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**CONNECTOR, SINGLE CAVITY, AEROSPACE, PANEL  
MOUNT, FLOATING, EN4165**

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**1 - SCOPE****1.1. Content**

This document covers the performances, tests, and quality requirements of a connector plug and shell, single cavity, designed for blind mating airborne applications, and accepting modules per EN4165 specification.

**1.2. Qualification**

When tests are performed on subject product line, procedures specified in international standards shall be used. All inspections shall be performed using applicable inspection plan and product drawings

**2 - APPLICABLE DOCUMENTS**

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, latest edition of the document applies. In the event of conflict between requirements of this specification and product drawing, product drawing shall take precedence. In the event of conflict between requirements of this specification and referenced documents, this specification shall take precedence.

**2.1. Tyco Electronics documents****2.1.1. Drawings**

1577134 : Plug shell, single cavity, EN4165, floating.

1577135 : Receptacle shell, single cavity, EN4165.

1577136 : Protecting cover (rear accessory)

1577132 : Module, EN4165, 12-20, female

1577133 : Module, EN4165, 12-20, male.

**2.1.2. Application specifications**

114-15121 Plug shell and receptacle, single cavity, floating, EN4165

114-15111 Application of modular rectangular modules and shells per EN4165

**2.2. Other Documents**

EN2591 Aerospace series-Elements of electrical and optical connection. Test methods, general.

EN4165 Connectors, electrical, rectangular, modular. Operating temperature 175°C continuous.

EN3155 Electrical contacts used in elements of connection.

RTCA/DO-160D Environmental conditions and test procedures for airborne equipment.

### **3 - REQUIREMENTS**

#### **3.1. Design and construction**

##### **3.1.1. General description**

This connector system is designed to meet the requirements of EN 4165 specification. The design of the shell and hardware is however adapted to the special requirements of a wall mounting application. The shells accept standard EN 4165 modules.

The mounting hardware of the stationary part is designed for compliance in both horizontal and vertical directions. This compliance, combined with guiding surfaces in the mating area of each shell, permits a self alignment of the shells and blind mating and un-mating.

The required force necessary to reliably seal the connector interface and grant mechanical and electrical stability to the connector is generated by two side springs integrated into the wall mounting hardware.

However, the connector pair does not integrate a locking mechanism. This function must be provided separately by the customer hardware design.

The stationary part accepts an optional cover protecting the cable and providing a strain relief function.

##### **3.1.2. Materials and construction**

Shells: aluminum alloy, anodic oxidation finish.

Hardware: stainless steel, passivated.

Protective rear cover: glass filled PEI

#### **3.2. TEST REQUIREMENTS AND PROCEDURE SUMMARY**

Unless stated otherwise, all tests are carried according to EN2591.

Previously qualified modules accepting 12 size 20 contacts shall be used for all applicable tests unless specified otherwise.

