

# QUALIFICATION TEST REPORT

## 2 POSITION HERMAPHRODITIC POWER CONNECTOR FOR AMPINNERGY WIRE-TO-WIRE TERMINALS

**AMP**

AMP Italia S.p.A.

						DR	NUMBER <b>501-20019</b>	REV <b>A</b>
						CHK		
						APP		
A	ACTIVE ET00-0434-97	G.S. <i>P. Schmitt</i>	10/11/97	G.P.C. <i>Stella</i>	10/11/97	NAME 2 POS.HERMAPHRODITIC POWER CONNECTOR . FOR AMPINNERGY WIRE-TO WIRE TERMINALS		
REV LTR	REVISION RECORD	DR	DATE	CHK	DATE			

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**QUALIFICATION TEST REPORT**1. INTRODUCTION1.1 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 2 POS.HERMAPHRODITIC POWER CONNECTOR FOR AMPINNERGY WIRE-TO-WIRE TERMINALS, as required by the AMP Product Specification 108-20180, Rev. A.

1.3 Conclusion

The 2 POS.HERMAPHRODITIC POWER CONNECTOR FOR AMPINNERGY WIRE-TO-WIRE TERMINALS meets all the mechanical, electrical and environmental performance requirements of AMP Product Specification 108-20180 Rev A.

1.4 Product Description

The AMPINNERGY connectors are hermaphroditic housings and contacts. Connectors are suitable in four different codings and colors. Mating is possible between compatible codings housing only.

### 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	2	282998-3	2-POS.HERMAPHRODITIC POWER CONNECTOR
	2	282998-4	2-POS HERMAPHRODITIC POWER CONNECTOR
	8	556136-1	AMPINNERGY WIRE TO WIRE TERMINALS CRIMPED ONTO 6 sq/mm WIRE
B	2	282998-3	2-POS.HERMAPHRODITIC POWER CONNECTOR
	2	282998-4	2-POS HERMAPHRODITIC POWER CONNECTOR
	8	556136-1	AMPINNERGY WIRE-TO-WIRE TERMINALS CRIMPED ONTO 6 sq/mm WIRE
C	2	282998-3	2-POS.HERMAPHRODITIC POWER CONNECTOR
	2	282998-4	2-POS HERMAPHRODITIC POWER CONNECTOR
	8	556136-1	AMPINNERGY WIRE-TO-WIRE TERMINALS CRIMPED ONTO 6 sq/mm WIRE
	4	788109-1	AMPINNERGY WIRE-TO-WIRE TERMINALS WITH INSULATION BARREL CRIMPED ONTO 1.0 sqmm WIRE
D	5	556136-1	AMPINNERGY WIRE-TO-WIRE -TERMINALS CRIMPED ONTO 6 sq/mm WIRE
	5	556136-1	AMPINNERGY WIRE-TO-WIRE TERMINALS CRIMPED ONTO 4 sq/mm
	5	556135-1	AMPINNERGY WIRE-TO-WIRE TERMINALS CRIMPED ONTO 2.5 sq/mm WIRE
	5	556135-1	AMPINNERGY WIRE-TO-WIRE TERMINALS CRIMPED ONTO 1.0 sq/mm WIRE
E	2	282998-1	2-POS.HERMAPHRODITIC POWER CONNECTOR
	2	282998-2	2-POS HERMAPHRODITIC POWER CONNECTOR
	8	788110-1	AMPINNERGY WIRE-TO-WIRE TERMINALS CRIMPED ONTO 6 sq/mm WIRE
F	2	282998-3	2-POS.HERMAPHRODITIC POWER CONNECTOR
	2	282998-4	2-POS HERMAPHRODITIC POWER CONNECTOR
	8	556136-1	AMPINNERGY WIRE-TO-WIRE TERMINALS CRIMPED ONTO 6 sq/mm WIRE
G	2	282998-3	2-POS.HERMAPHRODITIC POWER CONNECTOR
	2	282998-4	2-POS HERMAPHRODITIC POWER CONNECTOR
	8	556136-1	AMPINNERGY WIRE-TO-WIRE TERMINALS CRIMPED ONTO 6 sq/mm WIRE

**1.6 Qualification Test Sequence**

TEST	A	B	C	D	E	F	G
VISUAL EXAMINATION	1,8	1,8	1,7	1,3	1,3	1,8	1,5
CONNECTOR MATING FORCE	4						
CONNECTOR UNMATING FORCE	6						
SINGLE CONTACT INSERTION FORCE	3						
SINGLE CONTACT EXTRACTION FORCE	7	7	6			7	
CONTACT POLARIZATION RELIABILITY	2						
CONNECTOR RETENTION FORCE					2		
DURABILITY						3	
CRIMP TENSILE STRENGTH				2			
VIBRATION RESISTANCE			3				
INSULATION RESISTANCE		5	5				
DIELECTRIC WITHSTANDING VOLTAGE		6					
CONTACT RESISTANCE	5	2,4	2,4			2,4,6	2,4
TEMPERATURE RISE OVER AMBIENT TEMPERATURE WITH CURRENT OVERLOAD CYCLING						3	3
THERMAL CYCLING		3					
ACCELERATED AGEING						5	

The number inside each Test Group indicate the sequences in which Tests were performed.

