# AISG Connector Specification

## AISG C485

### Revision History

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<th>DATE</th>
<th>ISSUE</th>
<th>NOTES</th>
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<tr>
<td>10 December 2015</td>
<td>1.0</td>
<td>First Release</td>
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<tr>
<td>17 June 2016</td>
<td>1.1</td>
<td>- Define “accredited” with reference to ISO/IEC 17025</td>
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<tr>
<td></td>
<td></td>
<td>- Apply test requirements for all different combinations of connector styles</td>
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<tr>
<td></td>
<td></td>
<td>- Add cable specification for tests</td>
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<tr>
<td></td>
<td></td>
<td>- TG1 – Dimensional examination only for interface dimensions</td>
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<td></td>
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<td>- Introduce vendor specific connector styles</td>
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<td></td>
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<td>chapter 4.1.4</td>
</tr>
<tr>
<td></td>
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<td>- Correction of typing errors</td>
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</table>
Antenna Interface Standards Group
Standard No. AISG C485
V1.1
17th of June, 2016

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1 General

1.1 Foreword

The Antenna Interface Standards Group (AISG) published this AISG standard to describe and define the AISG connector for RS-485 (AISG C485) (based on IEC 60130-9), typically used for AISG outdoor applications. Different connector vendors and connector styles are used within the control infrastructure of antennas and antenna line products, such as RET, TMA, Sensor- and Monitoring- devices. Outdoor connector applications require good protection against environmental conditions to ensure waterproofness.

1.2 Scope

The purpose of this standard is to define the mechanical interface and outline to ensure compatibility between different connector vendors and styles, and to specify the test requirements for the quality assessment of the connectors. Using this specification for connector design and selection will substantially increase the quality of AISG connectors.

1.3 General information

This Standard describes circular connectors with IP 68 protection degree (definition see 5.3.1). These connectors consist of fixed and free connectors, either rewireable or non-rewireable, with M16 x 0.75 screw-locking. Male connectors have round contacts Ø1,5 mm. The contact terminations shall be of the following types: crimp or solder.

1.4 Quality requirements

Quality assessment and type approval shall be performed according to the test requirements in chapter 7. Tests must take place in an independent test house accredited according to ISO/IEC 17025. It is not permitted to refer to this standard on any product that has not been type approved according to this standard.

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/IEC 17025, General requirements for the competence of testing and calibration laboratories


IEC 60352-2, Solderless connections – Part 2: Crimped connections – General requirements, test methods and practical guidance

IEC 60512 (all parts), Connectors for electronic equipment – Tests and measurements

IEC 60512-1-100, Connectors for electronic equipment – Tests and measurements – Part 1-100: General – Applicable publications

IEC 60529:1989, Degrees of protection provided by enclosures (IP code)

IEC 60664-1:2007, Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests

IEC 61076-1, Connectors for electronic equipment Product requirements – Part 1: Generic specification
3 Technical Information

All dimensions are in mm. All drawings are drawn in the first angle projection.

The connectors do not need to comply with the illustration, only the shown dimensions must be correct.

In the test cases with the free connector an appropriate cable with shielding shall be used, which fulfils all electrical and mechanical requirements mentioned in the text.

3.1 Definitions

For the purposes of this International Standard, the terms and definitions given in IEC 60050-581 apply.

3.2 Number of contacts

4 or 5 contacts with max. crimp termination for wire gauge 0,75mm (AWG18) and max. solder termination 0,5mm² (AWG 20)

3.3 Marking

The marking of the connector and the package shall be in accordance with 2.6 of IEC 61076-2.

3.4 Safety aspects

For safety aspects IEC 61984 shall be considered unless otherwise specified.