The applicable tests are described in table 1

TABLE 1

EN2591-	Test designation	Requirements						
101	Visual examination	<p>Initial examination: connectors, accessories, loose parts (contacts, etc.)</p> <p>Details to be examined:</p> <ul style="list-style-type: none"> <li>- identification;</li> <li>- appearance;</li> <li>- marking;</li> <li>- surface finish and workmanship.</li> </ul> <p>Final examination: no loosening or loss of parts, no cracks, no trace of carbon, no excessive wear allowed.</p>						
102	Examination of dimensions and mass	The dimensions and mass shall meet the engineering documents.						
201	Contact resistance – low level	<p>Defined by the standards for contacts specified in EN 3155-002 Crimp contacts</p> <p>Connectors shall be mated and wired. Contact resistance shall be measured under a current of 10mA. Wire resistance shall be subtracted from measure.</p> <table border="1"> <tr> <th>Contact size</th><th>R (initial)</th><th>R (after test)</th></tr> <tr> <td>20</td><td>5 mΩ</td><td>7 mΩ</td></tr> </table>	Contact size	R (initial)	R (after test)	20	5 mΩ	7 mΩ
Contact size	R (initial)	R (after test)						
20	5 mΩ	7 mΩ						
202	Contact resistance at rated current	<p>Connectors shall be mated and wired, and mounted in test fixture fig 1. Tests defined by the standards for contacts specified in EN 3155-002 – Crimp contacts.</p> <p>Wire resistance shall be deduced from measurements.</p> <table border="1"> <tr> <th>Contact size</th><th>R initial</th><th>R after test</th></tr> <tr> <td>20</td><td>5(mΩ</td><td>7(mΩ</td></tr> </table>	Contact size	R initial	R after test	20	5(mΩ	7(mΩ
Contact size	R initial	R after test						
20	5(mΩ	7(mΩ						
206	Measurement of insulation resistance	<p>Connectors shall be mated and wired, and mounted in test fixture fig 1</p> <p>Method A – Minimum insulation resistance:</p> <ul style="list-style-type: none"> <li>- at ambient temperature: 5000MΩ (unmated connector)</li> <li>- at maximum operating temperature: 1000MΩ (unmated connectors)</li> <li>- during tests 315: 1000MΩ (unmated connectors)</li> <li>- during tests 301: 100MΩ (mated connectors)</li> </ul>						

**TABLE 1 (CONTINUED)**

EN2591-	Test designation	Requirements									
207	Voltage proof test	<p>Method A, unmated and mated connectors. For tests of mated connectors, test fixture fig 1 shall be used.</p> <p>For tests at low pressure, voltage is applied after 30 min at the pressure indicated.</p> <p>Max. leakage current: 2mA</p> <table> <tr> <th>Pressure</th><th>Mated (V r.m.s)</th><th>Unmated (V r.m.s)</th></tr> <tr> <td>12,1 kPa</td><td>1000</td><td>600</td></tr> <tr> <td>5,5 kPa</td><td>1000</td><td>400</td></tr> </table>	Pressure	Mated (V r.m.s)	Unmated (V r.m.s)	12,1 kPa	1000	600	5,5 kPa	1000	400
Pressure	Mated (V r.m.s)	Unmated (V r.m.s)									
12,1 kPa	1000	600									
5,5 kPa	1000	400									
210	Electrical overload	<table> <tr> <th>Contact size</th><th>Current A</th><th>Durations</th></tr> <tr> <td rowspan="2">20</td><td>15</td><td>40</td></tr> <tr> <td>75</td><td>0,6</td></tr> </table>	Contact size	Current A	Durations	20	15	40	75	0,6	
Contact size	Current A	Durations									
20	15	40									
	75	0,6									
216	Engagement of contacts	<p>Connectors shall be mated and wired, and mated in conditions resulting from test fixture fig 1</p> <p>min.engagement : 1,27 mm</p>									
301	Endurance at temperature	<p>Connectors shall be mated and wired with cable clamp. Method B without current.</p> <p>Temperature: 175°C</p> <p>Duration: 1000 h</p>									

