

# QUALIFICATION TEST REPORT

## 15 POSITION JPT SEALED FEMALE CONNECTOR

**AMP**

AMP Italia S.p.A.

						DR 08/07/1996 <i>Berto P.</i>	NUMBER  <b>501-20012</b>	REV  <b>A</b>
						CHK 24/07/96 <i>[Signature]</i>		
						APP		
<b>A</b>	<b>ET00-0317</b>	<b>D.B.</b> <i>P. Berto</i>	<b>28.08</b> <b>1996</b>	<b>G.P.C.</b> <i>[Signature]</i>	<b>28.08</b> <b>1996</b>	NAME <b>15 POSITION JPT SEALED FEMALE CONNECTOR</b>		
REV LTR	REVISION RECORD	DR	DATE	CHK	DATE			

08-28-96

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**QUALIFICATION TEST REPORT****1. INTRODUCTION****1.1 Purpose**

This document summarizes all Testing Activities performed on the Subject AMP Product made by AMP Italia and establishes its conformance to the requirements of the relevant AMP Product Specification as reported below.

**1.2 Scope**

This report covers the electrical, mechanical and environmental performance of AMP Italia 15 Position JPT Sealed Female Connector, as required by the AMP Product Specification 108-20113, Rev. A.

**1.3 Conclusion**

The 15 Position JPT Sealed Female Connector family meets all the mechanical, electrical and environmental performance requirements of AMP Product Specification 108-20113 Rev A.

**1.4 Product Description**

The 15 Position JPT Sealed Female Connector is suitable to be mounted onto Header Counterpart of Customer "FIAT".

This Connector belong to the Splash Proof Connector Family.

These connectors are suitable to be loaded with the J.P.T. Female Contacts.

Secondary Lock device prevents backout of contacts.

Moreover there is also present a sledge device which purpose is to reduce the Mating Force of Connector with counterpart.

### 1.5 Test Samples

Test samples were randomly selected from normal current production lots, and the following Part Numbers were used for test:

Test Group	Quantity	Part Number	Description
A	5	929937-1	JPT REC. CTC. (w.s. 0,5-1,0)
	5	929939-1	JPT REC. CTC. (w.s. 1,5-2,5)
	1	COUNTERPART TAB	FROM HEADER "FIAT"
B	2	282311-1	15 POS JPT SEALED FEM CONN
	2	COUNTERPART CONNECTOR	HEADER "FIAT"
C	20	929937-1	JPT REC. CTC. (w.s. 0,5-1,0)
	20	929939-1	JPT REC. CTC. (w.s. 1,5-2,5)
D	15	929937-1	JPT REC. CTC. (w.s. 0,5-1,0)
	1	282311-1	15 POS JPT SEALED FEM CONN
E	6	929937-1	JPT REC. CTC. (w.s. 0,5-1,0)
	1	282311-1	15 POS JPT SEALED FEM CONN
	1	COUNTERPART CONNECTOR	HEADER "FIAT"
F	12	929937-1	JPT REC. CTC. (w.s. 0,5-1,0)
	12	962916-1	JPT TAB CTC
G	90	929937-1	JPT REC. CTC. (w.s. 0,5-1,0)
	3	282311-1	15 POS JPT SEALED FEM CONN
	3	COUNTERPART CONNECTOR	HEADER "FIAT"
H	15	929937-1	JPT REC. CTC. (w.s. 0,5-1,0)
	1	282311-1	15 POS JPT SEALED FEM CONN
	1	COUNTERPART CONNECTOR	HEADER "FIAT"
I	30	929937-1	JPT REC. CTC. (w.s. 0,5-1,0)
	2	282311-1	15 POS JPT SEALED FEM CONN
	2	COUNTERPART CONNECTOR	HEADER "FIAT"
L	20	929937-1	JPT REC. CTC. (w.s. 0,5-1,0)
	20	962916-1	JPT TAB CTC
M	20	929937-1	JPT REC. CTC. (w.s. 0,5-1,0)
	20	962916-1	JPT TAB CTC
N	30	929937-1	JPT REC. CTC. (w.s. 0,5-1,0)
	2	282311-1	15 POS JPT SEALED FEM CONN
	2	COUNTERPART CONNECTOR	HEADER "FIAT"
O	3	282311-1	15 POS JPT SEALED FEM CONN
	3	COUNTERPART CONNECTOR	HEADER "FIAT"

