
International Standard



8668/2

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Aircraft — Terminal junction systems — Part 2 : Tests

Aéronefs — Systèmes de raccordement à modules amovibles — Partie 2: Essais

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8668/2 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Aircraft — Terminal junction systems — Part 2 : Tests

1 Scope and field of application

This part of ISO 8668 specifies the test procedures and performance requirements for the characteristics of aircraft terminal junction systems specified in ISO 8668/1 and shall be read in conjunction with it.

2 References

ISO 8668/1, *Aircraft — Terminal junction systems — Part 1: Characteristics.*

IEC Publication 68-2-1, *Basic environmental testing procedures — Part 2: Tests — Tests A: Cold.*

IEC Publication 68-2-2, *Basic environmental testing procedures — Part 2: Tests — Tests B: Dry heat.*

IEC Publication 68-2-3, *Basic environmental testing procedures — Part 2: Tests — Test Ca: Damp heat, steady state.*

IEC Publication 68-2-6, *Basic environmental testing procedures — Part 2: Tests — Test Fc and guidance: Vibration (sinusoidal).*

IEC Publication 68-2-11, *Basic environmental testing procedures — Part 2: Tests — Test Ka: Salt mist.*

IEC Publication 68-2-27, *Basic environmental testing procedures — Part 2: Tests — Test Ea: Shock.*

IEC Publication 68-2-30, *Basic environmental testing procedures — Part 2: Tests — Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle).*

3 Test details

The tests and performance requirements shall comply with the details given in the table on the following pages.

Test No.	Title of test	Test procedure	Test results required																		
1	Contact insertion force	Carry out the test individually on each contact or as specified in the detail specification. Insert the crimp contact using the appropriate insertion tool until the locking system operates. Check that the contact is effectively locked by applying to the cable a slight tensile force which in any case is less than that specified for the contact retention test.	The insertion force shall be not greater than the following values: <table><tr><th>Contact size</th><th colspan="2">Insertion force</th></tr><tr><td></td><th>N</th><th>lbf</th></tr><tr><td>22</td><td>23</td><td>5</td></tr><tr><td>20</td><td>45</td><td>10</td></tr><tr><td>16</td><td>68</td><td>15</td></tr><tr><td>12</td><td>68</td><td>15</td></tr></table>	Contact size	Insertion force			N	lbf	22	23	5	20	45	10	16	68	15	12	68	15
Contact size	Insertion force																				
	N	lbf																			
22	23	5																			
20	45	10																			
16	68	15																			
12	68	15																			
2	Internal electrical continuity	This test is not performed in type approval testing but as a production acceptance test, carried out on 100 % of the specimens. All the groups of contacts shall be checked. In the case of feed-through modules, in addition to checking the internal groups, the electrical continuity shall also be checked for two contacts designated by the same mark on either side of the module. The current intensity for the test shall not exceed 1 A.	The electrical continuity of all the contacts of each group shall comply with the diagram corresponding to the identification marking of the internal electrical connections indicated on the module and on the detail specification.																		
3	Insulation resistance	Carry out the test on completely wired specimens. Measure the insulation resistance using a 500 ± 50 V d.c. voltage, applied for 60 ± 5 s between the points below in 3a for feed-back modules and 3b for feed-through modules.	The insulation resistance shall be not less than 5 000 MΩ.																		
3a	Feed-back modules	Apply the voltage specified above — between the assembly of contacts of connected groups (one contact per group) of the modules on the one hand and the frame or test support on the other; — between one contact of a group of one module and in succession any contact of the other adjacent groups of the module; — between all the contacts of the connected group or groups (one contact per group) of a module and the contacts (one contact per group) of connected groups of adjacent modules.																			
3b	Feed-through modules	The measurement shall be carried out on a single side; on the other side the conductors shall be insulated one from another. The points of application shall be the same as specified in 3a for feed-back modules.																			