4 Dimensions

4.1 Survey of styles and variants

<table>
<thead>
<tr>
<th>Style</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Fixed connector, rear panel mounting, male contacts</td>
</tr>
<tr>
<td>A2</td>
<td>Fixed connector, flange mounting, male contacts</td>
</tr>
<tr>
<td>A3</td>
<td>Fixed connector, rear panel mounting, female contacts</td>
</tr>
<tr>
<td>A4</td>
<td>Fixed connector, flange mounting, female contacts</td>
</tr>
<tr>
<td>A5</td>
<td>Fixed connector, rear panel mounting, male contacts, prolonged shell</td>
</tr>
<tr>
<td>A6</td>
<td>Fixed connector, rear panel mounting, female contacts, prolonged shell</td>
</tr>
<tr>
<td>A7</td>
<td>Fixed connector, flange mounting, male contacts, prolonged shell</td>
</tr>
</tbody>
</table>
4.1.1.1 Style A1

1) With ring or hexagonal nut width across flats 20 (Ø D 23.1 max.).
2) Totally length of the connector including solder pins, glue or overmolding

4.1.1.2 Style A2

1) Totally length of the connector including solder pins, glue or overmolding
4.1.1.3 Style A3

1) With ring or hexagonal nut width across flats 20 (Ø D 23.1 max.).
2) Totally length of the connector including solder pins, glue or overmolding

4.1.1.4 Style A4

1) Totally length of the connector including solder pins, glue or overmolding
4.1.1.5 Style A5

1) With ring or hexagonal nut width across flats 20 (Ø D 23.1 max.).
2) Totally length of the connector including solder pins, glue or overmolding

4.1.1.6 Style A6

1) With ring or hexagonal nut width across flats 20 (Ø D 23.1 max.).
2) Totally length of the connector including solder pins, glue or overmolding
4.1.1.7 Style A7
4.1.1.8 Panel Cutout

Recommended characteristics for the sealing surface:
- roughness Rz6.3 (Ra 0,8) (according DIN ISO EN 4287)
- unevenness max. 0,1mm
- max. chamfer 0,1mm

Panel cutout for Style A1, A3, A5 and A6

Panel cutout for Style A2, A4 and A7
4.1.2 Free connectors

<table>
<thead>
<tr>
<th>Style</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Af1</td>
<td>Free connector, rewireable, straight version, male contacts, cable diameter 6,5-8mm</td>
</tr>
<tr>
<td>Af2</td>
<td>Free connector, rewireable, straight version, female contacts, cable diameter 6,5-8mm</td>
</tr>
</tbody>
</table>

1) Recommend value

4.1.2.1 Style Af1

![Diagram of Style Af1]

4.1.2.2 Style Af2

![Diagram of Style Af2]
4.1.3 Protective caps

All protective caps can be used with a cord or a chain in different length, to fix them at the panel or at the cable.

4.1.3.1 Protective cap for female connectors fixed and free

![Diagram of protective cap for female connectors]

4.1.3.2 Protective cap for male connectors fixed and free

![Diagram of protective cap for male connectors]

4.1.4 Vendor specific connector styles

It is allowed to create vendor specific connector designs, as long as the vendor specific connector mates with the standard styles A1...7, AF1 and AF2. Interface dimensions must be as described in section 4.2.1.1-4, 4.2.2 and 4.2.3. Vendor specific connectors shall meet the test requirements of this specification.
4.2 Dimensions

4.2.1 Interface dimensions

The shapes of the shown sealing are only for reference; the real shape depends on designer. The sealing is shown in the uncompressed state, so the dimensions related to the sealing are measured in the uncompressed state.

4.2.1.1 Fixed connector male

4.2.1.2 Fixed connector female

1) Dimension describes position of the contact point
4.2.1.3 Free connector male

![Diagram of free connector male]

4.2.1.4 Free connector female

![Diagram of free connector female]

1) Dimension describes position of the contact point
4.2.2 Pin front view of male connector and contact position

Male pin layout is based on DIN EN 61076-2-106:2012-04 variant 08-a. The male pins 2, 4 and 8 are not in use for AISG applications. Male pin 1 shall not be used for new constructions, only needed to keep compatibility to older versions. Pin assignment according AISG specification.

4.2.3 Pin front view of female connector and contact position

Female pin layout is based on DIN EN 61076-2-106:2012-04 variant 08-a. The female pins 2, 4 and 8 are not in use for AISG applications, but it must be ensured that fully loaded male connectors according DIN EN 61076-2-106:2012-04 variant 08-a are pluggable. Male pin 1 shall not be used for new constructions, only needed to keep compatibility to older versions. Pin assignment according AISG specification.
4.3 Gauges

4.3.1 Sizing gauges and retention force gauges

Material: tool steel, hardened

= Surface roughness according to ISO 1302: Ra = 0.25 µm max. 0.15 µm min.

