QUALIFICATION TEST REPORT

DOOR TO BODY - 10 & 29 POSITION

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						CHK 25/03/1996	NUMBER 501-20008 / REV A
						APP 18/03/1996	
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REV LTR	REVISION RECORD	DR	DATE	CHK	DATE	DOOR TO BODY CONNECTOR	

03-25-96

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QUALIFICATION TEST REPORT
DOOR TO BODY CONNECTOR FAMILY

1. INTRODUCTION

1.1 Purpose

This document summarize all Test ing Activities performed on the Subject AMP Product made by AMP Italia and estabilishes 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 Door to Body 10 & 29 Position Connector family, as required by the AMP Product Specification 108-20125, Rev. B.

1.3 Conclusion

The Door to Body Connector family meets all the mechanical, electrical and environmental performance requirements of AMP Product Specification 108-20125 Rev B.

1.4 Product Description

Door to Body is a 10 & 29 positions Circular Plastic Connector.
Male connector is suitable for panel mounting while female connector is preassembled with Coupling Ring and Seals.
There are also present Secondary Lock devices in both Male and Female connectors to prevent contacts backout.
These connectors are suitable to be loaded with pre-tin plated Tab and Rec Contacts similar to .070 se
ries MULTILOCK contact but with special barrels for application of wire rubber seals.
Special design of connectors is made to allow application of protective boots.

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	10	282225-1	.070 SRS REC CONTACT
	10	282227-1	.070 SRS TAB CONTACT
B	117	282225-1	.070 SRS REC CONTACT
	117	282227-1	.070 SRS TAB CONTACT
	3	282479-1	10 POS TAB CONN.
	3	282480-1	10 POS REC CONN.
	3	282454-1	29 POS TAB CONN.
	3	282455-1	29 POS REC CONN.
C	20	282225-1	.070 SRS REC CONTACT
	20	282227-1	.070 SRS TAB CONTACT
D	58	282225-1	.070 SRS REC CONTACT
	58	282227-1	.070 SRS TAB CONTACT
	2	282454-1	29 POS TAB CONN.
	2	282455-1	29 POS REC CONN.
E	10	282225-1	.070 SRS REC CONTACT
	10	282227-1	.070 SRS TAB CONTACT
F	88	282225-1	.070 SRS REC CONTACT
	88	282227-1	.070 SRS TAB CONTACT
	3	282479-1	10 POS TAB CONN.
	3	282480-1	10 POS REC CONN.
	2	282454-1	29 POS TAB CONN.
	2	282455-1	29 POS REC CONN.
G	88	282225-1	.070 SRS REC CONTACT
	88	282227-1	.070 SRS TAB CONTACT
	3	282479-1	10 POS TAB CONN.
	3	282480-1	10 POS REC CONN.
	2	282454-1	29 POS TAB CONN.
	2	282455-1	29 POS REC CONN.
H	88	282225-1	.070 SRS REC CONTACT
	88	282227-1	.070 SRS TAB CONTACT
	3	282479-1	10 POS TAB CONN.
	3	282480-1	10 POS REC CONN.
	2	282454-1	29 POS TAB CONN.
	2	282455-1	29 POS REC CONN.
I	88	282225-1	.070 SRS REC CONTACT
	88	282227-1	.070 SRS TAB CONTACT
	3	282479-1	10 POS TAB CONN.
	3	282480-1	10 POS REC CONN.
	2	282454-1	29 POS TAB CONN.
	2	282455-1	29 POS REC CONN.
L	78	282225-1	.070 SRS REC CONTACT
	78	282227-1	.070 SRS TAB CONTACT
	2	282479-1	10 POS TAB CONN.
	2	282480-1	10 POS REC CONN.
	2	282454-1	29 POS TAB CONN.
	2	282455-1	29 POS REC CONN.
M	88	282225-1	.070 SRS REC CONTACT
	88	282227-1	.070 SRS TAB CONTACT
	3	282479-1	10 POS TAB CONN.
	3	282480-1	10 POS REC CONN.
	2	282454-1	29 POS TAB CONN.
	2	282455-1	29 POS REC CONN.
N	234	282225-1	.070 SRS REC CONTACT
	234	282227-1	.070 SRS TAB CONTACT
	6	282479-1	10 POS TAB CONN.
	6	282480-1	10 POS REC CONN.
	6	282454-1	29 POS TAB CONN.
	6	282455-1	29 POS REC CONN.
O	5	282479-1	10 POS TAB CONN.
	5	282454-1	29 POS TAB CONN.