**TABLE 1 (CONTINUED)**

EN2591-	Test designation	Requirements
303	Cold/low pressure and damp heat	<p>Connectors shall be mated and wired, and mounted in test fixture fig 1</p> <p>Method A.</p> <ul style="list-style-type: none"> <li>- Preconditioning conditions:</li> </ul> <p>Slope from ambient temperature to 70 °C in 2h max;</p> <p>Temperature of 70 °C during 20h;</p> <p>Slope from 70 °C to 40 °C in 2 hours max.</p> <ul style="list-style-type: none"> <li>- Then 5 cycles shall be realized according to following conditions:</li> </ul> <p>Slope from 40 °C to 23 °C <math>\pm 5^{\circ}\text{C}</math> and 50% HR <math>\pm 10\%</math> in 2 hours max;</p> <p>Temperature of 23 °C <math>\pm 5^{\circ}\text{C}</math> C and 50% HR <math>\pm 10\%</math> maintained 1 hour;</p> <p>Slope from 23 °C and ambient pressure to <math>-55^{\circ}\text{C} \pm 5^{\circ}\text{C}</math> and 5,5 <math>\pm 0,1</math> kPa in 16 hours;</p> <p>Temperature of <math>-55^{\circ}\text{C}</math> and pressure of 5,5 kPa maintained 4 hours;</p> <p>Slope from <math>-55^{\circ}\text{C}</math> and 5,5 kPa to ambient pressure and <math>40^{\circ}\text{C} \pm 2^{\circ}\text{C}</math> in 5 hours max;</p> <p>Temperature of 40 °C and 95% <math>\pm 2/-3\%</math> HR maintained 16 hours;</p> <p>During test, a voltage of 300V dc applied between the contacts of even cavity numbers connected together and the contacts of odd cavities connected together.</p> <p>Leakage current shall be under 2mA.</p>
305	Rapid change of temperature	<p>Connectors shall be mated and wired, and mounted in test fixture fig 1</p> <p><math>T_A = (-55_{-5}^{+0})^{\circ}\text{C}</math></p> <p><math>T_B = (-175_{+0}^{+5})^{\circ}\text{C}</math></p>

**TABLE 1 (CONTINUED)**

EN2591-	Test designation	Requirements
306	Mould growth	Method A Duration 28d, Growth=0 No prior washing, no surface etching.
307	Salt mist	The connectors shall be suspended in the test chamber with non-metallic cords, so that no accumulation of condensed saline solution can occur.  The unmated connectors shall be exposed to the salt mist for 48h.
315	Fluid resistance	Connectors to be wired and mated. See table 2 for types of fluids, number of cycles, temperature and time of immersion and temperature for the third phase. Duration of drying at ambient temperature before stoving shall be 7 h +/-0,5h. Duration of stoving shall be 16 h +/-0,5h.  Final measurements: EN 2591-101, EN 2591-206 (except conductive fluids), EN 2591-408, EN 2591-409, EN 2591-410
317	Flammability	Method A . Connector mated, with cable clamp but without contacts. See EN2591-317 for test description and requirement..
402	Shock	Connectors shall be mated and wired with cable clamp and mounted in test fixture fig 1 Method A: Severity 100 Number of shocks : one each way for each of the three directions (i.e. six shocks in total) final measurement : EN2591-101, EN2591-408.

TABLE 1 (CONTINUED)

EN2591-	Test designation	Requirements						
403	Sinusoidal vibrations	<p>Connectors shall be mated and wired, and mounted in test fixture fig 1</p> <p>Same mounting configuration as EN2591-402.</p> <p>Method A</p> <p>Frequency range 5 Hz to 3000 Hz</p> <p>Acceleration : 20 g</p> <p>1 octave per minute</p> <p>Duration : 4 h / axis</p> <p>Final measurements : EN2591-101(ambient temperature), EN2591-205, EN2591-408.</p>						
406	Mechanical endurance	<p>Connectors shall be mated and wired. The floating element shall be mounted in test fixture fig 2</p> <p>Number of mating and un-mating operations: 500</p> <p>The rate shall not exceed 5 cycles/min.</p> <p>Mating speed 100mm/mn max</p> <p>Final measurements: EN 2591-101, EN 2591-202 (ambient temperature), EN 2591-408.</p>						
408	Mating and un-mating forces	<p>Connectors equipped with 12 size 20 modules, wired. Floating element shall be mounted in fixture fig 2 .</p> <p>Connectors shall be mated to nominal mating position.</p> <p>Mating force includes seal and spring compression and shall meet engineering drawings.</p> <p>Un-mating forces shall be 11N max</p> <p>Speed: 50 mm/mn</p>						
409	Contact retention in module	<p>Connectors shall be unmated. A preload of 10 N shall be applied to the front face in order to remove play of contacts in cavities. Then a load shall be applied axially to the contact front and maintained 10 s. At the end of the test, the displacement of contacts shall be measured.</p> <table border="1"> <thead> <tr> <th>Contact size</th><th>Axial load N</th><th>Tested contact</th></tr> </thead> <tbody> <tr> <td>20</td><td>90</td><td>50%</td></tr> </tbody> </table> <p>Displacement &lt; 0,3 mm after application of the load.</p>	Contact size	Axial load N	Tested contact	20	90	50%
Contact size	Axial load N	Tested contact						
20	90	50%						

