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QUALIFICATION TEST SUMMARY REPORT

ESR-9389

Qualification Type Testing of

Amphenol Corporation's 2M801 Series Connector

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Aerospace Operation

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REV. F

28 March 2014

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1. PURPOSE OF TEST:

The purpose of this test summary is to define the test samples, test sequences and test methods used to verify that Amphenol 2M801 Series of connectors meet industry standards for miniature ruggedized circular connectors.

The testing was meant to validate the Amphenol connector performance to the industry standard which was created from the competition test report 101706191 July 2009 located on their website. Where applicable Mil-C-38999 requirements were imposed and connectors were tested to the higher levels on the Amphenol connectors.

Where possible connectors were mated to competitor parts to be assured that the performance that was needed was also in a mated condition with competition produced parts.

2. CONCLUSION:

All following test groups of Amphenol 2M801 series connectors satisfactorily completed the qualification tests outlined in L-40991-240 Rev F.

The following testing was successfully performed to 38999 levels on Amphenol product:

Magnetic Permeability
Altitude Immersion
Vibration
Humidity

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Comparison Matrix (sect 2 cont) Amphenol or Competitor Test Plan Part Number	Competitor Test Plan 91906189				Amphenol QTP L-40991-240 Rev F				
Product	Competitor 801 Series				Amphenol 2M801 Series				
	Test Group				Test Group				
	1	2	3	4	1	2	3	4	5
Test Group Summary	Insert Retention, Salt Spray	Vibe, Shock	Sand and Dust, Immersion	EMI	Insert Retention, Salt Spray	Vibe, Shock	EMI	Sand and Dust, Immersion	Insert Retention
	+Test Sequence				+Test Sequence				
Visual and Mechanical Examination	1	1	1	1	1	1	1	1	1
Insert Retention	4				2				2,4
Magnetic Permeability	2				3				
Altitude Immersion	3				4				
*Insulation resistance at ambient temperature					5	4,12			
*Dielectric withstanding voltage at sea level					6	5,13			
Durability (500 cycles)	5	7			7	9			
Shell to shell conductivity	6,8				8,10				
Electrical Engagement	9				11				
Salt Spray	7				9				
*Insert Pushout					12				
Contact Retention		2				2,17			
Altitude – Low Temperature		3				3			
Temperature Cycling		4				6			3
Insulation Resistance at Elevated Temperature		5				7			
Dielectric Withstanding Voltage at Sea Level		6				8			
<u>Vibration</u>		8				**10			
Shock		9				11			
Humidity		10				14			
*Low Level Contact Resistance						15			
*Contact Resistance						16			
EMI Shielding Effectiveness				2			2		
Sand and Dust			2					2	
Immersion			3					3	
Post Test Examination	10	11	4	3	13	18	3	4	5
Results or Scheduled Completion Date	N/A	N/A	N/A	N/A	Passed	Passed	Passed	Passed	Passed

+Numbers shown in Test Sequence detail the order in which tests were completed in each group.

*Testing not completed in Competitor's Test Plan

** Vibration testing performed 2X on Amphenol product – once at industry standard vibe levels, then to Mil-C-38999 vibration profiles.

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3. TEST AGENCY:

All tests and inspections were performed at and by the Amphenol Corporation,
40-60 Delaware Avenue, Sidney, NY 13838.

4. STANDARD TEST CONDITIONS:

Ambient Temperature: $20 \pm 5^{\circ}\text{C}$

Ambient Humidity: $50 \pm 30\%$

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5. TEST SAMPLES:

The following connector samples, wire, sealing plugs, and contacts were provided for qualification testing.

