Tyco Electronics
AMP Italia S.p.A.

Description.
AMP SUPERSEAL 1,5 SERIES CONNECTORS

QUALIFICATION TEST REPORT

rev letter	rev. record	DR	Date	CHK	Date
B1	ADDED IPX6K TEST	M.G.	30/01/2008	R.M.	31/01/2008
B	REWRITTEN AND ADDED IP X9K TEST	M.G.	29/11/2007	R.M.	30/11/2007
A1	RE-ISSUED WITHOUT CHANGES	M.G.	16/12/2005	R.M.	16/12/2005
A	INCLUDED ADDENDUM PAG. 9 (ET00-0184-01)	M.P.	27/07/2001	R.M.	27/07/2001
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DR.	DATE	APVD	DATE
A.BRUNI	JUN. '94	A.BRUNI	JUN. '94

1) Introduction

1.1) Purpose

Testing was performed on the AMP SUPERSEAL 1,5 SERIES connector to determine its conformance to the requirements of AMP Product Spec. 108-20090 Rev. C1 and FIAT Spec. 9.91320/03.

1.2) Scope

This report covers the electrical, mechanical, environmental and water proofness performances of the a.m. connectors, manufactured by AMP Italia Spa.
Main testing was performed between July and October 1991. Some of the requirements were furtherly verified between January 91 and April 94.

1.3) Conclusion

The AMP SUPERSEAL 1,5 SERIES Connectors meet the requirements of AMP Spec. 108-20090 Rev. C1 and FIAT Spec. 9.91320/03.

1.4) Product Description

The AMP SUPERSEAL 1,5 SERIES Male and Female connectors are available in version of 1 to 6 positions. Front sealings and secondary locks are pre-assembled on housings.
Wire seals suitable to be mounted on wire ranging from 0,35 sq.mm (1,4 mm outside insul. dia.) to 2,5 sq.mm (3,3 mm outside insul. dia.) are available.
Mini Mic contacts (tab and receptacle) are suitable to crimp the same wires with the a.m. wire seals. They are available in pre-tinned version; the maximum current capacity is 14 A with 1,5 or 2,5 sq.mm wire.

1.5 Test samples

Samples were randomly selected from normal production lots. The following PNs were used:
282404-1, 282109-1, 282465-1 = Tab contacts (0,35-0,05 1-1,5 and 2,5 sq.mm respectively)
282403-1, 282110-1, 282466-1 = Rec. contacts as above
281934-2, 281934-3, 281934-4= Wire seals (1,8/2,4 ; 2,6/3,3 ; 1,4/1,7 insulation dia)
282081-1 = Rubber Plugs to close unloaded cavities.
282079-1, 282080-1, 282087-1, to 282090-... = Connector housings for receptacle contacts.
282103-1 to 282108-1 = Connector housings for tab contacts.
Tests performed used a significative quantity of each of the a.m. PNs, or a proper selection of them according to the performance to be verified.

1.6) Qualification test sequence

TEST DESCRIPTION	A	B	C	D	E	F	G	H	I	L	M	N	O	P
VISUAL EXAMIN.	1/11	1	1	1/5	1/5	1/17	1/5	1/5	1/12	1/5	1/16	1/9	1/10	1/5
CONN. ENGAG. FORCE						2/15			2/10		2/14	2/7	2/8	
CONN. DISENGAGING FORCE						3/14			3/9		3/13	3/6	3/7	
CONT. ENGAGING FORCE	2/7													
CONT. DISENGAGING FORCE	3/8													
CONT. RETENTION IN CAVITY		2				5/16			4/11		4/15	4/8	4/9	
CRIMP RESIST. FORCE			2											
VOLTAGE DROP	4/9			2/4	2/4	4/13	2/4	2/4	5/8		5/12			
CONTACT RESISTANCE	5/10													
INSUL. RESISTANCE						6/11				2/4	6/10			2/4
DIEL. BREAKDOWN						7/12					7/11			
CORROSION: SALT FOG								3						
KESTERNICH TEST							3							
STATIC IMMERSION IN WATER										3				
DINAMIC IMMERSION IN WATER						10 (*)							6 (*)	3
THERMAL CYCLES						8								
HEAT AGEING											8			
AUTOMOTIVE FLUIDS												5		
OZONE RESISTANCE													5	
VIBRATIONS									6					
HEAT WITH CURRENT LOAD				3										
CURRENT OVERLOAD					3									
DURABILITY	6					9			7		9			

(*) 10.000 CYCLES ONLY

2) Summary of Testing

2.1) Visual examination : All Groups

All samples were selected from normal production lots and inspected to check the conformance to the drawings.
Inspection after the test, as herebelow described, didn't show any damages.

