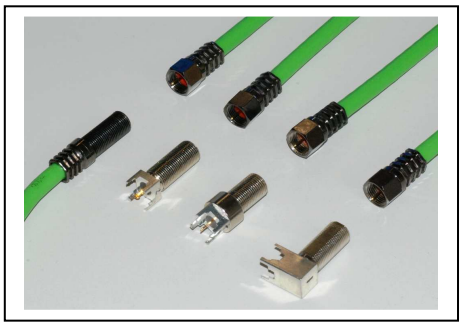
Job Number: **E09.03.456**	**Project Number:** **09DB01**	**Date of issue:** **May 2009**
Description: F-Connector **Product qualification tests**		**Part numbers:** **619315** **619338** **619316** **619317** **619374**

Scope:
To execute the qualification tests according Tyco Electronics Product Specification 108-71082 rev. A.



Conclusions:

The tested specimens met the requirements as defined in product specification 108-1971082 rev.A.

Test Specification: Tyco Electronics Product Specification 108-71082 rev. A.

Test Carried Out: 1 Prod. Qualification 4
2 5
3 6

Distribution: 1 D. Bozzer.
2 Doc. center
3 File Lab.

Test Engineer: G. de Volder.	**Requested by: Product Engineering**
Laboratory Manager: D.M.J. Jooren.	**Classification:** Unrestricted
Disposal of Samples: Ret. to requester	**Report Number:** 501-19137 Rev. O
Appendices:	**Page** 1 **of** 9 **Pages**

SAMPLE DESCRIPTION

For each of the 7 test groups, 3 F-Connector jacks per variant were available. For each jack, an F-Connector cable plug P/N 619316 was available. With these products, for each group the following test lots were formed:

lot a): 3 x P/N 619315 (jack 90° PCB) with 3 x P/N 619316 (cable plug);
lot b): 3 x P/N 619374 (jack fat PCB) with 3 x P/N 619316 (cable plug);
lot c): 3 x P/N 619317 (jack thin PCB) with 3 x P/N 619316 (cable plug);
lot d): 3 x P/N 619338 (cable jack, low loss) with 3 x P/N 619316 (cable plug).

The cable plugs and cable jacks were terminated on pieces (of 500 mm) of Lofar cable, type 1.13/4.8 FB Highscreen 90 dB.
The PCB jacks for test group 6 (return loss, current derating) were soldered on Printed Circuit Boards, the cable assemblies for this group had an SMA Jack on the other end, to enable the return loss measurement.
Because different dash-numbers for these products only indicate another colour (black or red) of the sealing cover, these dash-numbers are not given in this report. However, a mixture of products with black and red sealing covers was subjected to the tests.

TEST PROCEDURES

IEC 60512-1-1:
Test 1a

VISUAL EXAMINATION:
The test samples were visually inspected under a stereomicroscope, at a 10x magnification, with suitable illumination.

IEC 60512-2-1:
Test 2a

CONTACT RESISTANCE of the centre and shield contact :
The contact resistance was measured with an open circuit voltage of 20 mVolt and a maximum current of 100 mA DC.
For the cable connectors, the measuring values include the bulk resistance of 500 mm of the centre or shield conductor of the cable.

IEC 60512-3-1:
Test 3a

INSULATION RESISTANCE:
This measurement was done with a programmable electrometer. The measuring voltage was 100 Volt during one minute.

IEC 60512-4-1:
Test 4a

VOLTAGE PROOF:
This measurement was done with a high voltage tester. The test duration was one minute at $750V_{rms}$.

IEC 60512-5-1:
Test 5a

TEMPERATURE RISE:
All contacts of each group were wired in series, and charged with a DC current of 0.2A. This current was maintained for a stabilization period of 1 hour minimum. The temperature measurements were done by means of a thermocouple. In steps, the current was increased up to 1A.

RETURN LOSS:

Calibration setup of the network analyzer:
The set-up was, in the frequency range of 50MHz-20GHz, 1 port calibrated with the calibration kit HP85052B (3.5mm connector system). See figure 1.