**TABLE 1 (CONTINUED)**

EN2591-	Test designation	Requirements			
410	Insert retention in housing (axial)	Connector not fitted with contacts.  A load of 254 N shall be applied gradually at a rate of 25N/s max to the front face of the module and maintained during 5 s.  Displacement shall be lower than 0,2mm after application of the load			
412	Contact insertion and extraction forces	<b>Contact size</b>	<b>Insertion force in N</b>	<b>Extraction force in N</b>	<b>Tested contact</b>
		20	89	89	50%
420	Mechanical strength of rear accessories	Connectors shall be wired and mated. The rear accessory (cable cover) shall be mounted on applicable connectors and the cable shall be secured to the cover as specified. Connectors shall be installed on fixture fig 2 mounted horizontally. A load of 40 N shall be applied on the end of the rear accessories in front of the binding zone at a rate lower than 20 N/s during 1 min.  No damage permitted.			



**Table 2 – Resistance to fluids**

Fluid			Immersion		Stoving	Number of cycles
Category	References		Time min.	Temp. °C	Temp. °C	
Fuel	JP5	NATO F44	5 <sup>+2</sup> <sub>0</sub>	25	85	7
Mineral hydraulic fluid	MIL-H-5606E	NATO F515	15 <sup>+5</sup> <sub>0</sub>	85	100	5
Synthetic hydraulic fluid	AS 1241A	Skydrol 500B4	15 <sup>+5</sup> <sub>0</sub>	85	100	5
Mineral lubricant	MIL-L-7870 °	NATO 0142	15 <sup>+5</sup> <sub>0</sub>	120	125	5
Synthetic lubricant	MIL-L-23699C MIL-L-7808J	NATO 0156 NATO 0148	15 <sup>+5</sup> <sub>0</sub>	150	125	5
	MIL-C-25769J diluted	-	15 <sup>+5</sup> <sub>0</sub>	25	25	5
Cleaning products	25 % Propanol + 75 % White spirit					
	Methyl Ethyl Ketone	ASTM0740	5 <sup>+2</sup> <sub>0</sub>			2
De-icing fluid	MIL-A-8243D	NATO S742	15 <sup>+5</sup> <sub>0</sub>	50	100	5
Extinguishing fluid	Chlorobromethane	DUPONT FE1301	15 <sup>+5</sup> <sub>0</sub>	15	25	5
Cooling fluid	Coolanol	-	15 <sup>+5</sup> <sub>0</sub>	50	25	5

### Conditions for initial qualification

Initial qualification is obtained when the test samples have satisfied the applicable tests in groups 0 to 7.

### Sampling and definition of test samples

The test samples are pairs of connectors and unless otherwise specified are fitted with contacts and cable clamps.

Number of test samples (pair) see table 3.

**Table 3 - Test samples**

Test group	Number of test samples (pair)
0	4 pairs
1	2 pairs
2	2 pairs
3	2 per fluid
4	2 pairs
5	2 pairs
6	2 pairs
7	2 pairs

**Preparation of test samples**

Samples shall be randomly taken from production batches.

Connectors shall be wired as follows:

- Wires used shall be 250 mm long
- Copper wire according to ASNE 0261 shall be used:
  - 50% with the minimum section of wire gauge per size of contacts
  - 50% with the maximum section of wire gauge per size of contacts

Contacts shall be crimped per table 4 and modules mounted per application specification 114-152111.