2.2) Voltage Drop : Groups A, D, E, F, G, H, I, M

Measured between two points of the wires at 10 mm from insulation barrel. Intensity of current 7 A with 1 sq.mm wire.
All the measurements made on new connectors met the specification Limit-Values found at new condition: 16-17,8 mV.
Note: the voltage drops of wires have been subtracted.

2.3) Contact Resistance : Group A

Crimp and wire resistance were excluded: probes were placed between contact body and wire crimp zone. Intensity of current : 10 mA.
Values found : 2,2 ÷ 2,4 mΩ at new cond. 2,3 ÷ 2,6 mΩ after test.

2.4) Insulation Resistance : Groups F, L, M, P

Measured between a contact and the others together connected at a voltage of 500 V d.c.
Measures, after tests, met the AMP Spec. requirements, as herebelow specified. Values found at new condition: 1 ÷ 6 GΩ.

2.5) Dielectric breakdown : Group. F, M

Measured between a contact and the others together connected. A voltage of 1500 V r.s.m. was applied.
Measures, after tests, met the AMP Spec. requirements, as herebelow specified. Values found at new condition : 4000 ÷ 4300 V.

2.6) Engaging / Separating force of contacts : Group A

Measured inserting and separating a tab shown in fig. 1 at a speed of 25 mm/min. Female contact was inserted in housing meanwhile the tab was clamped to a two free movement table.
Values found: First IN 5,5 ÷ 7,6 N Tenth IN : 6,2 ÷ 7,2 N
First OUT 5,0 ÷ 7,2 N Tenth OUT : 6,5 ÷ 7,8 N

2.7) Engaging /Separating force of connectors : Groups F, I, M, N, O

Measured inserting and separating connectors, fully loaded with contacts, at a speed of 25 mm/min.
Separating force was measured without operating and operating the locking lance between conn.s.
Values found at new condition and after tests :
75 N ÷ 120 N (1-6 pos.) with lance operated in separating operation
180 N ÷ 250 N without lance operated.

2.8) Withdrawal force of contacts in housing : Groups B, F, I, M, N, O

Measured on both tab and rec. contact, crimped on 1 sq.mm wires, pull at the constant speed of 25 mm/min.

Values found new condition and after tests for both tab & rec. connectors :

> 70 N without sec. lock > 80 N with sec. lock

2.9) Durability : Groups A, F, I, M

- For Group A : performed by engaging/disengaging 10 times the tab of fig. 1. Results are shown on par. 2.6
- For Groups F, I, M : performed by engaging/separating 10 times the connectors, in order to check the effects of thermal cycling, vibrations, ageing, on the locking device. No damages were detected.

2.10) Corrosion Tests : Groups G, H

Two different tests performed on mated contacts, without housings :

- Exposure for 150 hours to salt fog at 35°C (5% of NaCl). Voltage drop measured after the test : 18,1 ÷26,2 mV.
- *Kesternich test : 4 cycles each composed of :* exposure for 8 hours to SO_2 atmosphere (0,66%), at 40°C and 95% H.R., followed by 16 hours in ambient room.
  Voltage drop measured after the test : 15,1 ÷ 26,1 mV.

2.11) Resistance to static immersion in water : Group L

Connectors loaded with contacts crimped on 0,35-1-1,5 sq.mm wires, mated, were submitted to 5 cycles cromposed of :

Exposure for 30 min. in oven at + 125°C, followed by immersion in salt water at 23°C and at a depth of 10 cm.

Insulation resistance after cycles > 20 GΩ

No ingress of water was detected by visual examination.

2.12) Resistance to dinamic immersion : Groups F, O, P

Connectors loaded with contacts crimped on 1 sq.mm wire, mated, were submitted to immersion in 10 cm of salt water. The wire of rec. or tab connector were pulled with a force of 1,5 ÷ 2,5 N and displaced laterally of ± 50 mm (See fig. 2).