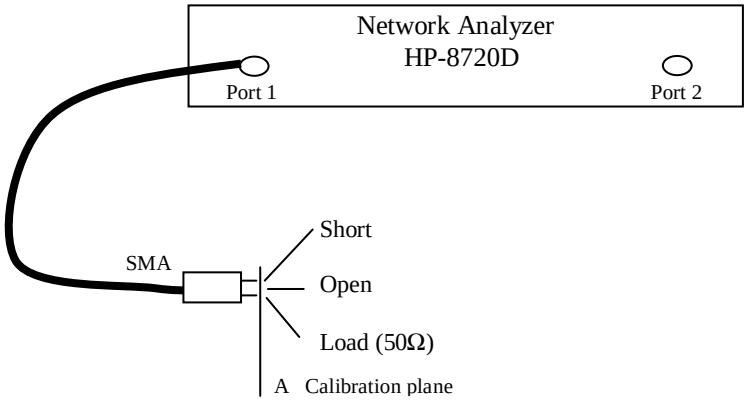


Figure 1: Calibration method at point A.

Return loss: (dB)
The return loss of the connectors was measured in the frequency range of 50MHz to 1GHz and was executed in forward direction with Gating operation active, see also figure 2.

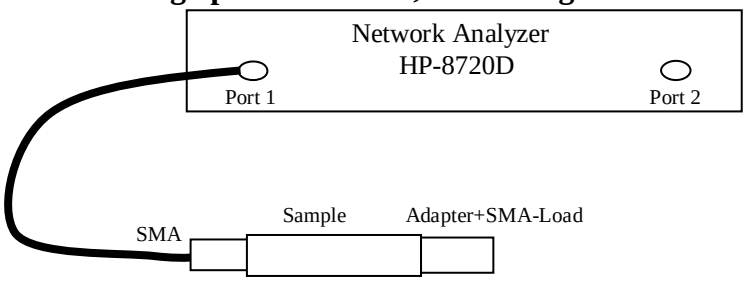


Figure 2: Return loss (S11), Forward direction.

IEC 60512-16-5:
Test 16e

GAUGE RETENTION FORCE (method A):
Each contact was sized 3 times with the maximum gauge (1.24-1.26 mm). After that the retention force was measured with the minimum gauge (0.57-0.58 mm).

IEC 61169-24:
Clause 9.3.6

COUPLING TORQUE:
A connector pair was mated, and the coupling nut was turned clockwise until a coupling torque of 1.7 Nm was applied on the nut.

IEC 60512-17-3

STRAIGHT CABLE PULL:
The straight cable pull force was measured on a tensile tester. The cable connector was fixed on the base of the tensile tester and the cable was fixed on the load cell. An axial load of 90 Newton was applied on the cable during 10 seconds.

IEC 60512-16-4:
Test 16d

TENSILE STRENGTH (coupling mechanism):
By means of a tensile tester, a force of 300N was applied on the coupling mechanism.

BENDING MOMENT:
The jack of each connector pair was fixed in a clamp, and a bending moment of 2 Nm was applied on the plug.

IEC 60512-11-3:
Test 11c

DAMP HEAT, STEADY STATE:
The samples were subjected to a damp heat steady state test under the following conditions:

Temperature	: 40°C.
Rel. humidity	: 95%.
Condition	: unmated.
Duration	: 4 days.

IEC 60512-11-1:

CLIMATIC SEQUENCE:
The samples were subjected to the following tests:

Dry heat	: 70°C, 16 hours.
Damp heat cyclic	: 25°C/ 55°C, RH 93%, 24 hours, 1 cycle.
Cold	: -40°C, 16 hours.
Damp heat cyclic	: 25°C/ 55°C, RH 93%, 24 hours, 20 cycles.
Condition	: mated.

IEC 60512-11-6:
Test 11f

SALT MIST:
The samples were placed in a salt spray chamber during 48 hours with a salt mist produced of a 5% salt solution, at a temperature of 35°C.

IEC 60512-9-1:
Test 9a

MECHANICAL OPERATION (endurance):
The samples were mated and unmated for 100 times at a rate of 500 cycles per hour.