1.6 Qualification Test Sequence

	TEST GROUP												
TEST	A	B	C	D	E	F	G	H	I	L	M	N	O
VISUAL EXAMINATION	1;7	1;8	1;3	1;4	1;5	1;9	1;7	1;7	1;7	1;7	1;6	1;4	1;4
ENGAGING FORCE	2;5												
SEPARATING FORCE	3;6												
TORQUE TO MATE/UNMATE		3											
DURABILITY 10 CYCLES	4	4											
CONTACT INSERTION FORCE		2											
CONTACT EXTRACTION FORCE		7				8	6			6			
CRIMP TENSILE			2										
INSERTION FORCE OF MALE CONN. ONTO PANEL MOUNT												2	
EXTRACTION FORCE OF MALE CONN. FROM PANEL MOUNT												3	
MILLIVOLT DROP		5		3	2;4	2;4	2;4	2;4	2;4	2;4			
CONTACT RESISTANCE		6				5	5	5	5	5			
INSULATION RESISTANCE						6		6	6		5		
DIELECTRIC WITHSTANDING VOLTAGE						7							
TEMPERATURE RISE OVER OVEN TEMPERATURE			2										
CURRENT CYCLING				3									
THERMAL CYCLING					3						2		2
ACCELERATED AGEING						3					3		3
RAIN TEST RESISTANCE											4		
SALT SPRAY							3						
INDUSTRIAL ATMOSPHERE (KESTERNICHK)								3					
VIBRATION									3				

The numbers inside each Test Group indicate the sequence in which Tests were performed

2. SUMMARY OF TESTING

All the below reported Tests were performed in agreement with AMP Specification 108-20125 Rev. B.

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	282225-1
	Tab Contact	P/N	282227-1

Test was performed as indicated at point 3.2.

The following values were found:

First Engaging Force	from 3,82 to 4,92 N
Tenth Engaging Force	from 1,83 to 3,68 N

Requested: 7 N Max

All measured forces were within specification limits

2.3 Separating Force (group A)

Part Numbers involved	Rec Contact	P/N	282225-1
	Tab Contact	P/N	282227-1

Test was performed as indicated at point 3.3.

The following values were found:

First Separating Force (N)	from 3,55 to 4,34 N	Requested 7,0 N Max
Tenth Separating Force (N)	from 1,62 to 4,14 N	Requested 1,5 N Min

All measured forces were within specification limits.

2.4) Torque to Mate/Unmate Connectors (group B)

Part Numbers involved	Rec Contacts	P/N	282225-1
	Tab Contacts	P/N.	282227-1
	10 Pos Tab	P/N	282479-1
	10 Pos Rec.	P/N	282480-1
	29 Pos Tab.	P/N	282454-1
	29 Pos Rec.	P/N	282455-1

Test was performed as indicated at point 3.4.
All connectors samples were fully loaded with their contacts (10 & 29 ways).

The following values were found:

i)Door to Body connector, 10 pos:

First Torque to Mate:	from 0,7 to 1,0 Nm
Tenth Torque to Mate:	from 1,0 to 1,1 Nm

ii)Door to Body connector, 29 pos:

First Torque to Mate:	from 3,0 to 3,2 Nm
Tenth Torque to Mate:	from 2,3 to 2,5 Nm

Requested 4Nm Max

All tested samples were within specification limits.

2.5 Insertion Force (Group B)

Part Numbers involved	Rec Contacts	P/N	282225-1
	Tab Contacts	P/N.	282227-1
	10 Pos Tab	P/N	282479-1
	10 Pos Rec.	P/N	282480-1

Test was performed as indicated at point 3.4.
Since the cavities are the same for 10 & 29 position Door to Body connectors, the insertion forces were measured only using 10 position connectors.