- For Group P, 500.000 cycles were performed.
  Insulation resistance after cycles : > 1000 GΩ
  No ingress of water was detected at visual examination.
  It has to be noted that wires of 0,3 & 0,5, were not able to withstand 500.000 cycles of alternate movement : they broke before the end of test.
- For Groups O & F, only 10.000 cycles were performed to evaluate the water proof performances of the thermal cycling and ozone exposure.
  Results were so good as those of Group P.

2.13) Thermal Cycling : Group F

Performed on fully loaded and mated connectors.
14 cycles each composed of : 16 hours at + 40°C with 95% of humidity, 2 hours at - 40°C, 2 hours at + 125°C, 4 hours at ambient temperature. In addition, connectors were exposed for 24 hours at 40°C with 95% of humidity.
Thermal cycling was followed by 10 durability cycles and 10.000 cycles of dinamic immersion:
After these tests were measured :
- Voltage drop : 15,1 ÷ 18,9 mV (current 5 A since contacts were crimped on 0,5 sq.mm wires)
- Insulation resistance : 2 GΩ
- Dielectric breakdown : 4000 V

2.14) Heat ageing : Group M

Fully loaded and mated connectors exposed for 100 hours in oven at 125°C and then to 10 durability cycles.
After these tests were measured :
- Voltage drop : 17,5 ÷ 18,6 mV (current intensity 7 A)
- Insulation resistance : > 4000 GΩ
- Dielectric breakdown : > 4000 V

2.15) Vibration : Group I

Performed on fully loaded and mated connectors, assembled on vibrator plate as specified in Fig. 3. Samples were submitted for 2 hours each orthogonal direction at a vibration with variable frequency from 10 to 500 Hz (sweeping : one octave/min.) and max acceleration of 10 G. Displacement was 1,5 mm.
During the test, all connectors were electrically connected to a circuit suitable to detect circuit breakings for less than 1 microsecond. None of them were found. After vibration, a durability cycles (see 2.8) were performed.
After these tests were measured :
- Voltage drop : 18,6 mV - 21,2 mV (current intensity 7 A)
- Insulation resistance : > 6000 GΩ
- Dielectric breakdown : > 4200 V

2.16) Resistance to Automotive fluids : Group N
Fully loaded and mated connectors subjected to immersion for 3 min. into following liquids:
- brake fluid at 50°C
- anti freeze fluid at 23°C
- gear box lubricant oil at 100°C
- engine lubricant oil at 100°C
- windscreen cleaning at 23°C
- diesel fuel at 23°C
- gasoline at 23°C

Visual examination didn't detect any damages.
Connector engaging/separating force and retention of contacts in housing were found in the a.m. limits. (par. 2.7 and 2.8).

2.17) Ozone resistance : Group O
Fully loaded and mated connectors exposed for 70 hours at 50°C at 0,5 ppM of ozone gas, followed by 10.000 cycles of dinamic immersion.
No damages or ingress of water were detected at visual examination.
Engaging/separating force of conectors and retention force of contacts in housing were found in the a.m. limits (par. 2.7 and 2.8)

2.18) Heat resistance with current load : Group D
Fully loaded and mated connectors were submitted to 5 hours in oven at 80°C while the contacts were loaded with 14 A (wire crimped : 1,5 sq.mm).
Temperature rise was continuously detected in the transition between contact body and wire barrel.
Maximum increase of temperature was 37°C
Voltage drop measured after the test was found : 23 ÷ 29,5 mV
(Note : test current 10 A).

2.19) Current overload : Group E
Mated contacts, without housing, crimped on 1,5 sq.mm wires, submitted to 500 current cyclings with intensity of 21 A. Each cycle composed of 45 min. of current ON and 15 min. of current OFF.
Max increase of temperature detected after the test : 58°C
Voltage drop : 28 ÷ 29,0 mV
(Note : test current 10 A).

2.20) Crimp resistance : Group C
Mechanical load has been applied between wire and contact body.
Results were : Rec. and tab ctc.s crimped on :
0,5 sq.mm wire 95 ÷ 109 N
1 sq.mm wire 204 ÷ 216 N
1,5 sq.mm wire 214 ÷ 237 N

2.21) Additional test not requested by AMP Spec. 108-20090

Fully loaded and mated connectors were submitted to the sequence of following tests :

- Thermal shocks : 4 cycles of 4 hours at + 125°C and 4 hours at - 30°C
- 12 hours at + 125°C
- Immersion in water (100 mm deep) at 23°C for 30 min.
- 100 hours at + 125°C
- Immersion in water as above

No ingress of water was detected at visual examination.