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**2. SUMMARY OF TESTING**

All the below reported Tests were performed in agreement with AMP Specification 108-20141 Rev. A.

**2.1 Examination of Products (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 Contact polarization reliability (Group A)**

Part Numbers involved	Ampinergy wire-to-wire Terminal	P/N	556136-1
	2 Pos.Hermaphroditic Connector Housing	P/N	282998-3

Test was performed as indicated at point 3.2

The following values were found:

At 70N no damage nor permanent engagement between housing and contact was observed during the test.

Requested: 70 N Min

All measured forces were within specification limits

**2.3 Contact Insertion Force (Group A)**

Part Numbers involved	Ampinergy wire-to-wire Terminal	P/N	556136-1
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-3
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-4

Test was performed as indicated at point 3.3.

The following values were found:

Range of Single terminal insertion force from 3,94 to 7,28 N Average: 5,79N

Requested 40 N Max

All tested samples were within specification limits.

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**2.4 Connector Mating Force (Group A)**

Part Numbers involved	Ampinergy wire-to-wire Terminal	P/N	556136-1
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-3
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-4

Test was performed as indicated at point 3.4.

The following values were found:

Range of First Mating Force	from 31,09 to 37,26 N	Average:	34,17N
Requested	100 N Max		

All measurement forces were within specification limits

**2.5 Contact resistance (Groups: A, B, C, F, G)**

Part Numbers involved	Ampinergy wire-to-wire Terminal	P/N	556136-1
	Crimped onto (1,0 to 2,5 )sqmm/wire		
	Ampinergy wire-to-wire Terminal	P/N	556136-1
	Crimped onto (4,0 to 6,0 )sqmm/wire		
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-3
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-4

Test was performed as indicated at point 3.5

Test current of 28A for terminals crimped onto 1,0 to 2,0 sq/mm wire.

Test current of 37A for terminals crimped onto 4,0 to 6,0 sq/mm wire.

The following values were found:

Samples as received	from 0,20 to 0,39 mV/A	Maximum Average	0,29 mV/A
Requested	1,0 mV/A Max		

Samples after Durability, .	from 0,59 to 0,82 mV/A	Maximum Average	0,72 mV/A
Requested	1,5 mV/A Max		

Samples after Accelerated Ageing.	from 0,81 to 1,09 mV/A	Maximum Average	0,91 mV/A
Requested	1,5 mV/A Max		

Sample after Temperature Rise over ambient temperature with current overload,cycling.	from 0,77 to 1.08 mV/A	Maximum Average	0,88 mV/A
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Requested 1,5 mV/A Max

Samples after Vibration, .

from 0,44 to 0,91 mV/A

Maximum Average 0,64 mV/A

Requested 1,5 mV/A Max

All measured forces were within specification limits.

### ***2.6 Connector Unmating Force (Group A)***

Part Numbers involved	Ampinergy wire-to-wire Terminal	P/N	556136-1
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-3
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-4

Test was performed as indicated at point 3.6

The following values were found:

Range of First Unmating Force	from 32,27 to 34,01 N	Average:	33,14N
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Requested 90 N Max

### ***2.7 Single Contact Extraction Force (Group A)***

Part Numbers involved	Ampinergy wire-to-wire Terminal	P/N	556136-1
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-3
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-4

Test was performed as indicated at point 3.7

The following values were found:

Range of Single contact Extraction force	from 257,3 to 284 N	Average:	267,9N
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Requested 100N Min

All tested samples were within specification limits.

### ***2.10 Thermal Cycling (Group B)***

Part Numbers involved	Ampinergy wire-to-wire Terminal	P/N	556136-1
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-3
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-4

Test was performed as indicated at point 3.10.

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No evidence of physical damage to either the contacts or the connectors was visible as a result of Thermal Cycling and the Contact Resistance were in the limits

### ***2.11 Insulation Resistance (Group B)***

Part Numbers involved	Ampinergy wire-to-wire Terminal	P/N	556136-1
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-3
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-4

Test was performed as indicated at point 3.11

All contacts are inserted in cavities of sample connectors.