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Mass g</th>
<th>Application</th>
<th>Ø a mm</th>
<th>l min. mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>G11</td>
<td>-</td>
<td>Sizing</td>
<td>1.53</td>
<td>10</td>
</tr>
<tr>
<td>G12</td>
<td>20</td>
<td>Retention force</td>
<td>1.47</td>
<td>10</td>
</tr>
</tbody>
</table>

See 7.2.2 test TG A2 under application

5 Characteristics

5.1 Climatic category

Conditions: IEC 60068-1

<table>
<thead>
<tr>
<th>Climatic Category</th>
<th>Category of temperature</th>
<th>Damp heat steady-state</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lower °C</td>
<td>Upper °C</td>
<td>Temperature °C</td>
</tr>
<tr>
<td>40/85/21</td>
<td>-40</td>
<td>+85</td>
<td>40</td>
</tr>
</tbody>
</table>
5.2 Electrical characteristics

5.2.1 Rated Voltage - Rated impulse withstand voltage - Pollution degree

Conditions: IEC 60664-1

The permissible rated voltage depends on the application or specified safety requirement. Reductions in creepage or clearance distances may occur due to the printed board or wiring used and shall be duly taken into account.

Rated Voltage: 32V
Rated impulse withstand voltage: 0.8kV
Pollution degree: 3

1) The rated voltage and impulse voltage are based on pollution degree 2. This results from application of the rules from IEC 60664-1.

5.2.2 Voltage between contacts and housing

Conditions:
- IEC 60512-4-1, Test 4a
- Standard atmospheric conditions
- Mated connectors

Impulse withstand voltage between contacts and between contacts and metal housing 500V

5.2.3 Current carrying capacity

Conditions:
- IEC 60512, Test 5a
- All contacts
- Values at 40 °C ambient temperature
- 0.5mm² wire gauge

Current carrying capacity 5 A

5.2.4 Contact resistance

Conditions:
- IEC 60512, Test 2a
- Standard atmospheric conditions
- Connecting points see 7.1.1

Contact resistance ≤ 5mΩ

5.2.5 Insulation resistance

Conditions:
- IEC 60512, Test 3a, Method A
- Standard atmospheric conditions

Insulation resistance ≥ 10⁸Ω
5.2.6 Surge current capability

5.2.6.1 Test conditions
This test is to be carried out on an assembled male/female connector pair. The test pulses and test method shall conform to IEC 61000-4-5 (8/20µs pulse) and IEC62305-1 (10/350µs pulse).

5.2.6.2 Test method
The following test pulses are to be applied to each contact and its associated crimp or solder termination in turn, in each case, applying one pulse every 60s:

- Five positive pulses with 8kA (8/20µs pulse form)
- Five negative pulses with 8kA (8/20µs pulse form)
- Five positive pulses with 2,5kA (10/350µs pulse form)
- Five negative pulses with 2,5kA (10/350µs pulse form)

The following test pulses are to be applied to the connector shield. The pulses are injected via the cable shield for free connectors (cable length ≤ 0,5m) and via the intended shield connection for fixed connectors.
In each case, applying one pulse every 60s:

- Five positive pulses with 20kA (8/20µs pulse form)
- Five negative pulses with 20kA (8/20µs pulse form)
- Five positive pulses with 5kA (10/350µs pulse form)
- Five negative pulses with 5kA (10/350µs pulse form)

5.2.6.3 Performance criteria following conduct of the pulse tests:
The contacts and insulation between them shall not be damaged.
The contact resistance and contact insulation shall meet the criteria specified in Section 5.2.4 and 5.2.5 respectively.

5.2.7 Measurement of screening attenuation
The AISG RS-485 cable is required to be provided with a screen whose function is to isolate the cable cores from external electromagnetic fields. The effectiveness of the screening is a function both of the quality of the cable screen and of the integrity of the grounding provided by the connector.