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AB/amg
09/06/94

Addendum 1 to QTR 501-20000

Further tests (not included in AMP Spec. 108-20090) have been performed on some P/Ns according to various Customer requests:

TESTED P/Ns:
282087-1 + 282105-1 (3 pos.)
282088-1 + 282106-1 (4 pos.)
282090-1 + 282108-1 (6 pos.)

Connectors loaded with contacts 282109-1 + 282110-1 and wire seals 281934-2

TYPE OF USED WIRES:
PVC, according to FIAT Std.s 1.5sqmm
RAYCHEM 1.5sqmm
SILICONE, supplied by CATERPILLAR, 0.75 and 1.5sqmm

SEQUENCES:
GROUP 1:
1) Water immersion (samples for 2 hrs at 50°C immediately followed by 120 minutes in water 1000mm deep at 21°C)
2) Vibration (sinusoidal 24-2000Hz – displacement 2mm peak to peak – acceleration 10g (50-300Hz) and 20g (300-2000Hz) – duration 6hrs each of 3 axis)
3) Thermal shocks (20 cycles of 1 hr at -40°C + 1hr at 120°C)
4) Water immersion (as above)

GROUP 2:
1) Temperature life (500hrs at 120°C)
2) Water immersion (as Group 1)
3) Vibration (as Group 1)
4) Water immersion (as Group 1)

Measurements and visual examination were made to check: contact resistance, dielectric breakdown, insulation resistance, absence of micro-interruptions (for vibration test only) and waterproofness.

All samples of both groups passed the requirements.

Addendum 2 to QTR 501-20000

On the basis of further Customer requests, it was decided to carry on on all connectors family (1 to 6 ways) the **IP X6K** and the **IP X9K** tests according to IEC 529 DIN 40050, Part 9.

These tests has been included in rev. C (IP X9K) and rev. C1 (IP X6K) of Product Specification 108-20090.

IP X9K TEST:

Fully loaded and mated connectors were subjected to the cumulative action of high pressure water-jet by 4 nozzles (see Fig. 4), 30s each nozzle.

At the end of the test, all the measured Insulation resistances were greater than 200MΩ and all the measured dielectric withstanding voltages were greater than 1500Va.c..
No ingress of water was detected at a visual examination.

IP X6K TEST:

Fully loaded and mated connectors were subjected to the action of strong high velocity water-jet with increased pressure out of a 6.3mm dia nozzle (see Fig. 5), pressure 1000kPa, duration: 3' minimum.

At the end of the test, all the measured Insulation resistances were greater than 200MΩ.
No ingress of water was detected at a visual examination.

All samples passed the Spec. requirements.