The following values were found:

10 Pos Rec Connector:	Contact insertion force	from 10,38 to 14,23 N
10 Pos Tab Connector:	Contact insertion force	from 8,43 to 24,40 N

Requested 30 N Max

All tested samples were within specification limits.

2.6 Extraction Force (Group B, F, G, L)

Part Numbers involved	Rec Contacts	P/N	282225-1
	Tab Contacts	P/N.	282227-1
	10 Pos Tab	P/N	282479-1
	10 Pos Rec.	P/N	282480-1
	29 Pos Tab.	P/N	282454-1
	29 Pos Rec.	P/N	282455-1

Test was performed as indicated at point 3.6
All samples had secondary lock engaged.

The following values were found:

Door to Body connector, 10 pos.

Range of First Extraction Force for:
Rec Contactas received: from 101,9 to 116,3 N;
Tab Contact as received: from 78,42 to 98,42 N

Door to Body connector, 29 pos

Range of First Extraction Force for:
Rec Contact as received: from 100,6 to 122,4 N
Tab Contact as received: from 105,1 to 136,9 N

Sample after: Thermal Cycles, Heat Ageing, Vibration

Range Extraction Force (N) - REC: from 109,9 to 130,0
Range Extraction Force (N) - TAB: from 108,5 to 147,0

Requested 80 N Min

All tested samples were within specification limits.

2.7 Crimp Tensile Strength (group C).

Part Numbers involved	Rec Contacts	P/N	282225-1	Crimped onto 1.5 sq. mm wire
	Tab Contacts	P/N.	282227-1	Crimped onto 1.5 sq. mm wire

Test was performed as indicated at point 3.7.

The following values were found:

Rec Contact: Crimp Tensile Force from 224,7 to 272,5 N
Tab Contact: Crimp Tensile Force from 243,4 to 289,3 N

Crimp Tensile Force requested: 155 N Min.

All tested samples were within specification limits.

2.8 Torque to Mate Tab Connector onto Panel Mount (group O)

Part Numbers involved	10 Pos Tab	P/N	282479-1
	29 Pos Tab.	P/N	282454-1

Test was performed as indicated at point 3.8.

The following values were found:

10 Pos Tab. Connector	Couple to Torque	from 0,3 to 0,5 Nm
29 Pos Tab. Connector	Couple to Torque	from 0,5 to 0,9 Nm

Requested 4 Nm Max

All tested samples were within specification limits.

2.9 Tab Connector Extraction Force from Panel Mount (group O)

Part Numbers involved	10 Pos Tab	P/N	282479-1
	29 Pos Tab.	P/N	282454-1

Test was performed as indicated at point 3.9.

The following values were found:

10 Pos Tab. Connector	Extraction Force	> 500 N
29 Pos Tab. Connector	Extraction Force	> 500 N

Requested 500N Min

All tested samples were within specification limits.

2.10 Millivolt Drop (group B, D, E, F, G, H, I, L)

Part Numbers involved	Rec Contacts	P/N	282225-1
	Tab Contacts	P/N.	282227-1
	10 Pos Tab	P/N	282479-1
	10 Pos Rec.	P/N	282480-1
	29 Pos Tab.	P/N	282454-1
	29 Pos Rec.	P/N	282455-1

Test was performed as indicated at point 3.10.

Test current of 14 A.

The following values were found:

Initial:	from 1,48 to 2,84 mV/A	Requested 4 mV/A Max
After 10 Durability cycling, Current Load in Oven (Esercizio gravoso) and Vibration:	from 2,03 to 3,03 mV/A	Requested 4 mV/A Max
After Thermal Cycles, Current Overload, Heat Ageing, Salt Spray, Kesternich Test:	from 1,96 to 4,27 mV/A	Requested 6mV/A Max

All tested samples were within specification limits.

2.11 Contact Resistance, Dry circuit (group B, F, G, H, I, L).

Part Numbers involved	Rec Contacts	P/N	282225-1
	Tab Contacts	P/N.	282227-1
	10 Pos Tab	P/N	282479-1
	10 Pos Rec.	P/N	282480-1
	29 Pos Tab.	P/N	282454-1
	29 Pos Rec.	P/N	282455-1

Test was performed as indicated at point 3.11.
All connectors (10 & 29 pos) are fully loaded with contacts.