Test No.	Title of test	Test procedure	Test results required										
4	Voltage	Carry out the test on completely wired specimens. Apply progressively an alternating voltage, the final value of which, 1 500 V, r.m.s. value, shall be maintained for 60 ± 5 s. The points of application of the voltage shall be those specified in 3a.	No breakdown or flashover shall occur during application of the voltage. The leakage current shall not exceed 2 mA.										
5	Contact resistance	This test shall be carried out in conformity with the requirements of the annex.	The contact resistance shall be not greater than the following values: <table><tr><th>Contact size</th><th>Contact resistance mΩ</th></tr><tr><td>22</td><td>5</td></tr><tr><td>20</td><td>4</td></tr><tr><td>16</td><td>3</td></tr><tr><td>12</td><td>2</td></tr></table>	Contact size	Contact resistance mΩ	22	5	20	4	16	3	12	2
Contact size	Contact resistance mΩ												
22	5												
20	4												
16	3												
12	2												
5a	Low voltage	Carry out the test with d.c. or a.c. If the measurement is carried out with a.c., the frequency of the applied voltage shall not be more than 1 500 Hz. The open circuit voltage shall be $20 \begin{smallmatrix} 0 \\ -2 \end{smallmatrix}$ mV and the current shall be adjusted and maintained constant at $50 \begin{smallmatrix} 0 \\ -10 \end{smallmatrix}$ mA. Carry out one measurement on each contact. If the measurement is carried out in d.c., ensure, by inverting the polarity of the source, that the thermoelectric phenomena do not interfere with measurement by more than 10 %. Then, take the mean value of the two measurements.											
5b	Rated current	Adjust the current passing through the contact to the specified value of its rated current, as stated in the detail specification.	The contact resistance shall be not greater than the following values: <table><tr><th>Contact size</th><th>Contact resistance mΩ</th></tr><tr><td>22</td><td>5</td></tr><tr><td>20</td><td>4</td></tr><tr><td>16</td><td>3</td></tr><tr><td>12</td><td>2</td></tr></table>	Contact size	Contact resistance mΩ	22	5	20	4	16	3	12	2
Contact size	Contact resistance mΩ												
22	5												
20	4												
16	3												
12	2												
6	Thermal shock	Carry out the test on completely wired specimens. The modules may either be mounted on a frame or fixed on an appropriate test support. Place the specimens for at least 30 min in a chamber where the temperature is maintained at the minimum stated temperature ± 3 °C. After a period of 2 to 3 min in standard atmospheric conditions, transfer the specimens to a chamber maintained at the maximum stated temperature ± 2 °C and leave them there for at least 30 min. Carry out five cycles in these conditions. At the end of the fifth cycle leave the specimens to return to normal conditions.	There shall be no visible sign of mechanical deterioration.										

Test No.	Title of test	Test procedure	Test results required																	
7	Contact extraction force and mechanical endurance	Carry out the test individually on each contact or as specified in the detail specification. Extract the contact using the appropriate extraction tool. For this, introduce the tool until the system of unlocking operates, then, while keeping the axial alignment, apply a sufficient force to the crimped wire to extract the contact. Using the appropriate insertion tool, insert the contact until the locking system operates. These two operations make up one cycle. Carry out ten cycles on two contacts chosen from those which are the closest to each other on each module. Measure the extraction force during the first and final cycles.	The extraction force shall be not greater than the following values: <table><tr><th rowspan="2">Contact size</th><th colspan="2">Extraction force</th></tr><tr><th>N</th><th>lbf</th></tr><tr><td>22</td><td>23</td><td>5</td></tr><tr><td>20</td><td>45</td><td>10</td></tr><tr><td>16</td><td>45</td><td>10</td></tr><tr><td>12</td><td>68</td><td>15</td></tr></table>	Contact size	Extraction force		N	lbf	22	23	5	20	45	10	16	45	10	12	68	15
Contact size	Extraction force																			
	N	lbf																		
22	23	5																		
20	45	10																		
16	45	10																		
12	68	15																		
8	Contact retention in the insulator	Carry out the test individually on each contact. Introduce the contact using the appropriate insertion tool until the locking system operates. Having withdrawn the tool, check, by exerting a slight tensile force, that the contact is really locked. Apply to the crimped conductor an axial force of increasing intensity, the rate of variation of which shall be less than 5 N/s and apply the final load, which is given below, for 5 s. <table><tr><th rowspan="2">Contact size</th><th colspan="2">Final load applied</th></tr><tr><th>N</th><th>lbf</th></tr><tr><td>22</td><td>54</td><td>12</td></tr><tr><td>20</td><td>90</td><td>20</td></tr><tr><td>16</td><td>113,5</td><td>25</td></tr><tr><td>12</td><td>136</td><td>30</td></tr></table>	Contact size	Final load applied		N	lbf	22	54	12	20	90	20	16	113,5	25	12	136	30	The contact shall remain fixed in the module or splice. There shall be no deterioration of either insulator or the contact. During and after application of the force, the electrical continuity shall be checked.
Contact size	Final load applied																			
	N	lbf																		
22	54	12																		
20	90	20																		
16	113,5	25																		
12	136	30																		
9	Mechanical shock	Fix the terminal junction system onto the plate of the shock generator using the usual device. Carry out the test in conformity with the requirements of tests Ea specified in IEC Publication 68-2-27. The impulse shall be half-sine wave, with an acceleration of 981 m/s² (100g) and 6 ms in duration. Apply three shocks in succession in each of the three rectangular directions. One of these directions shall be perpendicular to the plane of the front surface. The directions in which the shocks are carried out may be in any order.																		