## 1.6 Qualification Test Sequence

TEST	TEST GROUPS												
	A	B	C	D	E	F	G	H	I	L	M	N	O
VISUAL EXAMINATION	1,9	1,7	1,3	1,5	1,4	1,4	1,9	1,8	1,7	1,5	1,5	1,7	1,3
ENGAGING FORCE	2,6												
SEPARATING FORCE	4,8												
DURABILITY 10 CYCLES	5	4											
CONTACT INSERTION FORCE				2									
KOJIRI TEST				3									
CONTACT EXTRACTION FORCE				4			8	7				6	
CRIMP TENSILE			2										
CONNECTOR MATING FORCE		2,5											
CONNECTOR UNMATING FORCE		3,6					5	6				5	
CONNECTOR EXTRACTION FORCE													2
MILLIVOLT DROP	3,7				3	3	2,4	2,5		2,4	2,4	2,4	
INSULATION RESISTANCE							6		5				
DIELECTRIC WITHSTANDING VOLTAGE							7		6				
TEMPERATURE RISE OVER OVEN TEMPERATURE					2								
CURRENT CYCLING						2							
THERMAL CYCLING							3	3	2				
ACCELERATED AGEING								4	3				
RAIN TEST RESISTANCE									4				
SALT SPRAY										3			
INDUSTRIAL ATMOSPHERE (KESTERNICH)											3		
VIBRATION (SINE &RANDOM)												3	

The number inside each Test Group indicate the sequences in which

**2. SUMMARY OF TESTING**

All the below reported Tests were performed in agreement with AMP Specification 108-20113 Rev. D.

**2.1 Examination of Product (all groups)**

All samples submitted for testing were selected from normal current production lots. They were inspected and accepted by Quality Assurance as conformal to Drawings.

**2.2 Engaging Force (group A)**

Part Numbers involved	Rec Contact	P/N	929939-1
	Rec Contact	P/N	929937-1

Test was performed as indicated at point 3.2.

The following values were found:

P/N 929939-1			
Range of first Engaging Force	from 7,7 to 9,6 N	Average:	8,5 N
Range of tenth Engaging Force	from 7,0 to 12,2 N	Average:	9,9 N
P/N 929937-1			
Range of first Engaging Force	from 8,4 to 13,5 N	Average:	9,8 N
Range of tenth Engaging Force	from 11,3 to 17,5 N	Average:	15,6 N

Requested:            18 N   Max

All measured forces were within specification limits

**2.3 Separating Force (group A)**

Part Numbers involved	Rec Contact	P/N	929939-1
	Rec Contact	P/N	929937-1

Test was performed as indicated at point 3.3.

The following values were found:



P/N 929939-1			
Range of first Separating Force	from 4,1 to 7,4 N	Average:	5,8 N
		Requested	18 N Max
Range of tenth Separating Force	from 6,1 to 10,6 N	Average:	7,6 N
		Requested	2,5 N Min
P/N 929937-1			
Range of first Separating Force	from 7,9 to 10,1 N	Average:	9,3 N
		Requested	18 N Max
Range of tenth Separating Force	from 10,8 to 13,3 N	Average:	12,4 N
		Requested	2,5 N Min

All measured forces were within specification limits.

**2.4 Insertion Force (Group D)**

Part Numbers involved	Rec Contact	P/N	929937-1
	15 Pos JPT Sealed Female Connector.	P/N	282311-1

Test was performed as indicated at point 3.4.  
The following values were found:

Range of contact insertion force	from 7,3 to 10,5 N	Average:	8,7 N
Requested	30 N Max		

All tested samples were within specification limits.

**2.5 Kojiri Test (Group D)**

Part Numbers involved	Rec Contact	P/N	929937-1
	15 Pos JPT Sealed Female Connector.	P/N	282311-1

Test was performed as indicated at point 3.5.

No damage nor pull out of the contacts was observed during the test, in both cases



**2.6 Extraction Force (Group D, G, H, N)**

Part Numbers involved	Rec Contact	P/N	929939-1
	Rec Contact	P/N	929937-1
	15 Pos JPT Sealed Female Connector.	P/N	282311-1

Test was performed as indicated at point 3.6

Samples with only primary lock engaged.

The following values were found:

Range of Extraction Force for samples as received:

from 116,0 to 185,0 N;                      Average                      143,7

Range of Extraction Force for samples after: Thermal Cycles, Heat Ageing, Vibration

from 93,9 to 194,2 N;                      Minimum average                      149,2

Requested 70 N Min

Samples with only secondary lock engaged.