5.2.7.1 Test conditions
The test is to be carried out on an assembly comprising a 0.5m length of screened cable terminated at each end by the connectors under test, each mated with an adaptor providing a screened transition to a single coaxial geometry, as shown in Figure 5.2.7.1-1.

5.2.7.2 Test method
The test shall be performed using the absorbing clamp method specified in EN50083-2:2012 over the frequency range 30–1000 MHz.
5.2.7.3 Performance criteria

The measured screening attenuation shall exceed the following values:

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>Screening attenuation</th>
</tr>
</thead>
<tbody>
<tr>
<td>30–100 MHz</td>
<td>≥55 dB</td>
</tr>
<tr>
<td>100–1000 MHz</td>
<td>≥40 dB</td>
</tr>
</tbody>
</table>

5.3 Mechanical characteristics

5.3.1 IP degree

Conditions:
- Based on IEC 60529:1989 IP 68
- Before testing the samples must be subjected to a temperature changing test with the following key data
  o Lower storage temperature -40°C
  o Upper storage temperature +70°C
  o Storage time 30 min
  o Rate of temperature change 1K/min
  o Cycles 50

Samples must pass test according 7.1.3

5.3.2 Mechanical operation

Conditions:
- IEC 60512, Test 9a
- Standard atmospheric conditions
- Max. speed of operations = 10 mm/s
- Rest: 30 s, unmated

Mechanical operations > 100

5.3.3 Insertion and withdrawal forces

Conditions:
- IEC 60512, Test 13b
- Standard atmospheric conditions
- Max. speed = 10 mm/s

Total insertion force max. 60N
Total withdrawal force max. 60N

5.3.4 Polarizing method

Conditions: IEC 60512, Test 13e

Engaging force: 1,5 x total insertion force but 35 N min.
5.3.5 Vibration

Conditions:
- IEC 60512, Test 6d
- Standard atmospheric conditions
- Connectors in mated and locked position
- The fixed and free connector shall be rigidly installed in a suitable fixture as specified in 7.1.2

Vibration Severity: 10 Hz to 500 Hz and 0.35 mm or 5 g

5.3.6 Shock

Conditions:
- IEC 60512 Test 6c
- Connectors in mated and locked position
- The fixed and free connector shall be rigidly installed in a suitable fixture as specified in 7.1.2

Half sine shock acceleration 490m/s² (50g)
Duration of impact: 11ms

5.3.7 Cable retention

Conditions:
- IEC 61984:2008 table 6

Retention force 80 N
Torque 0.1 Nm

5.3.8 Tightening torque

The tightening torque of the coupling nut must be between 1 – 1.5Nm. If possible a suitable tool must be available to apply the correct torque.

5.4 Environmental conditions

5.4.1 Salt mist resistance

Conditions:
- DIN IEC 60068 part 2-11, test Ka
- Connectors in mated and locked position
- 5% NaCl
- Temperature 35°C
- Continuous spraying

Duration 720h

5.4.2 Exposure to sunlight and rain

Conditions:
- DIN EN ISO 4892-2 Procedure A1

Duration 500h
5.5 Materials

5.5.1 Contact surface
The contact surfaces of male and female pins shall be plated with gold or silver.

5.5.2 Housing surface
It is recommended to use Nickel as surface material. If another material is used the galvanic contact potential should not differ more than 0,25V from Nickel. Non metallic coatings are also allowed, if they are not influencing the shielding characteristics.

5.5.3 Contacts inserts
The flammability class of the plastic material for the contact inserts must be according UL 94V0.

6 Assembly instructions
Assembly instructions for the cable connectors must be available (e.g. on the connector manufacturer website, printed on the package or printed on a separate instruction for each bulk package)

7 Test requirements

7.1 General

This section shows the tests and the order in which they shall be carried out as well as the requirements to be met.

Unless otherwise specified, all tests shall be carried out under standard atmospheric conditions for testing as specified in IEC 60068-1, as directed by the applicable part of IEC 60512.

Unless otherwise specified, mated and locked sets of connectors shall be tested. Care shall be taken to keep a particular combination of connectors together during the complete test sequence, i.e. when unmating is necessary for a certain test, the same connector styles as before shall be mated for the subsequent tests.

To get repeatable and comparable test results the cable connectors must be assembled with an appropriate cable.