IEC 60068-2-20,
Test Ta, method 1

SOLDERABILITY (method 1):
The samples were subjected to a dry heat test under the following conditions:

Temperature	:155°C.
Duration	:16 hours.

After that, the samples were plunged in a solder bath with a temperature of 265°C during 10 seconds.

TEST SEQUENCE

Test or Examination	Test group							
	1	2	3	4	5	6	7	
	Test sequence (*)							
Initial examination of product	1	1	1	1	1	1	1	
Current temperature						3		
Insulation resistance		2						
Voltage proof		3						
Centre contact resistance		4, 7	2, 5	2, 5	2, 6			
Outer contact resistance		5,8	3, 6	3, 6	3, 7			
Return loss						2		
Gage retention force					4			
Coupling torque, proof	2							
Cable pulling, **	3							
Tensile strength of coupling mechanism	4							
Bending moment	5							
Humidity		6						
Climatic sequence			4					
Salt mist				4				
Mechanical endurance					5			
Solderability test							2	
Final examination of product	6	9	7	7	8	4	3	

NOTE: (*) Numbers indicate sequence in which tests are performed.
(**) Only cable connectors

EQUIPMENT USED

Equipment	Producer	Type	Series Nb	Cal. Due
Micro-ohmmeter	Keithley	580	374687	01-10.
Electrometer	Keithley	6517A	1068400	01-10.
High voltage tester	Sefelec	PR-12-NN	264	11-09.
Tensile tester	MTS	400M	165811-20	09-10.
Load cell	MTS	500N	2239	09-10.
Climatic chamber	CTS	C-40/100	87131	01-10.
Climatic chamber	CTS	C-65/100	87130	01-10.
Oven	Heraeus	UT5042K	7600793	01-15
Saltmist chamber	Weiss	S450SSC	264347	01-10.

TESTRESULTS

Test group 1:

All tested samples could withstand the coupling torque test, the cabling pulling, the tensile strength of the coupling mechanism and the bending moment test: visual examination after these tests indicated no mechanical damage or any other aspects that can be detrimental for the functionality of the product.

Test group 2:

Insulation resistance:

All values represented in Ohms.

Product name: F-connector

Column.	Group	Lot	Test
-1-:	2	a,b,c,d.	insul. Res
	-1-		
1	3.04E+14		lot a
2	2.11E+13		lot a
3	7.12E+14		lot a
4	4.70E+08		lot b
5	3.15E+08		lot b
6	4.25E+08		lot b
7	3.78E+08		lot c
8	9.54E+08		lot c
9	1.25E+09		lot c
10	5.99E+13		lot d
11	6.00E+13		lot d
12	7.00E+12		lot d
Max.	**7.12E+14**		
Min.	**3.15E+08**		
Mean.	**9.70E+13**		

Voltage proof: all tested specimens could withstand the test voltage of 750V_{rms} during one minute.

Contact resistance:

All values represented in milli-Ohms.				
Product name:	F-connector			
Column.	**Group**	**Lot**	**Test**	
-1-:	2	1-3	Centre contact, initial	
-2-:	2	1-3	Ground contact, initial	
-3-:	2	1-3	Centre contact, final	
-4-:	2	1-3	Ground contact, initial	
	-1-	***-2-***	***-3-***	***-4-***
1	15.12	6.15	15.97	5.33
2	14.38	5.37	13.72	5.81
3	14.24	4.78	14.16	6.76
4	15.76	5.91	16.06	6.74
5	16.69	4.63	15.46	6.24
6	15.77	5.51	15.78	6.08
7	16.84	4.85	14.98	5.62
8	15.10	4.97	17.81	7.97
9	14.88	4.90	14.48	7.89
10	22.03	8.66	19.70	10.16
11	20.69	9.01	23.26	9.37
12	21.47	8.92	23.47	9.73
Max.	**22.03**	**9.01**	**23.47**	**10.16**
Min.	**14.24**	**4.63**	**13.72**	**5.33**
Mean.	**16.91**	**6.14**	**17.07**	**7.31**

Test group 3:

Contact resistance:

All values represented in milli-Ohms.				
Product name:	F-connector			
Column.	**Group**	**Lot**	**Test**	
-1-:	3	1-3	Centre contact, initial	
-2-:	3	1-3	Ground contact, initial	
-3-:	3	1-3	Centre contact, final	
-4-:	3	1-3	Ground contact, initial	
	-1-	***-2-***	***-3-***	***-4-***
1	13.33	5.55	13.20	9.91
2	13.69	5.32	13.43	7.05
3	14.05	4.90	13.15	9.30
4	14.93	4.78	14.93	7.09
5	13.72	5.45	13.59	10.38
6	14.44	4.86	13.43	10.69
7	15.60	5.31	12.85	10.27
8	14.03	5.37	28.76	5.87
9	14.68	5.10	16.88	7.24
10	23.93	8.65	26.05	16.05
11	21.04	8.75	23.49	21.17
12	23.61	9.54	25.96	15.44
Max.	**23.93**	**9.54**	**28.76**	**21.17**
Min.	**13.33**	**4.78**	**12.85**	**5.87**
Mean.	**16.42**	**6.13**	**17.98**	**10.87**

Test group 4:

Contact resistance:

All values represented in milli-Ohms.				
Product name:	F-connector			
Column.	**Group**	**Lot**	**Test**	
-1-:	4	1-3	Centre contact, initial	
-2-:	4	1-3	Ground contact, initial	
-3-:	4	1-3	Centre contact, final	
-4-:	4	1-3	Ground contact, initial	
	-1-	***-2-***	***-3-***	***-4-***
1	13.45	4.98	13.20	5.96
2	13.84	5.35	13.48	5.34
3	13.63	4.95	13.95	5.46
4	12.87	4.87	12.96	5.17
5	14.43	4.75	13.07	6.00
6	17.25	5.31	13.32	5.90
7	15.09	5.63	14.86	5.60
8	16.94	6.86	19.04	6.40
9	13.96	4.93	13.62	6.10
10	20.01	8.98	20.34	9.74
11	23.76	8.82	23.64	9.40
12	24.34	8.72	23.82	9.05
Max.	**24.34**	**8.98**	**23.82**	**9.74**
Min.	**12.87**	**4.75**	**12.96**	**5.17**
Mean.	**16.63**	**6.18**	**16.28**	**6.68**

Test group 5:

Contact resistance:

All values represented in milli-Ohms.				
Product name:	F-connector			
Column.	**Group**	**Lot**	**Test**	
-1-:	5	1-3	Centre contact, initial	
-2-:	5	1-3	Ground contact, initial	
-3-:	5	1-3	Centre contact, final	
-4-:	5	1-3	Ground contact, initial	
	-1-	***-2-***	***-3-***	***-4-***
1	13.91	5.15	17.46	5.02
2	13.87	4.94	16.13	4.63
3	14.34	4.87	17.35	6.43
4	14.35	6.09	17.25	6.69
5	15.02	4.97	16.68	5.74
6	14.00	5.40	15.72	6.02
7	16.53	5.38	17.87	4.69
8	15.38	4.76	15.15	7.82
9	13.99	5.01	14.24	5.01
10	23.74	8.66	24.97	8.74
11	21.60	8.93	21.99	8.90
12	21.97	8.99	21.62	8.99
Max.	**23.74**	**8.99**	**24.97**	**8.99**
Min.	**13.87**	**4.76**	**14.24**	**4.63**
Mean.	**16.56**	**6.10**	**18.04**	**6.56**

Test group 6:

Return loss:

The values represent the min. Return Loss between 500MHz - 1GHz.

	Connector type				
Sample #	”374”	“317”	“315”	“338”	“316”
1	**16.3**	**18.0**	**15.1**	**18.4**	**21.3**
2	**16.3**	**18.4**	**15.4**	**18.7**	**22.3**
3	**17.1**	**17.6**	**15.8**	**18.7**	**21.7**
Requirement	***16***	***16***	***14***	***16***	***20***
	dB	dB	dB	dB	dB

Temperature rise vs. current:
At a current up to 1A, the temperature rise did not exceed 1K for any of the tested samples.

Test group 7:

Solderability of the PCB connectors:
None of the samples showed any dewetting or pinholes on the soldered area.