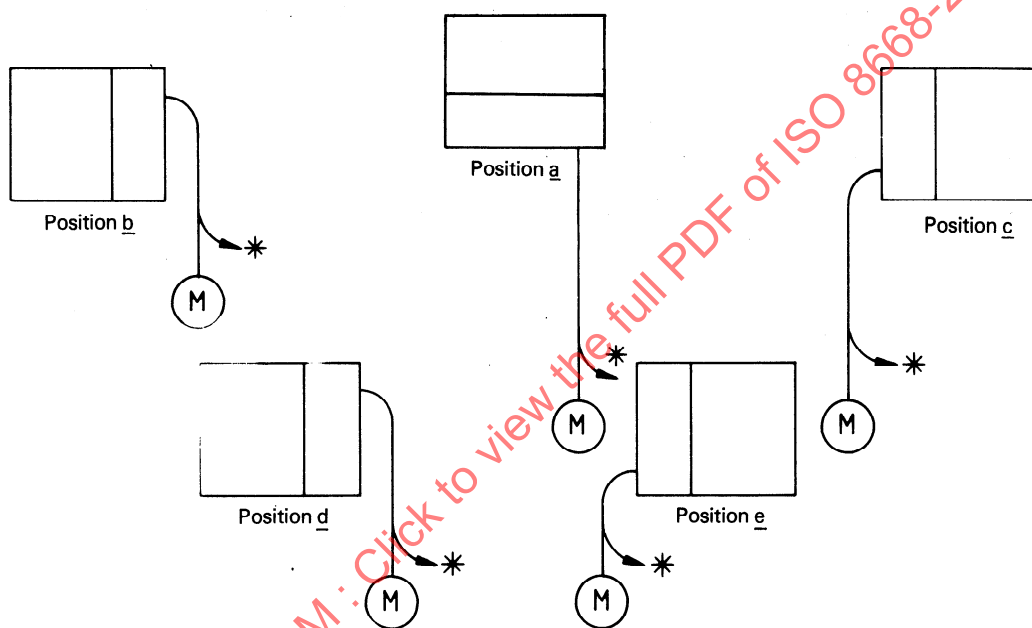
Test No.	Title of test	Test procedure	Test results required
9	Mechanical shock (<i>concluded</i>)	During the test, check the electrical continuity through the contacts connected in series (in the case of modules with more than two contacts connected together, only two contacts shall be inserted in the test series circuit). The circuit thus constituted shall be supplied at $29 \pm 2,9$ V in open circuit and with a current of 100 mA max. (d.c.).	There shall be no interruption of electrical continuity longer than 1 μ s.
10	Vibration	Fix the terminal junction system to the vibration generator using the usual fixing device. Clamp the connection cables to non-vibrating points 300 mm from the modules. If specified in the detail specification, the specimens shall be submitted to the test in the following temperature conditions: — at the ambient temperature for 50 % of the time; — at the maximum stated temperature for 25 % of the time; — at the minimum stated temperature for 25 % of the time. Carry out the test in conformity with the requirements of test Fc specified in IEC Publication 68-2-6, procedure B4. Frequency range: 10 to 2 000 Hz Amplitude: 0,75 mm or 98 m/s² (10g) above the transition frequency Total duration of the test: 12 h During the test, check the electrical continuity through the contacts connected in series (in the case of modules with more than two contacts connected together, only two contacts shall be inserted in the test series circuit). The circuit thus constituted shall be supplied at $29 \pm 2,9$ V in open circuit and with a current of 100 mA max. (d.c.).	There shall be no interruption of electrical continuity longer than 1 μ s.
11	Climatic test	Submit the terminal junction systems to a series of climatic tests (as specified in 11a to 11d).	
11a	Dry heat	Expose the specimens for 16 h to the maximum stated temperature, in the conditions laid down for test B specified in IEC Publication 68-2-2, then place them in the normal recovery conditions for 4 h.	
11b	Damp heat (1st cycle)	Subject the specimens to a cycle of damp heat (accelerated test) in the conditions laid down for test Db specified in IEC Publication 68-2-30.	