All the tests with free connectors and associated cables must be carried out with a cable according to annex A. The type of cable used for the tests must be recorded. Manufacturers are reminded that for complete certainty of sealing to cables of other diameters, specific testing is recommended.

In the following, a mated and locked set of connector styles is called a specimen.

Within the submitted connector styles by the manufacturer, all different combinations of fixed and free connectors shall be tested. When the initial tests have been completed, all the specimens are divided in the 4 test groups TG A, TG B, TG C and TG D. In addition 20 single contacts are used for SP.

Before testing commences, the connectors shall be stored for at least 24 h in the non-engaged state under standard atmospheric conditions as per IEC 60068-1.

<table>
<thead>
<tr>
<th>Test groups</th>
<th>TG</th>
<th>TG A</th>
<th>TG B</th>
<th>TG C</th>
<th>TG D</th>
<th>SP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of specimen</td>
<td>20</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>20 single contacts</td>
</tr>
</tbody>
</table>
7.1.1 Arrangement for contact resistance measurements

Conditions: see 5.2.4

The measurement of contact resistance shall be carried out on the number of contacts specified and between the connector shielding and the housing. Any subsequent measurements of contact resistance shall be made on the same contacts.

7.1.2 Arrangement for vibration and shock tests

Conditions: see 5.3.5 and 5.3.6
7.1.3 Arrangement for IP 68 testing

Attach the test samples to the test cube and tighten the screw rings to the recommended torque. Put the test cube under pressure with 0.2 bar. After this put the cube into a water bowl so that the cube is fully covered with water.

In unmoved condition no bubbles must be visible. Test duration 5s.

In moved condition, means the connector must be fixed in the water bowl and the cable must be moved from 30° to max. 45° for five times back and force holding 10 cm behind the connector end. No bubbles must be visible.

7.1.4 Test for cable retention

With the connector body fixed, apply a constant force $F$ (80N) on the cable parallel to the centreline of the connector. After 1 min the maximal movement of the cable shall be not more than 3 mm.

Apply a constant torque $D$ (0.1Nm) on the cable in the shown direction. After 1 min the maximal rotation of the cable relative to the connector shall be not more than 30°.
7.2 Test requirements

7.2.1 Test group TG - Preliminary

<table>
<thead>
<tr>
<th>Test phase</th>
<th>Test</th>
<th>Measurement to be performed</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>TG 1</td>
<td>General examination</td>
<td>Unmated connectors</td>
<td>Visual examination</td>
</tr>
<tr>
<td></td>
<td>IEC 60512 Test No.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TG 2</td>
<td>Connection points according to 7.1.1 all contacts per specimens</td>
<td>Contact resistance – Millivolt level method</td>
<td>Initial value acc.5.2.4</td>
</tr>
<tr>
<td></td>
<td>IEC 60512 Test No.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TG 3</td>
<td>Test voltage 500 V ± 15 V DC Method A</td>
<td>Insulation resistance</td>
<td>Initial value acc.5.2.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TG 4</td>
<td>Contact/ contact same measuring points as for P3</td>
<td>Voltage proof</td>
<td>According to 5.2.2</td>
</tr>
<tr>
<td></td>
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</tbody>
</table>

The specimen shall be divided into 4 groups. All connectors in each group shall undergo the tests specified for the relevant group.
### Test group TG A – Dynamic/ Climatic