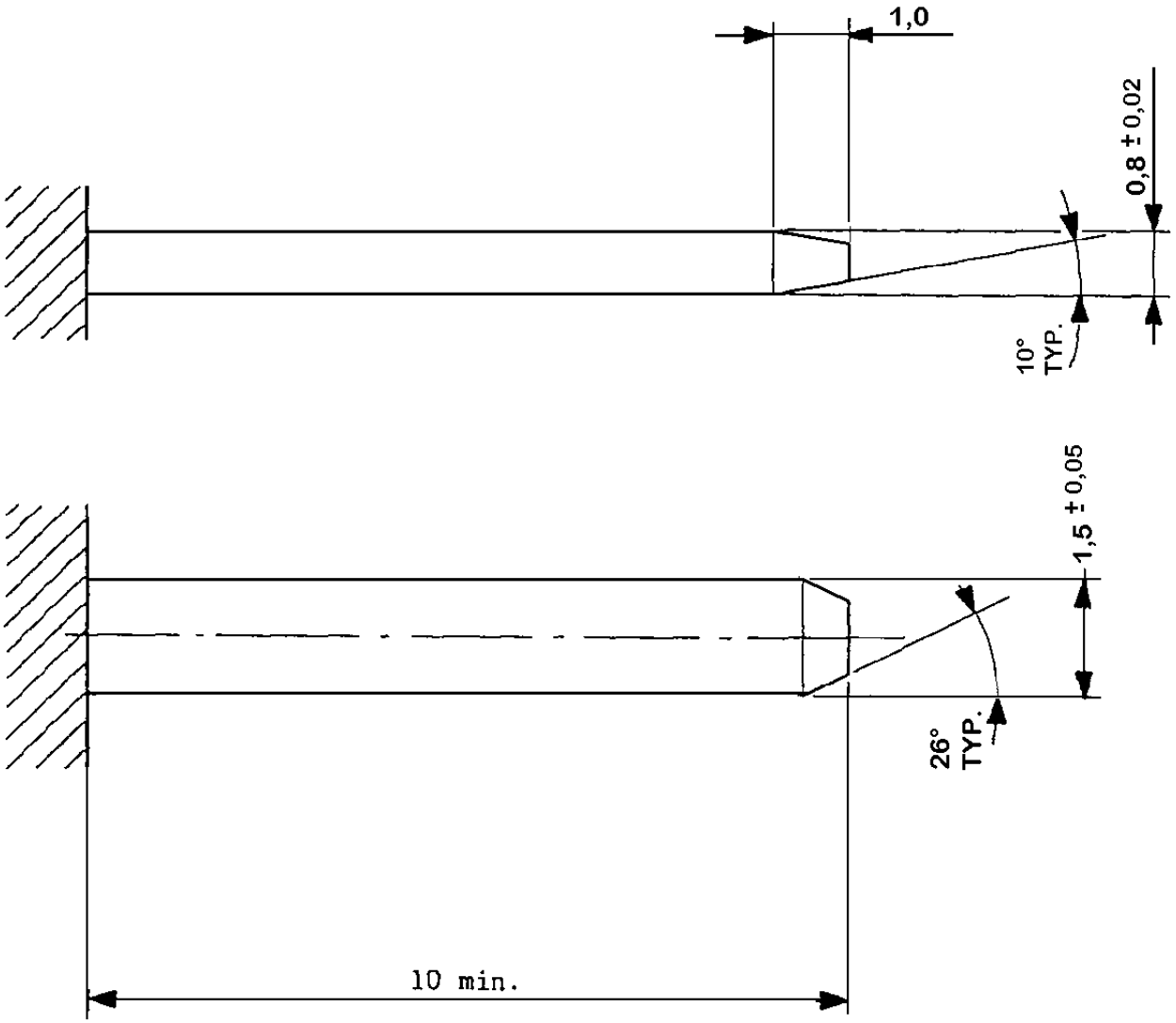


Fig. 1