Amphenol Part Number	Description	Size	Coded Number	Total	Group					Spares
					1	2	3	4	5	
F7-678111-07P	Plug	6	2M801-008-26MT6-7PA	13	3	3		3	2	2
F7-678171-07S	Receptacle	6	2M801-010-02MT6-7SA	13	3	3		3	2	2
*801-008-26MT6-7PA	Plug	6	N/A	4	1	1		1		1
*801-010-02MT6-7SA	Receptacle	6	N/A	4	1	1		1		1
F7-696904-006	Backshell	6	2M620MS064MT06	26	8	8		8		2
FH-696368-006	Plug Shell Kit	6	N/A	4			2			2
FH-678058-006	Recept Shell	6	N/A	4			2			2
10-597346-735	Pin	23	2M809-001	77						
10-597345-735	Socket	23	2M809-002	77						
FH-678116-37S	Plug	13	2M801-008-26M13-37SA	13	3	3		3	2	2
FH-678176-37P	Receptacle	13	2M801-010-02M13-37PA	13	3	3		3	2	2
*801-008-26M13-37SA	Plug	13	N/A	4	1	1		1		1
*801-010-02M13-37PA	Receptacle	13	N/A	4	1	1		1		1
FH-696904-012	Backshell	13	2M620MS064M12	26	8	8		8		2
FH-696368-013	Plug Shell Kit	13	N/A	4			2			2
FH-678058-013	Recept Shell	13	N/A	4			2			2
10-597346-735	Pin	23	2M809-001	407						
10-597345-735	Socket	23	2M809-002	407						
F9-678118-85S	Plug	17	2M801-008-26NF17-85SA	13	3	3		3	2	2
F9-678178-85P	Receptacle	17	2M801-010-02NF17-85PA	13	3	3		3	2	2
*801-008-26NF17-85SA	Plug	17	N/A	4	1	1		1		1
*801-010-02NF17-85PA	Receptacle	17	N/A	4	1	1		1		1
F9-696904-015	Backshell	17	2M620MS064NF15	26	8	8		8		2
FH-696368-017	Plug Shell Kit	17	N/A	4			2			2
FH-678058-017	Recept Shell	17	N/A	4			2			2
10-597346-735	Pin	23	2M809-001	935						
10-597345-735	Socket	23	2M809-002	935						
AS22759/11-24	Wire	24	N/A	AN						
AS22759/22-24	Wire (High Strength)	24	N/A	AN						

AN= As Needed

*Competitor Part Numbers

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6. TEST SEQUENCES:

The samples shall be subjected to tests in order specified.

Qualification Test Sequences

Test Group 1		
<u>TEST</u>	MIL-DTL-38999 Requirement Paragraph	MIL-DTL-38999 Test Paragraph
Visual and mechanical examination <u>6X optical inspection</u>	3.1, 3.3, 3.4, 3.5, 3.52 and 3.53	4.5.1
Preparation of samples	L-40991-240 Para 7.1	
Insert Retention <u>25lbs for size 6, 30lbs for size 13, 50lbs for size 17</u>	L-40991-240 Para. 8.12.1	
Magnetic permeability <u>2μ Max</u>	3.3.4	4.5.48
Altitude Immersion <u>EIA-364-03</u>	3.13	4.5.9
Insulation resistance at ambient temperature <u>500 Gohms @ 500 VDC</u>	3.14.1	4.5.10.1
Dielectric withstanding voltage at sea level <u>Less than 2 milli-amperes @ 500 VAC</u>	3.15	4.5.11.1
Durability <u>500 Cycles</u>	3.12	4.5.8
Shell-to-shell conductivity <u>Less than 2.5 millivolt drop at 1 amp</u>	3.29	4.5.25
Salt spray (Static test) <u>48 hr exposure, unmated</u>	3.17	4.5.13.1
Shell-to-shell conductivity <u>Less than 2.5 millivolt drop at 1 amp</u>	3.29	4.5.25
Insert Pushout <u>Max axial force until bond failure (See Table 3)</u>	L-40991-240 Para. 8.12.2	
Post test examination <u>6X optical inspection</u>	3.52 and 3.53	4.5.49

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Test Group 2		
TEST	MIL-DTL-38999 Requirement Paragraph	MIL-DTL-38999 Test Paragraph
Visual and mechanical examination <u>6X optical inspection</u>	3.1, 3.3, 3.4, 3.5, 3.52 and 3.53	4.5.1
Preparation of samples	L-40991-240 Para 7.2	
Contact retention (5% or 3 contacts minimum) <u>6lbs Min</u>	3.24	4.5.20.1
Altitude- Low Temperature <u>40,000ft & -65C</u>	L-40991-240 Para 8.1	
Insulation resistance at ambient temperature <u>500 Gohms @ 500 VDC</u>	3.14.1	4.5.10.1
Dielectric withstanding voltage at sea level <u>Less than 2 milli-amperes @ 500 VAC</u>	3.15	4.5.11.1
Temperature Cycling (Shock) <u>-65C to +150C, 5 cycles</u>	3.8	4.5.4
Insulation resistance at Elevated temperature <u>1,000 Megohms@500VDC & 150C</u>	L-40991-240 Para 8.2	
Dielectric withstanding voltage at altitude <u>Less than 2 milli-amperes@100VAC & 40,000ft</u>	L-40991-240 Para 8.3	
Durability <u>500 Cycles</u>	3.12	4.5.8
Vibration (See paragraph 6.2 for further detail) <u>43.9g RMS, 60G sine</u>	3.27*	4.5.23.2*
Shock <u>300 G half-sine, 3 millisecond duration, 3 pulses in each direction of 3 axes (18 pulses), no discontinuities greater than 1 micro-second.</u>	L-40991-240 Para 8.5	
Humidity <u>10 days of 100% humidity cycles</u>	3.30	4.5.26
Insulation resistance at ambient temperature <u>500 Gohms @ 500 VDC</u>	3.14.1	4.5.10.1
Dielectric withstanding voltage at sea level <u>Less than 2 milli-amperes @ 500 VAC</u>	3.15	4.5.11.1
Low Level Contact Resistance <u>20 milli-ohms Max (20mV max and 100mA max)</u>	L-40991-240 Para 8.11	
Contact Resistance <u>45mV Max voltage drop @ 3A</u>	L-40991-240 Para 8.10	
Contact Retention (5% or 3 contacts minimum) <u>6lbs Min</u>	3.24	4.5.20.1
Post test examination <u>6X optical inspection</u>	3.52 and 3.53	4.5.49