Test No.	Title of test	Test procedure	Test results required
11c	Cold	Expose the specimens for 16 h to the minimum stated temperature, in the conditions laid down for test A specified in IEC Publication 68-2-1, then place them in the normal recovery conditions for 4 h.	
11d	Damp heat (2nd to 6th cycles)	Subject the specimens to five cycles of damp heat (accelerated test) in the conditions laid down for test Db specified in IEC Publication 68-2-30.	At the end of the series of climatic tests, the insulation resistance shall be not less than 500 MΩ.
12	Endurance at maximum temperature	Expose the specimens to the maximum stated temperature $\pm 5^\circ\text{C}$ for a period of 1 000 h. At the end of this period of 1 000 h, and while the specimens are still at maximum temperature, measure the insulation resistance in accordance with test No. 3. Examine the specimens visually.	The values shall be not less than 100 MΩ. There shall be no visible material deterioration.
13	Damp heat, steady-state	Subject the specimens to a continuous damp heat test in the conditions laid down for test Ca specified in IEC Publication 68-2-3. Severity: 21 days	The marking shall remain legible.
14	Immersion at low air pressure	Unless otherwise specified, the free ends of the cables shall not be sealed. Separate the different ends of the cables as widely as possible. Immerse the specimens in a container of water to which a quantity 5 % (m/m) of sodium chloride has been added in order to make the water conductive. Place the container in an appropriate test chamber with the free ends of the cable terminated inside the chamber, but not immersed. Reduce the atmospheric pressure inside the chamber to $1 \pm 0,2 \text{ kPa}^{1)}$ and maintain it at this value for $30 \pm 5 \text{ min}$. Then return the chamber to normal atmospheric pressure. Repeat the above procedure twice. At the end of the third cycle, and while the specimens are still submerged, subject them to an insulation resistance test (see test No. 3).	The insulation resistance shall be not less than 100 MΩ.
15	Ozone	Place the modules in a test chamber containing ozone with a concentration of between 0,010 and 0,015 % (V/V) for a minimum period of 2 h at the ambient temperature. Then, examine the modules visually to reveal any signs of deterioration caused by ozone.	There shall be no evidence of cracking of material or other deterioration that will adversely affect the performances during subsequent tests.