<table>
<thead>
<tr>
<th>Test phase</th>
<th>Test</th>
<th>Measurement to be performed</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>TG A1</td>
<td>See 5.3.3</td>
<td>Insertion and withdrawal forces</td>
<td>Requirements see 5.3.3</td>
</tr>
<tr>
<td>TG A2</td>
<td>Gauge retention force</td>
<td>3 female contacts per specimen. For sizing and retention force gauge see 4.3.1</td>
<td>Engaging and separating forces; See 4.3.1</td>
</tr>
<tr>
<td>TG A3</td>
<td>Vibration</td>
<td>Sweep cycles: 10; Full duration: 6 h; See 5.3.5</td>
<td>Contact disturbance; See 5.3.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TG A4</td>
<td>Shock</td>
<td>See 5.3.6</td>
<td>Contact disturbance; See 5.3.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TG A5</td>
<td>IP protection degree</td>
<td>See 5.3.1</td>
<td>IP degree; See 7.1.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TG A6</td>
<td>Climatic sequence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TG A6.1</td>
<td>Dry heat</td>
<td>Temperature: 85 °C; Duration: 16 h</td>
<td>Insulation resistance at high temperature; Initial value acc. 5.2.5</td>
</tr>
<tr>
<td>TG A6.2</td>
<td>Damp heat, cyclic, first cycle</td>
<td>Method Db; Temperature: 40 °C; Recovery time: 2 h</td>
<td>Visual examination; There shall be no defect that would impair normal operation</td>
</tr>
<tr>
<td>TG A6.3</td>
<td>Cold</td>
<td>Temperature: −40°C; Duration: 2 h; Recovery time: 2 h</td>
<td>Visual examination; There shall be no defect that would impair normal operation</td>
</tr>
</tbody>
</table>
### Test phase

<table>
<thead>
<tr>
<th>Test phase</th>
<th>Title</th>
<th>Severity or Condition of test</th>
<th>Measurement to be performed</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>TG A6.4</td>
<td>Damp heat, cyclic, remaining cycles</td>
<td>11m</td>
<td>Conditions according to A6.2 5 cycles Recovery time: 2 h</td>
<td>Contact resistance – Millivolt level method</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3a</td>
<td>Insulation resistance</td>
<td>Initial value acc.5.2.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4a</td>
<td>Voltage proof</td>
<td>According to 5.2.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13b</td>
<td>Insertion and withdrawal forces</td>
<td>Requirements see 5.3.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1a</td>
<td>Visual examination</td>
<td>There shall be no defect that would impair normal operation</td>
</tr>
<tr>
<td>TG A7</td>
<td>IP protection degree after aging</td>
<td>See 5.3.1</td>
<td>IP degree See 7.1.3</td>
<td>See 7.1.3</td>
</tr>
<tr>
<td>TG A8</td>
<td>Visual examination</td>
<td>1a</td>
<td>There shall be no defect that would impair normal operation</td>
<td></td>
</tr>
<tr>
<td>TG A9</td>
<td>Polarizing method</td>
<td>13e</td>
<td>See 5.3.4</td>
<td>It shall be possible to correctly align and mate the appropriate mating connectors. It shall not be possible to mate the connectors in any other than the correct manner. The insertion and withdrawal forces acc. TG A1</td>
</tr>
</tbody>
</table>
## 7.2.3 Test group TG B – Mechanical endurance

<table>
<thead>
<tr>
<th>Test phase</th>
<th>Test</th>
<th>Measurement to be performed</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>TG B1</td>
<td>Female contacts only 3 contacts/ specimen sizing and retention force gauge see 4.3.1</td>
<td>Gauge retention force</td>
<td>See 4.3.1</td>
</tr>
<tr>
<td>TG B2</td>
<td>Mechanical operation (half of the specified number of operations)</td>
<td>Speed 10 mm/s max. Rest 30 s (unmated) Operations see 5.3.2 Speed: 10 mm/s max. Rest time: 30 s (unmated)</td>
<td>Visual examination</td>
</tr>
<tr>
<td>TG B3</td>
<td>Damp heat steady state</td>
<td>Contact resistance – Millivolt level method</td>
<td>Rise in relation to initial values ≤10 mΩ</td>
</tr>
<tr>
<td>TG B4</td>
<td>Mechanical operation (remaining half of specified number of operations)</td>
<td>See TG B2</td>
<td>Contact resistance – Millivolt level method</td>
</tr>
<tr>
<td></td>
<td>Unmated connectors</td>
<td>Visual examination</td>
<td>There shall be no defect that would impair normal operation</td>
</tr>
<tr>
<td>TG B5</td>
<td>Insertion and withdrawal forces</td>
<td></td>
<td>For requirements, see 5.3.3</td>
</tr>
<tr>
<td>TG B6</td>
<td>Female contacts only 3 contacts/ specimen sizing and retention force gauge see 4.3.1</td>
<td>Gauge retention force</td>
<td>See 4.3.1</td>
</tr>
<tr>
<td>TG B7</td>
<td>Cable retention force</td>
<td>See 7.1.4</td>
<td>Cable retention force</td>
</tr>
</tbody>
</table>
### 7.2.4 Test group TG C – Electrical characteristics