*Also reference L-40991-240 paragraph 8.4

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Test Group 3		
TEST	MIL-DTL-38999 Requirement Para.	MIL-DTL-38999 Test Para.
Visual and mechanical examination 6X optical inspection	3.1, 3.3, 3.4, 3.5, 3.52 and 3.53	4.5.1
Preparation of samples	L-40991-240 Para 7.3	
EMI Shielding-High Frequency Met minimum dB attenuation requirements for all frequencies (See Table 1)	L-40991-240 Para 8.8	
EMI Shielding-Low Frequency Met minimum dB attenuation requirements for all frequencies (See Table 2)	L-40991-240 Para 8.9	
Post test examination 6X optical inspection	3.52 and 3.53	4.5.49

Test Group 4		
TEST	MIL-DTL-38999 Requirement Para.	MIL-DTL-38999 Test Para.
Visual and mechanical examination 6X optical inspection	3.1, 3.3, 3.4, 3.5, 3.52 and 3.53	4.5.1
Preparation of samples	L-40991-240 Para 7.4	
Sand and Dust MIL- STD-810F, Method 510.4	L-40991-240 Para 8.6	
Immersion 1 meter water for 30 minutes	L-40991-240 Para 8.7	
Post test examination 6X optical inspection	3.52 and 3.53	4.5.49

Test Group 5		
TEST	MIL-DTL-38999 Requirement Para.	MIL-DTL-38999 Test Para.
Visual and mechanical examination 6X optical inspection	3.1, 3.3, 3.4, 3.5, 3.52 and 3.53	4.5.1
Preparation of samples	L-40991-240 Para 7.5	
Insert Retention 25 lbs for size 6, 30 lbs for size 9 and 12	L-40991-240 Para. 8.12.1	
Temperature Cycling (Shock) -65C to +150C, 5 cycles	3.8	4.5.4
Insert Retention 25 lbs for size 6, 30 lbs for size 9 and 12	L-40991-240 Para. 8.12.1	
Post test examination 6X optical inspection	3.52 and 3.53	4.5.49

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6.1 EMI Testing Detail:

EMI Testing was completed to the following requirements:

Frequency	dB. Min. Attenuation
1 GHz	55
3 GHz	50
5 GHz	45
18 GHz	40

Table 1: Minimum Attenuation: High Frequency

Frequency	dB. Min. Attenuation
100 MHz	75
200 MHz	70
300 MHz	65
400 MHz	63
800 MHz	58
1000 MHz	55

Table 2: Minimum Attenuation: Low Frequency

6.2 Vibration Testing Detail:

Vibration, Random:

EIA-364-28F Condition V letter I with the following details:

Duration: 4 hours each of three axis

Temperature: Ambient

Frequency range: 50Hz to 2000Hz

37.8g RMS

After testing done above test connectors to MIL-DTL-38999 para. 4.5.23.2.3 (Series III)

EIA-364-28F Condition VI letter I with the following details:

Duration: 8 hours each of three axes

Temperature: Ambient

Frequency range: 50Hz to 2000Hz

43.9g RMS

Vibration, Sine:

Condition G. 12 sweep cycles per axis (3 axes), 20 minutes per 10-2000-10Hz sweep cycle, ambient temperature. (30G)

After testing done above test connectors to MIL-DTL-38999 para. 4.5.23.2.1 (Series III)

12 hrs per axis (3 axes), 20 minutes per 10-2000-10Hz sweep cycle, ambient temperature. (60G)

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6.3 Insert Pushout Testing Data:

Shell Size	Average Insert Pushout (lbs)
6	55.3
13	477.5
17	692.2

Table 3: Insert Pushout Data

7.0 SAMPLE PREPARATION/DEFINITION:

7.1 Group 1-Sample Breakdown

Two mated pairs of Amphenol Connectors, each connector size shall be prepared with two foot lengths of AS22759/11-24 wire.