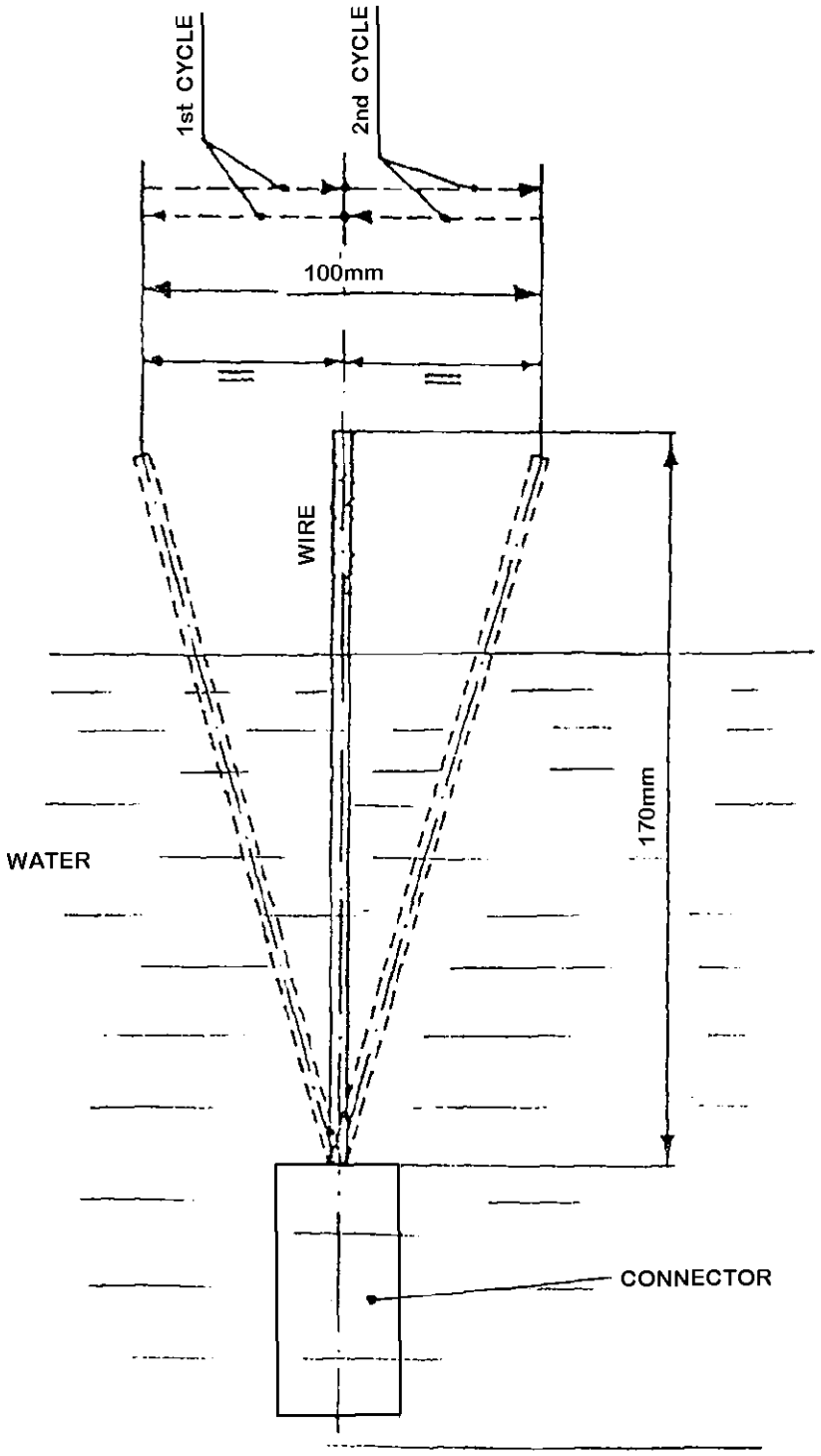
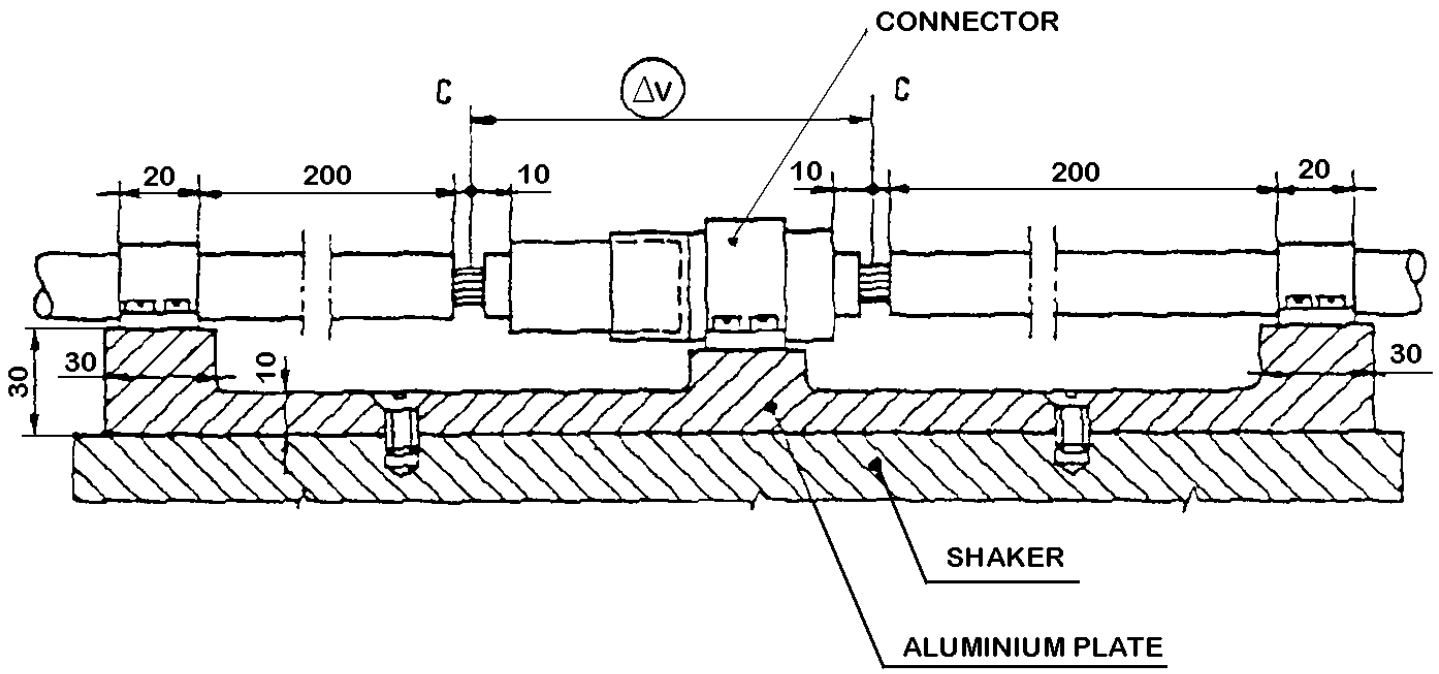