After Thermal Cycling and Vibration resistance Test, values found were all greater than 400 GOhm.

Requested: 1 GOhm Min

### ***2.12 Dielectric Withstanding Voltage (Group B)***

Part Numbers involved	Ampinergy wire-to-wire Terminal	P/N	556136-1
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-3
	2 Pos.Hermaphroditic Connector Housing	P/N.	282998-4

Test was performed as indicated at point 3.12.

All contacts are inserted in cavities of sample connectors.

The Dielectric Withstanding Voltage after Thermal cycling all samples were within the specification limits (greater than 2500 V<sub>eff</sub>).

### ***2.13 Vibration (Group C)***

Part Numbers involved	Ampinergy wire-to-wire Terminal	P/N	556135-1
	Ampinergy wire-to-wire Terminal with insulation barrel crimped onto 1.0 sqmm wire	P/N	788109-1
	2 Pos.Hermaphroditic Connector Housing	P/N	282998-3
	2 Pos.Hermaphroditic Connector Housing	P/N	282998-4

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 Contact Resistances were in the specification limits .

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**2.14 Crimp Tensile Strength (Group D).**

Part Numbers involved	Ampinnergy Terminal P/N	556135-1	Crimped onto 1,0 sq. mm wire
	Ampinnergy Terminal P/N	556135-1	Crimped onto 2.5 sq. mm wire
	Ampinnergy Terminal P/N	556136-1	Crimped onto 4.0 sq. mm wire
	Ampinnergy Terminal P/N	556136-1	Crimped onto 6.0 sq. mm wire

Test was performed as indicated at point 3.14

The following values were found:

Ampinnergy wire-to-wire Terminals	P/N	556135-1	Crimped onto 1,0 sq. mm wire:	
Range of Crimp Tensile Force:	from 225,4 to 245,2 N		Average	235,4 N
Requested 115 N Min.				
Ampinnergy wire-to-wire Terminals	P/N	556135-1	Crimped onto 2,50 sq. mm wire:	
Range of Crimp Tensile Force:	from 292,1 to 404.6 N		Average	399.4 N
Requested 235 N Min.				
Ampinnergy wire-to-wire Terminals	P/N	556136-1	Crimped onto 4,0 sq. mm wire:	
Range of Crimp Tensile Force:	from 667,1 to 731,9 N		Average	708 N
Requested 320 N Min.				
Ampinnergy wire-to-wire Terminalss	P/N	556136-1	Crimped onto 6,0 sq. mm wire:	
Range of Crimp Tensile Force:	from 517,9 to 693,2 N		Average	09,4 N
Requested 400 N Min.				

All tested samples were within specification limits.

**2.15 Connector retention force (Group E)**

Part Numbers involved	Ampinnergy wire-to-wire Terminal	P/N	788110-1
	2 Pos.Hermaphroditic Connector Housing	P/N	282998-1
	2 Pos.Hermaphroditic Connector Housing	P/N	282998-2

Test was performed as indicated at point 3.15

The following values were found:

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The following values were found:

At 60N and at 100N no damage nor contact disconnecting was observed during the test.

Requested: Single wire 60 NMin  
Requested: Double wire 100 NMin

All measured forces were within specification limits

### ***2.16 Durability (Group F)***

Part Numbers involved	Ampinergy wire-to-wire Terminal	P/N	556136-1
	2 Pos.Hermaphroditic Connector Housing	P/N	282998-3
	2 Pos.Hermaphroditic Connector Housing	P/N	282998-4

Test was performed as indicated at point 3.16.

The following values were found:

No evidence of mechanical damage to either the contacts or the connectors were visible during the test and the contact resistances were within specification limits

### ***2.17 Accelerated Ageing (Group F)***

Part Numbers involved	Ampinergy wire-to-wire Terminal	P/N	556136-1
	2 Pos.Hermaphroditic Connector Housing	P/N	282998-3
	2 Pos.Hermaphroditic Connector Housing	P/N	282998-4

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 Temperature and the Contact resistances were in the limits.

### ***2.18 Temperature Rise over Ambient Temperature with Current Overload cycling (Group G)***

Part Numbers involved	Ampinergy wire-to-wire Terminal	P/N	556136-1
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Test was performed as indicated at point 3.18

All the values have been found within specification limit (< 60°C of temperature rise) and Contact Resistances were in the specification limits.

All tested samples were within specification limits.

### 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 Contact Polarization Reliability

As specified in Product Spec the test method is the following: Rotating the terminal at 180° from normal polarization condition and pushing same contact with a force of 70N with a rate of 25.4 mm/min of travel speed for 1 min., the contact shall not be inserted into the cavity of the housing.