**Table 4 - CONTACTS AND CRIMP TOOLING**

Designation	Part number	Contact Size	Barrel size	Crimping tool	Positioner	Cable size	Tool Selector
EN3155-003S2020 M39029/57-357	1577137-1	20	20	M22520/2-01	M22520/2-10	20	6
						24	4
EN3155-008P2020 M39029/58-363	1577140-1	20	20	M22520/2-01	M22520/2-10	20	6
						24	4

**Program of qualification tests**

The qualification tests are defined in table 5 and shall be performed in the order indicated.

TABLE 5 – QUALIFICATION TEST SEQUENCE

Designation of the test	EN 2591-	Remarks
<b>Group 0</b>		
Visual examination	101	
Examination of dimensions and mass	102	
Mating and unmating forces	408	
Module retention in housing	410	
Measurement of insulation resistance	206	
Voltage proof	207	
Visual examination	101	
<b>Group 1</b>		
Measurement of insulation resistance	206	
Voltage proof test	207	
Salt mist	307	
Visual examination	101	
Mating and unmating forces	408	
Visual examination	101	
<b>Group 2</b>		
Visual examination	101	
Contact resistance at low level	201	
Mechanical endurance	406	
Mating and unmating forces	408	
Shock	402	
Sinusoidal and random vibration	403	
Cold/low pressure and damp heat	303	
Contact resistance at low level	201	
Measurement of insulation resistance	206	
Voltage proof	207	
Mould growth	306	
Visual examination	101	
<b>Group 3</b>		
Contact retention in insert	409	
Fluid resistance	315	
Measurement of insulation resistance	206	
Contact retention in insert	409	
Visual examination	101	

TABLE 5 – QUALIFICATION TEST SEQUENCE (CONTINUED)

Designation of the test	EN 2591-	Remarks
<b>Group 4</b>		
Visual examination	101	
Contact resistance at low level	201	
Electrical overload	210	
Measurement of insulation resistance	206	
Voltage proof	207	
Contact resistance at low level	201	
Contact resistance at rated current	202	
Endurance at temperature	301	
Contact resistance at low level	201	
Mechanical strength of rear accessory	420	
Visual examination	101	
<b>Group 5</b>		
Contact insertion and extraction forces	412	
Engagement of contact	216	
Rapid change of temperature	305	
Mating and un-mating forces	408	
Measurement of insulation resistance	206	
Voltage proof	207	
Module retention in housing	410	
Visual examination	101	
<b>Group 6</b>		
Visual examination	101	
Flammability	317	
Visual examination	101	
<b>Group 7</b>		
Visual examination	101	
Mould growth	306	
Visual examination	101	

## 4 - QUALITY ASSURANCE PROVISIONS

### 4.1. Test sequence

Qualification inspection shall be verified by testing samples as specified in table 5.

### 4.2. Acceptance

Acceptance is based on verification that product meets requirements of 3.2.

### 4.3. Re-qualification testing

If changes affecting significantly form, fit and function are made to the product or manufacturing process, partial or complete re-qualification testing will be implemented, according to requirements established by customer, by product engineering and quality assurance.