1) $1 \text{ Pa} = 1 \text{ N/m}^2$

Test No.	Title of test	Test procedure	Test results required																																					
16	Salt spray	Submit the specimens to a salt spray test in conformity with the requirements of test Ka specified in IEC Publication 68-2-11. Test duration: 48 h The specimens shall be completely wired. Examine the specimens visually.	No corrosion or deterioration sufficient to impair use shall be noted.																																					
17	Contact resistance stability	Place each wired module with its contacts inserted normally with the wire entrance face downwards in the first position <u>a</u> (see figure 1). Carry out the test on a bussed pair of wired contacts carrying rated current. Record the voltage drop continuously. Unless otherwise stated in the detail specification, a test mass the value of which is given in the table below, is attached to one of the two wires. <table><tr><th rowspan="2">Contact size</th><th rowspan="2">AWG wire size</th><th colspan="2">Test mass</th></tr><tr><th>kg</th><th>lb</th></tr><tr><td>22</td><td>22</td><td>1,1</td><td>0,5</td></tr><tr><td>20</td><td>20</td><td>2,2</td><td>1,0</td></tr><tr><td>16</td><td>16</td><td>2,8</td><td>1,25</td></tr><tr><td>12</td><td>12</td><td>3,3</td><td>1,5</td></tr></table> Then swing each module slowly through 90° to positions <u>b</u>, <u>c</u>, <u>d</u> and <u>e</u> (see figure 1). Return to position <u>a</u> after each position has been tested in order to avoid rotation of the contacts about their axes. Repeat the test with the test mass attached to the second wire of the pair being tested.	Contact size	AWG wire size	Test mass		kg	lb	22	22	1,1	0,5	20	20	2,2	1,0	16	16	2,8	1,25	12	12	3,3	1,5	The variation in the resistance of each contact shall be not greater than the values below: <table><tr><th>Contact size</th><th>AWG wire size</th><th>Maximum variation mΩ</th></tr><tr><td>22</td><td>22</td><td>2,5</td></tr><tr><td>20</td><td>20</td><td>1,75</td></tr><tr><td>16</td><td>16</td><td>1,25</td></tr><tr><td>12</td><td>12</td><td>1,00</td></tr></table>	Contact size	AWG wire size	Maximum variation mΩ	22	22	2,5	20	20	1,75	16	16	1,25	12	12	1,00
Contact size	AWG wire size	Test mass																																						
		kg	lb																																					
22	22	1,1	0,5																																					
20	20	2,2	1,0																																					
16	16	2,8	1,25																																					
12	12	3,3	1,5																																					
Contact size	AWG wire size	Maximum variation mΩ																																						
22	22	2,5																																						
20	20	1,75																																						
16	16	1,25																																						
12	12	1,00																																						
18	Resistance to fluids	First expose wired test specimens for at least 24 h to the following ambient conditions: — temperature: 15 to 35 °C; — humidity: 45 % to 75 %; — pressure: 86 to 106 kPa (860 to 1 060 mbar). The fluids to be used shall be specified in the detail specification.																																						

Test No.	Title of test	Test procedure	Test results required
18	Resistance to fluids (concluded)	Use different specimens for each fluid. The fluid shall be either at the temperature specified in the detail specification or at the maximum temperature intended for the specimens, whichever is the lesser. Submit the wired specimens to the following cycle: Submerge the specimens for the specified period. If the use of grease is specified, it is sufficient to smear it generously over all the exposed surfaces of the grommet face. When the specimens have returned to normal conditions as stated above, remove and replace two random contacts. If indicated in the detail specification, repeat the above sequence for a further four cycles.	There shall be no deterioration which will prevent the specimens from passing subsequent specified tests.
19	Flammability	Under consideration.	



* Towards the contact resistance measuring system

Figure 1 — Test positions for contact resistance stability

Annex

Contact resistance — Measurement of voltage drop

The conductors crimped to the male contacts shall be made of copper and with a cross-section equal to the maximum standardized cross-section for this contact. All the modules submitted to the test shall be completely wired. The measurement between two adjacent contacts shall be made according to the "four-terminal" method in conformity with figure 2.

Strip the wires to about 25 mm¹⁾ above the insulator of the module. The position of the stripping shall allow the tool to be inserted below the compounding. Attach measuring wires by a suitable means (soldering, crimping, etc.) to the conductors crimped to the contacts. The joints shall be protected by an appropriate insulating and sealing compound which shall remain intact throughout the tests where the measurement of the contact resistance is required.

Keep the modules in a vertical position throughout the test, with one of the contact outlet faces, or the contact outlet face in the case of feed-back modules, being horizontal and pointing upwards. Keep the conductors perpendicular to the module outlet face for about 25 mm.

In the case of feed-through modules, the measurement of the contact resistance of internal groups shall be carried out on one face and also on two contacts designated by the same mark on either side of the module (see figure 3).

No mechanical force shall be applied to the contacts during the measurement. The ohmic resistance of the conductors is deducted from the measured value.

1) The measuring wires may be attached anywhere along the cable wires provided the measurements take into account the change in voltage at mV caused by the different location.