<table>
<thead>
<tr>
<th>Test phase</th>
<th>Test</th>
<th>IEC 60512 Test No.</th>
<th>Severity or Condition of test</th>
<th>Measurement to be performed</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>TG C1</td>
<td>Rapid change of temperature</td>
<td>11d</td>
<td>-40 °C to 85 °C r = 1h 5 cycles</td>
<td>Contact resistance – Millivolt level method</td>
<td>2a Rise in relation to initial values ≤10 mΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Insulation resistance</td>
<td>3a Initial value acc.5.2.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Voltage proof</td>
<td>4a According to 5.2.2</td>
</tr>
<tr>
<td>TG C2</td>
<td>Mechanical operation</td>
<td>9a</td>
<td></td>
<td></td>
<td>See TG B2</td>
</tr>
<tr>
<td>TG C3</td>
<td>Electrical load and temperature</td>
<td>9b</td>
<td>Duration: 10h Amb. Temp.: 40 °C Current load according to 5.2.3 Recovery time: 2 h Temperature sensor in centre of specimen</td>
<td>Contact resistance – Millivolt level method</td>
<td>2a Rise in relation to initial values ≤10 mΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Insulation resistance</td>
<td>3a Initial value acc.5.2.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Voltage proof</td>
<td>4a According to 5.2.2</td>
</tr>
<tr>
<td>TG C4</td>
<td>Shielding attenuation</td>
<td>See 5.2.7</td>
<td></td>
<td></td>
<td>According to 5.2.7</td>
</tr>
<tr>
<td>TG C5</td>
<td>Surge current capability</td>
<td>Test all contacts and shielding</td>
<td></td>
<td></td>
<td>According to 5.2.6</td>
</tr>
<tr>
<td>TG C6</td>
<td>Unmated connectors</td>
<td>Visual examination</td>
<td>1a</td>
<td>There shall be no defect that would impair normal operation</td>
<td></td>
</tr>
</tbody>
</table>
### 7.2.5 Test group TG D – environmental conditions

<table>
<thead>
<tr>
<th>Test phase</th>
<th>Test</th>
<th>Measurement to be performed</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Title</td>
<td>IEC 60512 Test No.</td>
<td>Severity or Condition of test</td>
</tr>
<tr>
<td>TG D1</td>
<td>Salt mist resistance</td>
<td>See 5.4.1</td>
<td>Contact resistance – Millivolt level method</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IP degree</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Insulation resistance</td>
</tr>
<tr>
<td>TG D2</td>
<td>exposure to sunlight and rain</td>
<td>See 5.4.2</td>
<td>Visual inspection</td>
</tr>
</tbody>
</table>

### 7.2.6 Test group SP – connection method tests

<table>
<thead>
<tr>
<th>Test phase</th>
<th>Test</th>
<th>Measurement to be performed</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Title</td>
<td>IEC 60512 Test No.</td>
<td>Severity or Condition of test</td>
</tr>
<tr>
<td>TG 1</td>
<td>Tensile strength (crimped connection)</td>
<td>16d</td>
<td>Test samples 5 male and 5 female crimped contacts, according to IEC 60352-2</td>
</tr>
</tbody>
</table>
ANNEX A: Cable specification for tests according to chapter 7

In order to achieve accurate, reproducible and comparable measurement results the following minimum requirements for the test cable shall be observed:

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>outer diameter</td>
<td>6,5-7,0 mm across any axis</td>
</tr>
<tr>
<td>cable sheath</td>
<td>PUR</td>
</tr>
<tr>
<td>core wires</td>
<td>AWG24 (0,25mm²) – AWG19 (0,75mm²)</td>
</tr>
<tr>
<td>shielding</td>
<td>• one wrapping of AL-foil overlapped with contact to braid</td>
</tr>
<tr>
<td></td>
<td>• metal braid with coverage factor of 85%</td>
</tr>
</tbody>
</table>