The following values were found:

Initial, after Durability Cycles and Vibration:	from 1,80 to 4,00 mΩ	Requested 4mΩ Max
After Thermal Cycles, Heat Ageing, Salt Spray, Kesternich Test	from 1,60 to 3,80 mΩ	Requested 6mΩ Max

All samples were within specification limits.

2.12 Insulation Resistance (groups F, H, I, M)

Part Numbers involved	Rec Contacts	P/N	282225-1
	Tab Contacts	P/N.	282227-1
	10 Pos Tab	P/N	282479-1
	10 Pos Rec.	P/N	282480-1
	29 Pos Tab.	P/N	282454-1
	29 Pos Rec.	P/N	282455-1

Test was performed as indicated at point 3.12.
All contacts are inserted in cavities of sample connectors (10 & 29 ways).

After Accelerated Ageing, Industrial Atmosphere, Thermal Cycling and Rain Test, values found were all greater than 50 MOhm.

Requested: 10 MOhm Min

2.13 Dielectric Withstanding Voltage (group F)

Part Numbers involved	Rec Contacts	P/N	282225-1
	Tab Contacts	P/N.	282227-1
	10 Pos Tab	P/N	282479-1
	10 Pos Rec.	P/N	282480-1
	29 Pos Tab.	P/N	282454-1
	29 Pos Rec.	P/N	282455-1

Test was performed as indicated at point 3.13.

The Dielectric Withstanding Voltage after Accelerated Ageing for all Test ed samples was within the specification limit (greather than 1000 V_{eff}).

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

Part Numbers involved	Rec Contacts	P/N	282225-1
	Tab Contacts	P/N	282227-1
	29 Pos Tab.	P/N	282454-1
	29 Pos Rec.	P/N	282455-1

Test was performed as indicated at point 3.14.

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

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

Part Numbers involved	Rec Contact	P/N	282225-1
	Tab Contact	P/N	282227-1

Test was performed as indicated at point 3.15.

All the values have been found within specification limit (< 70°C of temperature rise)

2.16 Thermal Cycling (group F, M, O)

Part Numbers involved	Rec Contacts	P/N	282225-1
	Tab Contacts	P/N.	282227-1
	10 Pos Tab	P/N	282479-1
	10 Pos Rec.	P/N	282480-1
	29 Pos Tab.	P/N	282454-1
	29 Pos Rec.	P/N	282455-1

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 Thermal Cycling and the Millivolt Drop were in the limits as reminded at point 2.10.

2.17 Accelerated Ageing (group G)

Part Numbers involved	Rec Contacts	P/N	282225-1
	Tab Contacts	P/N.	282227-1
	10 Pos Tab	P/N	282479-1
	10 Pos Rec.	P/N	282480-1
	29 Pos Tab.	P/N	282454-1
	29 Pos Rec.	P/N	282455-1

Test was performed as indicated at point 3.17.

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 2.10.

2.18 Rain Test (group M)

Part Numbers involved	Rec Contacts	P/N	282225-1
	Tab Contacts	P/N.	282227-1
	10 Pos Tab	P/N	282479-1
	10 Pos Rec.	P/N	282480-1
	29 Pos Tab.	P/N	282454-1
	29 Pos Rec.	P/N	282455-1

Test was performed as indicated at point 3.18.

No evidence of water drops or humidity both in the body of connector, and counterpart box emulating the door.

2.19 Salt Spray (group H)

Part Numbers involved	Rec Contacts	P/N	282225-1
	Tab Contacts	P/N.	282227-1
	10 Pos Tab	P/N	282479-1
	10 Pos Rec.	P/N	282480-1
	29 Pos Tab.	P/N	282454-1
	29 Pos Rec.	P/N	282455-1

Test was performed as indicated at point 3.19.

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 2.10.
The Contact Resistances were in the limits as reminded at point 2.11.

2.20) Industrial Atmosphere - Kesternich Test (group I)

Part Numbers involved	Rec Contacts	P/N	282225-1
	Tab Contacts	P/N.	282227-1
	10 Pos Tab	P/N	282479-1
	10 Pos Rec.	P/N	282480-1
	29 Pos Tab.	P/N	282454-1
	29 Pos Rec.	P/N	282455-1

Test was performed as indicated at point 3.20.