The following values were found:

Range of Extraction Force for samples as received:

from 56,1 to 113,3 N;                      Average                      84,4

Range of Extraction Force for samples after: Thermal Cycles, Heat Ageing, Vibration

from 43,2 to 110,1 N;                      Minimum average                      80,4

Requested 30 N Min

All tested samples were within specification limits.

**2.7 Crimp Tensile Strength (group C)**

Part Numbers involved	Rec Contacts	P/N	929939-1	Crimped onto 0,5 sq. mm wire
	Rec Contacts	P/N.	929939-1	Crimped onto 1,0 sq. mm wire
	Rec Contacts	P/N.	929937-1	Crimped onto 1,5 sq. mm wire
	Rec Contacts	P/N.	929937-1	Crimped onto 2,5 sq. mm wire

Test was performed as indicated at point 3.7.

The following values were found:

Rec Contacts P/N 929939-1 crimped onto 0,5 sq. mm wire:

Range of Crimp Tensile Force:	from 81,6 to 98,3 N	Average	90,7 N
Requested	70 N Min.		

Rec Contacts P/N 929939-1 crimped onto 1,0 sq. mm wire:

Range of Crimp Tensile Force:	from 208,4 to 226,6 N	Average	215,0 N
Requested	115 N Min.		

Rec Contacts P/N 929937-1 crimped onto 1,5 sq. mm wire:

Range of Crimp Tensile Force:	from 294,4 to 326,6 N	Average	312,2 N
Requested	155 N Min.		

Rec Contacts P/N 929937-1 crimped onto 2,5 sq. mm wire:

Range of Crimp Tensile Force:	from 264,6 to 291,8 N	Average	281,6 N
Requested	235 N Min.		

All tested samples were within specification limits.

**2.8 Connector Mating Force (group B)**

Part Numbers involved	15 Pos JPT Sealed Female Connector Header Counterpart	P/N	282311-1
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Test was performed as indicated at point 3.8.

The following values were found:

Range of Mating Force for samples as received: from 77,5 to 78,2 N	Average	77,8 N
Range of Mating Force for samples after durability: from 55,1 to 56,4 N	Average	55,7 N

Requested 140 N Max

All tested samples were within specification limits.

#### 2.9 Connector Unmating Force (group B, G, H, N)

Part Numbers involved	15 Pos JPT Sealed Female Connector Header Counterpart "MARELLI"	P/N	282311-1
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Test was performed as indicated at point 3.8.

The following values were found:

Range of Unmating Force for samples as received: from 33,6 to 34,8 N	Average	34,2 N
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Requested 80 N Max.

Range of Unmating Force for samples after durability, Thermal Cycles, Heat Ageing, Vibration: from 25,5 to 32,0 N	Maximum Average	34,0 N
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Requested 50 N Max.

All tested samples were within specification limits.

#### 2.10 Connector Extraction Force (group O)

Part Numbers involved	15 Pos JPT Sealed Female Connector.	P/N	282311-1
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Test was performed as indicated at point 3.9.

The following values were found:

Unmating Force for sample as received: Requested 100 N Min	from 792,8 to 895,8	Average	839,4 N
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All tested samples were within specification limits.

**2.11 Millivolt Drop (group A, E, F, G, H, L, M, N).**

Part Numbers involved	Rec Contacts	P/N 929939-1	Crimped onto 0,5 sq. mm wire
	Rec Contacts	P/N. 929939-1	Crimped onto 1,0 sq. mm wire
	Rec Contacts	P/N. 929937-1	Crimped onto 1,5 sq. mm wire
	Rec Contacts	P/N. 929937-1	Crimped onto 2,5 sq. mm wire
	15 Pos JPT Sealed Female Connector	P/N 282311-1	

Test was performed as indicated at point 3.10.

Test current of 6A for contacts crimped onto 0,5 sq. mm wire.  
Test current of 11 A for contacts crimped onto 1,0 sq. mm wire.  
Test current of 14 A for contacts crimped onto 1,5 sq. mm wire.  
Test current of 20 A for contacts crimped onto 2,5 sq. mm wire.

The following values were found:

Samples as received  
from 0,62 to 2,55 mV/A                      Maximum Average 2,44 mV/A  
Requested 3 mV/A Max

Sample after Durability, Temperature Rise over Oven Temperature, Vibration.  
from 0,62 to 2,90 mV/A                      Maximum Average 2,81 mV/A  
Requested 3 mV/A Max

Sample after Thermal Cycles, Current Overload, Heat Ageing, Salt Spray, Kesternich Test:  
from 0,78 to 3,86 mV/A                      Maximum Average 2,00 mV/A  
Requested 4,5 mV/A Max

All tested samples were within specification limits.