Two mated pairs of Amphenol/Competitor Connectors, each connector size shall be prepared with two foot lengths of AS22759/11-24 wire. (Amphenol Plug-Competitor Receptacle, Amphenol Receptacle-Competitor Plug)

Part Number	Description	QTY	Size
F7-678111-07P	Plug	3	6
F7-678171-07S	Receptacle	3	6
801-008-26MT6-7PA	Plug	1	6
801-010-02MT6-7SA	Receptacle	1	6
FH-678116-37S	Plug	3	13
FH-678176-37P	Receptacle	3	13
801-008-26M13-37SA	Plug	1	13
801-010-02M13-37PA	Receptacle	1	13
F9-678118-85S	Plug	3	17
F9-678178-85P	Receptacle	3	17
801-008-26NF17-85SA	Plug	1	17
801-010-02NF17-85PA	Receptacle	1	17
F7-696904-006	Backshell	4	6
FH-696904-012	Backshell	4	13
F9-696904-015	Backshell	4	17
10-597345-735	Socket	387	23
10-597346-735	Pin	387	23
AS22759/11-24	Wire	AN	24
*AFM8 or similar	Crimp Tool	N/A	N/A
*K1461-1	Crimp Positioner	N/A	23

AN=As needed

*Crimp tool and crimp positioner are Daniels part numbers

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7.2 Group 2-Sample Breakdown

Two mated pairs of each connector size shall be prepared with four foot lengths of AS22759/22-24 wire.

Two mated pairs of Amphenol/Competitor Connectors, each connector size shall be prepared with four foot lengths of AS22759/22-24 wire. (Amphenol Plug-Competitor Receptacle, Amphenol Receptacle-Competitor Plug)

*Samples in this group must use high strength wire only.

Part Number	Description	QTY	Size
F7-678111-07P	Plug	3	6
F7-678171-07S	Receptacle	3	6
801-008-26MT6-7PA	Plug	1	6
801-010-02MT6-7SA	Receptacle	1	6
FH-678116-37S	Plug	3	13
FH-678176-37P	Receptacle	3	13
801-008-26M13-37SA	Plug	1	13
801-010-02M13-37PA	Receptacle	1	13
F9-678118-85S	Plug	3	17
F9-678178-85P	Receptacle	3	17
801-008-26NF17-85SA	Plug	1	17
801-010-02NF17-85PA	Receptacle	1	17
F7-696904-006	Backshell	4	6
FH-696904-012	Backshell	4	13
F9-696904-015	Backshell	4	17
10-597346-735	Pin	387	23
10-597345-735	Socket	387	23
AS22759/22-24	HS Wire	AN	24
*AFM8 or similar	Crimp Tool	N/A	N/A
*K1461-1	Crimp Positioner	N/A	23

AN=As needed

*Crimp tool and crimp positioner are Daniels part numbers

7.3 Group 3-Sample Breakdown

Three mated pairs of each connector size, connectors consist of special Electroless Nickel plated modified shells for EMI (no inserts or contacts).

Part Number	Description	QTY	Size
FH-696368-006	Plug Shell Kit	3	6
FH-678058-006	Recept Shell	3	6
FH-696368-013	Plug Shell Kit	3	13
FH-678058-013	Recept Shell	3	13
FH-696368-017	Plug Shell Kit	3	17
FH-678058-017	Recept Shell	3	17

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7.4 Group 4-Sample Breakdown

Two mated pairs of each connector size shall be prepared with two foot lengths of AS22759/11-24 wire.

Two mated pairs of Amphenol/Competitor Connectors, each connector size shall be prepared with two foot lengths of AS22759/11-24 wire. (Amphenol Plug-Competitor Receptacle, Amphenol Receptacle-Competitor Plug)

Part Number	Description	QTY	Size
F7-678111-07P	Plug	3	6
F7-678171-07S	Receptacle	3	6
801-008-26MT6-7PA	Plug	1	6
801-010-02MT6-7SA	Receptacle	1	6
FH-678116-37S	Plug	3	13
FH-678176-37P	Receptacle	3	13
801-008-26M13-37SA	Plug	1	13
801-010-02M13-37PA	Receptacle	1	13
F9-678118-85S	Plug	3	17
F9-678178-85P	Receptacle	3	17
801-008-26NF17-85SA	Plug	1	17
801-010-02NF17-85PA	Receptacle	1	17
F7-696904-006	Backshell	4	6
FH-696904-012	Backshell	4	13
F9-696904-015	Backshell	4	17
10-597346-735	Pin	387	23
10-597345-735	Socket	387	23
AS22759/11-24	Wire	AN	24
*AFM8 or similar	Crimp Tool	N/A	N/A
*K1461-1	Crimp Positioner	N/A	23

AN=As needed

*Crimp tool and crimp positioner are Daniels part numbers

7.5 Group 5-Sample Breakdown

Part Number	Description	QTY	Size
F7-678111-07P	Plug	2	6
F7-678171-07S	Receptacle	2	6
FH-678116-37S	Plug	2	13
FH-678176-37P	Receptacle	2	13
F9-678118-85S	Plug	2	17
F9-678178-85P	Receptacle	2	17