#### 3.3 Contact Insertion Force.

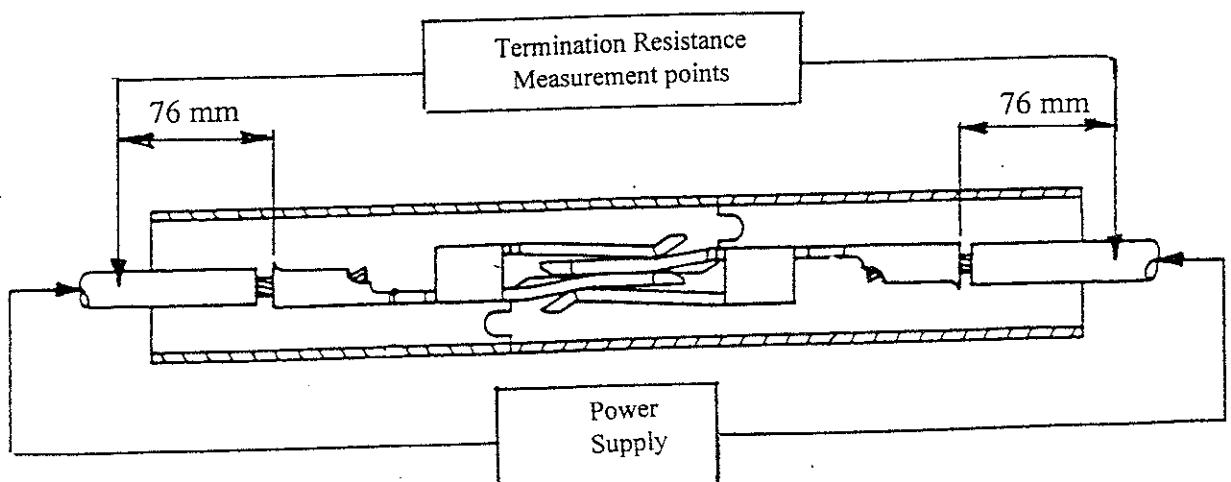
The force required to insert a single wired terminal crimped onto 6,0 sq. mm into the relevant housing cavity was measured using a free floating fixture with a rate of travel of 25,4 mm/min.

#### 3.4 Connectors mating force

The Force to Mate completely loaded hermaphroditic power terminals was measured at new using a free floating fixture with a rate of travel of 25,4 mm/min.

#### 3.5 Contact Resistance

The Contact Resistances were measured on both loose Ampinergy wire-to-wire terminals, mated together, and loaded into the relevant Hermaphoditict power Connectors, mated together. Termination resistance equals millivolts divided by test current less resistance of 152 mm of wire. Test current was as required by the Product Specification for the different wire size. See scheme below.



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**3.6 Connectors Unmating Force**

The Force to Unmating completely loaded hermaphroditic power terminals was measured at new using a free floating fixture with a rate of travel of 25,4 mm/min.

**3.7 Single Contact Extraction Force.**

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

**3.10 Thermal Cycling**

The mated Hermaphroditic power connectors assembled with Ampinergy wire-to-wire terminals, were submitted to the Thermal Cycles each of 2 hours at 105°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 5 cycles. Total testing time of 30 hours.

**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 2500 V r.m.s. was applied for 1 minute between adjacent contact pairs.

**3.13 Vibration Resistance**

Mated connectors were subjected to Sine sinusoidal vibration, having a simple harmonic motion with an amplitude of 2mm p.k to p.k. The vibration frequency was varied uniformly between the limits of 10 and 200 and return to 10 Hz. This cycle was performed in each of three mutually perpendicular planes, for a total vibration time of 8 hours each axe. Connectors were monitored for discontinuities grather than one microsecond, using a current of 10 milliamperes the monitoring circuit.

**3.14 Crimp Tensile Strength**

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

**3.15 Contact Retention Force**

An axial load of 60N was applied to each terminal and held for 60 seconds, than an axial load of 100N was applied unto two contacts and held for 60 seconds. The forces were applied in a direction to cause removal of the contascts from the housing.

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**3.16 Durability**

Connectors were mated and unmated 200 times at the rate not exceeding of 400 cycles per hour.

**3.17 Accelerated Ageing**

The mated connectors were submitted to 100 hours of exposure at 105 °C (+/- 2 °C).

**3.18 Temperature Rise over Ambient Temperature with Current Overload, Cycling.**

The Ampinergy wire-to-wire terminals mated together, crimped onto 4,0 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 "Aga Thermovision Set."

4. VALIDATION

Prepared by:

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Reviewed by:



28 / 10 / 1997

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Approved by:

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