Fig. 2


CONNECTOR
C
ΔV
C
20
200
10
10
200
20
30
30
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30
SHAKER
ALUMINIUM PLATE

Fig. 3

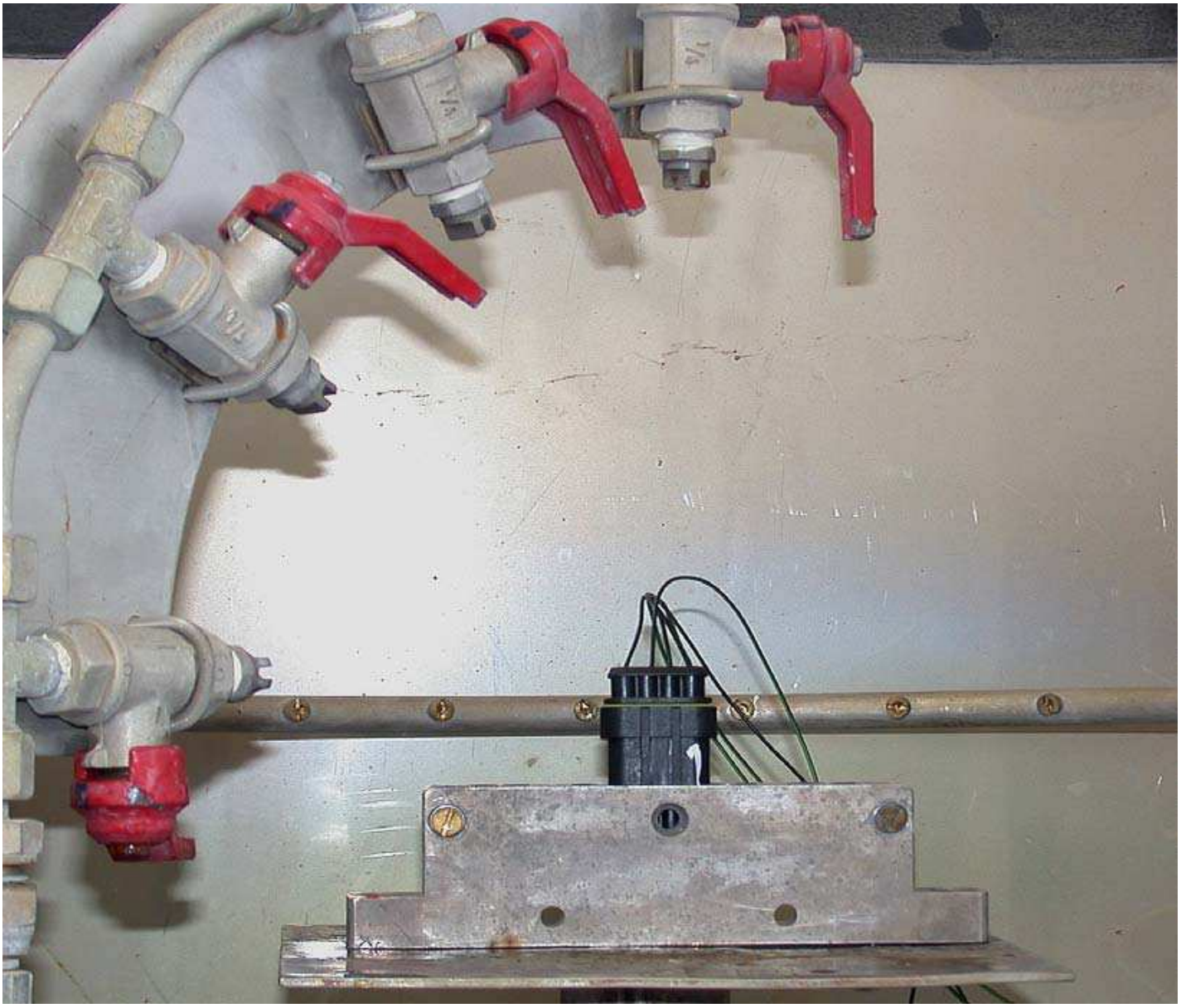

Fig. 4

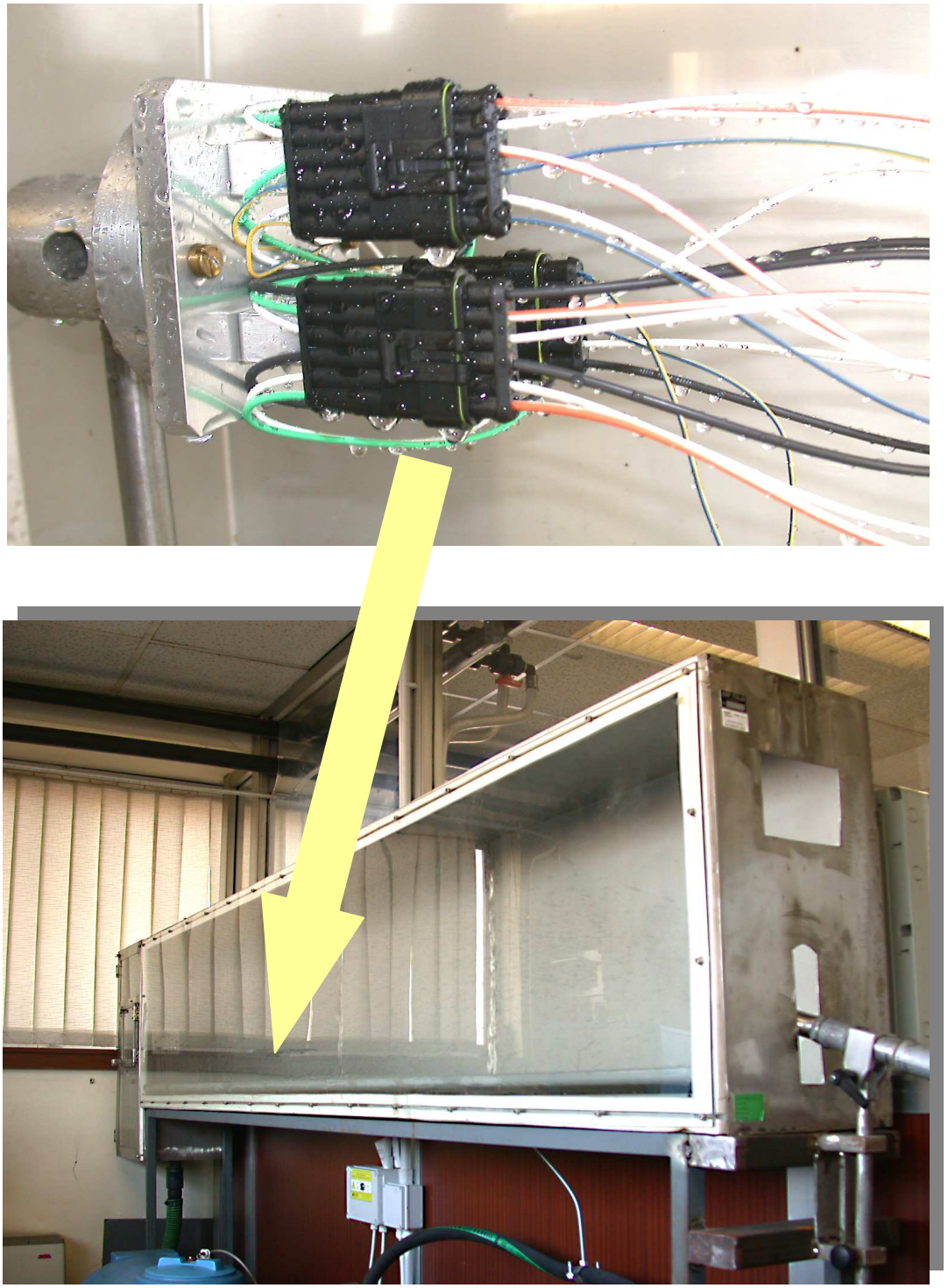

Fig. 5