14	Thermal time constant										
15	Electrical stress test										
16	Friction corrosion										R
17	Dynamic load							N			

18A	Coastal climate load											
18C	Deicing salt load											R
19	Environmental simulation											
20	Climate load of housing											
21	Long-term temperature aging											
22A	Chemical resistance											
22B	Chemical resistance, extended test											
23	Water leak tightness									G		
24	Impenetrability to paint											
28	Locking noise											
29	Retention force of the blind plugs											
Tests acc. To LV 214-2												
	Crimp stability											

5.2 Test matrix for housings

		HOUSING												
		Not leaktight				Leaktight								
PG	Tests acc. to LV 214	New part, unsealed	Tool, new installation, unsealed (duplication)	Tool relocation, unsealed	New material, unsealed	New part, sealed	Tool, new installation, sealed (duplication)	Tool relocation, sealed	New material, sealed	New keying	CPA for existing housing	Optional cable clamping	New cap	Specific additional test
0	Inspection of as-received condition										J			
1	Dimensions (incl. dimensions from Crimp Standard Team)										J			
2	Material and surface analysis, contacts													
3	Material and surface analysis, housing										J	K		
4	Contact engagement length													

5	Mechanical and thermal relaxation behavior													
6	Interaction between contact and housing											L	L	
7	Handling and functional reliability of housing										J			
8	Insertion and retention forces of the contact parts in the											M		
9	Pin insertion inclination/misuse safe (scoop-proofing)													
10	Contacts: conductor pull-out strength													
11	Contacts: Insertion and removal forces, mating cycle frequency													
12	Current heating, derating													
13	Housing effect on derating													
14	Thermal time constant													
15	Electrical stress test													
16	Friction corrosion													R
17	Dynamic load													
18A	Coastal climate load													
18C	Deicing salt load													R
19	Environmental simulation													
20	Climate load of housing										J	K	K	
21	Long-term temperature aging										J	K	K	
22A	Chemical resistance										J	K	K	
22B	Chemical resistance, extended test										J	K	K	
23	Water leak tightness													
24	Impenetrability to paint													
28	Locking noise													
29	Retention force of the blind plugs													
Tests acc. To LV 214-2														
	Crimp stability													

5.3 Test matrix for seals and additional tests

		Single-wire seal and housing seal				
		New part	Tool, new installation Tool relocation	Tool relocation	New material Material change	Specific additional test
PG	Tests acc. to LV 214					
0	Inspection of as-received condition					
1	Dimensions (incl. dimensions from Crimp Standard Team)					
2	Material and surface analysis, contacts					
3	Material and surface analysis, housing					
4	Contact engagement length					
5	Mechanical and thermal relaxation behavior					
6	Interaction between contact and housing					
7	Handling and functional reliability of housing					
8	Insertion and retention forces of the contact parts in the housing	M	M		M	
9	Pin insertion inclination/misuse safe (scoop-proofing)					
10	Contacts: conductor pull-out strength					
11	Contacts: Insertion and removal forces, mating cycle frequency					
12	Current heating, derating					
13	Housing effect on derating					
14	Thermal time constant					
15	Electrical stress test					
16	Friction corrosion					R
17	Dynamic load					

18A	Coastal climate load					
18C	Deicing salt load					R
19	Environmental simulation					
20	Climate load of housing					
21	Long-term temperature aging					
22A	Chemical resistance					
22B	Chemical resistance, extended test					
23	Water leak tightness					
24	Impenetrability to paint					
28	Locking noise					
29	Retention force of the blind plugs					
Tests acc. To LV 214-2						
	Crimp stability					

7. History and Approval

Rev	*Change*	*Description*	*Date*
A		**Initial Released**	**30.Oct.'18**
A1		**LOCAL DOC TYPE Updated**	**08JAN2024**

Prepared by,	Checked By,	Approved by
JY BAE	YH MA	YJ YOUN
R&D/Product Dvl Engineer	Sr R&D/Product Dvl Engineer	Mgr R&D/Product Dvl Engineering