**2.12 Insulation Resistance (group G,I)**

Part Numbers involved	Rec Contacts	P/N 929937-1
	15 Pos JPT Sealed Female Connector.	P/N 282311-1

Test was performed as indicated at point 3.11.  
All contacts are inserted in cavities of sample connectors.

After Thermal Cycling, Accelerated Ageing, and Rain Test, values found were all greater than 10.000 GOhm.

Requested: 10 MOhm Min  
All tested samples were within specification limits

**2.13 Dielectric Withstanding Voltage (group G.I)**

Part Numbers involved	Rec Contacts	P/N	929937-1
	15 Pos JPT Sealed Female Connector	P/N	282311-1

Test was performed as indicated at point 3.12.

The Dielectric Withstanding Voltage after Accelerated Ageing for all Test ed samples was within the specification limit (greater than 1500 V<sub>eff</sub>).

**2.14 Temperature Rise over Oven Temperature with Current Load - ESERCIZIO GRAVOSO - (group E)**

Part Numbers involved	Rec Contacts	P/N	929937-1
	15 Pos JPT Sealed Female Connector	P/N	282311-1

Test was performed as indicated at point 3.13.

All the values have been found within the specification limit (< 50 °C of temperature rise)

**2.15 Temperature Rise over Ambient Temperature with Current Overload cycling (group F)**

Part Numbers involved	Rec Contacts	P/N	929937-1
	Tab Contact	P/N	962916-1

Test was performed as indicated at point 3.14.

All the values have been found within specification limit (< 60°C of temperature rise)

**2.16 Thermal Cycling (group G.H.I)**

Part Numbers involved	Rec Contacts	P/N	929937-1
	15 Pos JPT Sealed Female Connector.	P/N	282311-1

Test was performed as indicated at point 3.15.

No evidence of physical damage to either the contacts or the connectors was visible as a result of Thermal Cycling and the Millivolt Drop were in the limits as reminded at point 2.10.

### 2.17 Accelerated Ageing (group H.I)

Part Numbers involved	Rec Contacts	P/N	929937-1
	15 Pos JPT Sealed Female Connector	P/N	282311-1

Test was performed as indicated at point 3.16.

No evidence of physical damage to either the contacts or the connectors was visible as a result of exposure to Humidity-Temperature Cycling and the Millivolt Drops were in the limit as reminded at point 2.12.

### 2.18 Rain Test (group I)

Part Numbers involved	Rec Contacts	P/N	929937-1
	Rec Contacts	P/N	929939-1
	15 Pos JPT Sealed Female Connector.	P/N	282311-1

Test was performed as indicated at point 3.17.

No evidence of water drops or humidity in the body of connector.

### 2.19 Salt Spray (group L)

Part Numbers involved	Rec Contacts	P/N	929937-1
	Tab Contact	P/N	962916-1

Test was performed as indicated at point 3.18.

After Test no physical damage or corrosion products from base material were visible on the samples tested.

The Millivolt Drops were in the limits as reminded at point 2.11.

### 2.20) Industrial Atmosphere - Kesternich Test (group M)

Part Numbers involved	Rec Contacts	P/N	929937-1
	Tab Contact	P/N	962916-1

Test was performed as indicated at point 3.19.

No evidence of physical damage to either the contact or the connector was visible as a result of exposure to the corrosive gas, and the Millivolt Drops were in the limits as reminded at point 2.11.

### 2.21) Vibration Sine and Random (group N)

Part Numbers involved	Rec Contacts	P/N	929937-1
	Rec Contacts	P/N	929939-1
	15 Pos JPT Sealed Female Connector	P/N	282311-1

Test was performed as indicated at point 3.20.

No discontinuities of the contacts were detected during vibration. After the vibration test, no cracks, break or loose on the connector assemblies were visible and the Millivolt Drops were in the limits as reminded at point 2.11.

## 3. TEST METHODS

### 3.1 Examination of Product

Product drawings and inspection plan were used to examine the samples. They were examined visually and functionally.

### 3.2 Engaging Force

The force required to engage the single Receptacle Contact onto the Tab Contact of Customer Header was measured using a free floating fixture with a rate of 25.4 mm/min of travel speed.

### 3.3 Separating Force

The force required to separate the single Receptacle Contact from the Tab Contact of Customer Header was measured using a free floating fixture with a rate of 25.4 mm/min of travel speed.