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 2.10.

2.21) Vibration (group L)

Part Number involved	Rec Contacts	P/N	282225-1
	Tab Contacts	P/N.	282227-1
	10 Pos Tab	P/N	282479-1
	10 Pos Rec.	P/N	282480-1
	29 Pos Tab.	P/N	282454-1
	29 Pos Rec.	P/N	282455-1

Test was performed as indicated at point 3.21.

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 2.10.

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 Tab Contact onto the Receptacle Contact 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 Tab Contact from the Receptacle Contact was measured using a free floating fixture with a rate of 25.4 mm/min of travel speed.

3.4 Torque to Mate/Unmate Connectors

The Torque to Mate/Unmate completely loaded male and female connectors was measured, rotating the coupling Ring clockwise (anticlockwise to Unmate) at new and after 10 Durability Cycles, using a Torquemeter.

3.5 Insertion Force.

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

3.6 Extraction Force.

The force required to pull-out Tab and 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 Tab and 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 Torque to Mate Tab Connectors onto Panel Mount

The torque required to mate the Tab Connector to Panel Mount was measured acting clockwise with a Torquemeter.

3.9 Extraction Force of Tab Connectors from Panel Mount

An axial force was applied and measured to remove from the Panel mount the completely wired Tab 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 togheter, and Tab and Rec Contacts loaded into the relevant connectors, mated togheter.
The insulation of the applied wires was stripped at the distance of 5 mm from the edge of Connectors housings.
Test current was 14 A as required by the Product Specification.

3.11 Contact Resistance

The Contact Resistance was measured in Dry Circuit (20 mV - 10 mA) on sample Contacts arranged in the same way as in point 3.10.

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

3.13 Dielectric Withstanding Voltage

The Dielectric Withstanding Voltage of 1000 V r.m.s. was applied for 1 minute between adiacent contact pairs.

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

The Connector Performance at the "Esercizio Gravoso" Test was performed on 29 Position Connectors as required in the Product Specification.
Oven temperature was 65 °C. Test duration was 5 hours.
Temperature measurements taken by means of "J" type thermocouples, cemented to the transition zones of the Rec Contacts.

3.15 Temperature Rise over Ambient Temperature with Current Overload, Cycling.

The Tab and Rec Contacts, mated togheter, crimped onto 1,5 sq. mm wires were submitted to the Overload current of 1,5 times the max current of 14 A, for 500 cycles of 45 ' ON and 15 ' OFF. Temperature measurements were taken by means of AGA Infrared Thermovision System.

3.16 Thermal Cycling

The mated connectors samples with wire seals assembled only on the Female Connectors, were submitted to the Thermal Cycles each of 2 hours at 100 °C (+/- 2 °C), 2 hours at 40 °C (+/- 2 °C) with R.H. of 90 min , 2 hours at -30 °C (+/- 2 °C) for a total testing time of 30 hours.

3.17 Accelerated Ageing

The mated connectors were submitted to 200 hours of exposure at 100 °C (+/- 2 °C).

3.18 Rain Test

The mated samples connectors, correctly assembled on the Panel Mount, emulating the Door Body part, were submitted to 2 hours of exposure at the Rain equipment, according to IEC IPx4 Test Procedure.

3.19 Salt Spray

Mated connectors with wire seals only on the Rec Contacts were submitted to.the exposure at Salt Spray for 96 hours according to same Test parameters as in FIAT Specification 7.Z28460 or IEC 68-2-11.

3.20 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_2 concentration of 0,66 % according to the same Test parameters as in FIAT Specification 50180, Method D1, or DIN 50.018.

3.21 Vibration

Mated connectors with wire seals only on Rec Contacts, were submitted to the Vibration Test for 8 hours for each axis, with Sinusoidal Sweep, 10-200 Hz, 1/8 for minute, displacement 2 mm peak to peak, acceleration 3g, according to FIAT Specification 7.Z8510, with microinterruption check at 10 mA of test curren; failure defined as resistance increase greather than 100 Ohm for 1 microsecond.