## 5 - ANNEX

FIG 1 TEST FIXTURE 1 MOUNTING HARDWARE

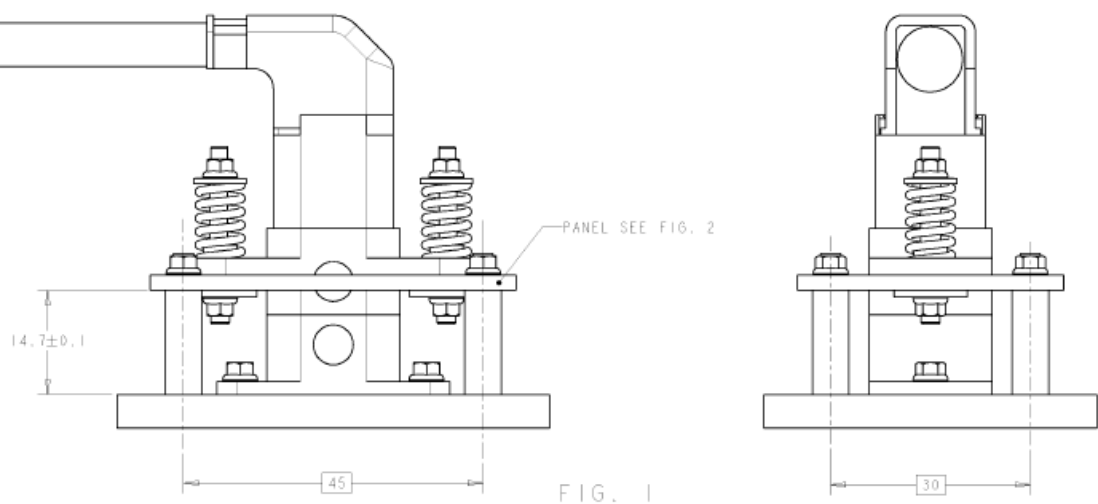
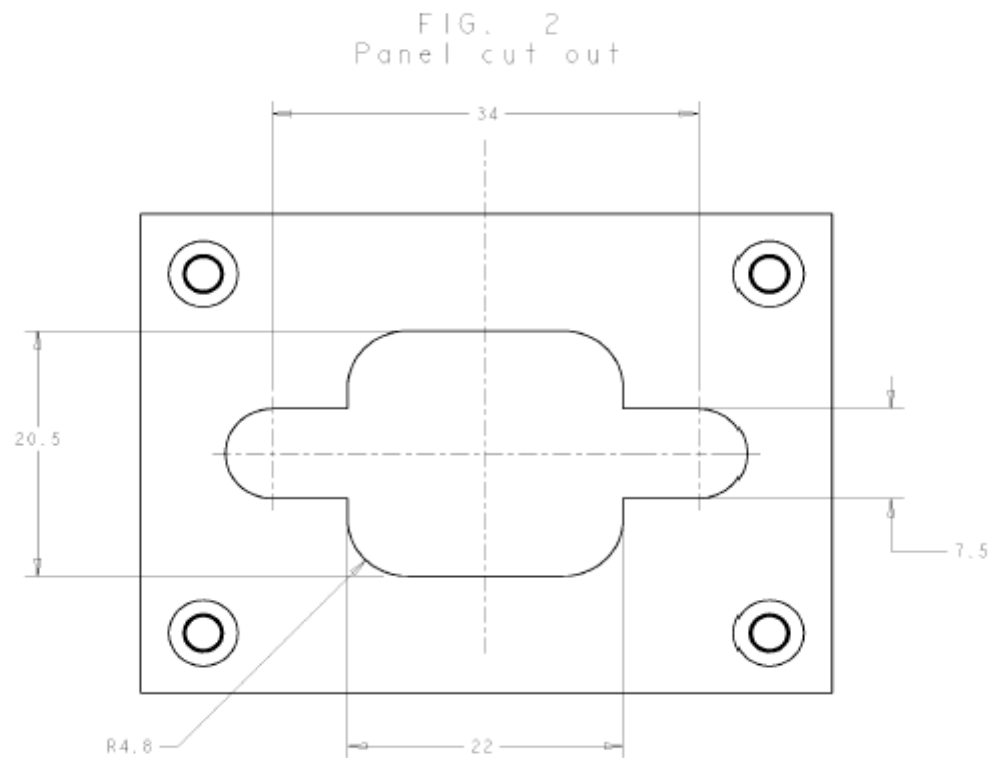


FIG 2 TEST FIXTURE 2: PANEL MOUNTING



Steel plate, Ni plated, thickness 1,9mm 0 +0,1

Missing dimensions per drawing 1577134