### 3.4 Insertion Force.

The force required to insert a single wired contact crimped onto 2,5 sq. mm into the relevant housing cavity was measured using a free floating fixture with a rate of travel of 25,4 mm/min.

### 3.5 Kojiri Test

A single contact was put under strain using a force of 70 N. Then the wire had to be rotated with an angle of 45° with the right straight axis of the same connector.

During the Force Application the detector of Microinterruption was introduced into the circuit of the contacts sample and results reported.

### 3.6 Extraction Force.

The force required to pull-out Receptacle Contacts from the relevant housing cavity was measured using a free floating fixture with a rate of travel of 25,4 mm/min.

### 3.7 Crimp Tensile Strength

The force required to pull out Receptacle Contacts from the relevant wires was measured using a free floating fixture with a rate of travel of 25,4 mm/min.

### 3.8 Force to Mate/Unmate Connectors

The Force to Mate/Unmate completely loaded male and female connectors was measured at new and after 10 Durability Cycles using a free floating fixture with a rate of travel of 25,4 mm/min.

### 3.9 Extraction Force of Connectors from Customer Counterpart.

An axial force was applied and measured to remove from the Customer Counterpart the completely wired Connector, using a free floating fixture with a rate of travel of 25,4 mm/min.



### 3.10 Millivolt Drop

The Millivolt Drops were measured on both loose Tab and Rec Contacts, mated together, and Tab and Rec Contacts loaded into the relevant connectors, mated together.

The insulation of the applied wires was stripped at the distance of 5 mm from the edge of Connectors housings.

Test current was as required by the Product Specification for the different wire size.

### 3.11 Insulation Resistance

The Insulation Resistance was measured on mated Connectors, with an applied voltage of 500 V d.c., between adjacent contacts pairs, for one minute.

### 3.12 Dielectric Withstanding Voltage

The Dielectric Withstanding Voltage of 1500 V r.m.s. was applied for 1 minute between adjacent contact pairs.

### 3.13 Temperature Rise over Oven Temperature with Current Load (Esercizio Gravoso).

The Connector Performance at the "Esercizio Gravoso" Test was performed on 15 Position JPT Sealed Female Connectors as required in the Product Specification.

Oven temperature was 80 °C. Test duration was 5 hours.

Temperature measurements taken by means of "J" type thermocouples, cemented to the transition zones of the Rec Contacts.

### 3.14 Temperature Rise over Ambient Temperature with Current Overload, Cycling.

The Tab and Rec Contacts, mated together, crimped onto 1,5 and 2,5 sq. mm wires were submitted to the Overload current of 1,5 times the max wire current, for 500 cycles of 45 ' ON and 15 ' OFF.

Temperature measurements taken by means of "J" type thermocouples, cemented to the transition zones of the Rec Contacts.

### 3.15 Thermal Cycling

The mated 15 Position JPT Sealed Female Connectors samples assembled with wire seals assembled, were submitted to the Thermal Cycles each of 2 hours at +125 °C (+/- 2 °C), 2 hours at 40 °C with R.H. of 90-95% min (+/- 2 °C) and 2 hours at -30 °C (+/- 2 °C) for other 5 cycles. Total testing time of 30 hours.

### 3.16 Accelerated Ageing

The mated connectors were submitted to 200 hours of exposure at 125 °C (+/- 2 °C).

### 3.17 Rain Test

The mated connectors samples, correctly assembled were submitted to 2 hours of exposure at the Rain equipment, according to IEC 529 IPx4 Test Procedure.

### 3.18 Salt Spray

Mated connectors with wire seals only on the Rec Contacts were submitted to the exposure at Salt Spray for 150 hours according to same Test parameters as in FIAT Specification 7.Z28460 or IEC 68-2-11.

### 3.19 Industrial Atmosphere (Kesternich)

Mated connectors with wire seals only on the Rec Contacts, were submitted to the exposure of the Industrial Atmosphere (Kesternich), for 4 cycles with SO<sub>2</sub> concentration of 0,66 % according to the same Test parameters as in FIAT Specification 50180, Method D1, or DIN 50.018.

### 3.20 Vibration

Mated connectors with wire seals only on Rec Contacts, were submitted to the Vibration Test for 2 hours for each axis, with Sine sweep (10-500-10 Hz in 5 minutes; displacement 1,5 mm peak to peak, ; acceleration 25 g) and Random Sweep, according to FIAT Spectrum reported at last page of Product Specification (Body component vibration Spectrum) and with microinterruption check at 10 mA of test curren; failure defined as resistance increase higher than 100 Ohm for 1 microsecond.