

**1. Scope****1.1 Contents**

This specification covers the requirements for product performance, test methods, and quality assurance provisions of 040 Series Sealed PAIR MATE Connectors. Applicable product description and part numbers are as shown in Appendix 1.

**2. Applicable Documents**

The following documents form a part of this specification to the extent specified herein. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

**2.1 AMP Specification**

A. 109-5000	Test Specification, General Requirements for Test Methods
B. 114-5149	Application Specifications
C. 501-xxxx	Test Report

**2.2 Commercial Standard and Specifications**

A. JASO D 605	Multi-Position Connectors for Automobiles
B. JIS C 3406	Low Voltage Cables for Automobiles
C. JIS D 1601	Vibration Testing Methods for Automobile Parts

**3. Requirements****3.1 Design and Construction**

Product shall be of the design, construction and physical dimensions specified in the applicable product drawing.

**3.2 Materials**

A. Contact	
a. Receptacle contact	Phosphor Bronze
b. Tab contact	Brass
B. Housing	PBT
C. Others	
a. Seal Ring	Silicone Rubber
b. Seal Rubber	Silicone Rubber
c. Packing	Silicone Rubber

**3.3 Ratings**

A. Temperature Rating	-40°C to 120°C (Room temperature + temperature rising by energized current)
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**3.4 Performance and Test Descriptions**

The product shall be designed to meet the electrical, mechanical and environmental performance requirements specified in Fig.2. All test shall be performed in the room temperature, unless otherwise specified.

Test Requirements and Procedures Summary

Para	Test Items	Requirements			Procedures
3.5.1	Confirmation of Product	Product shall be conforming to the requirements of applicable product drawing and Application Specification.			Visually, dimensionally and functionally inspected per applicable quality inspection plan.
<b>Electrical Requirements</b>					
3.5.2	Termination Resistance (Specified Current)	Wire Size mm <sup>2</sup> (AWG)	Test Current (A)	Resistance mV/A (max.)	Measure initial millivolt drop of contact test circuit in mated connectors. Fig.3. AMP Spec. 109-5311-2
		0.5 (#20)			
		0.85(#18)			
		1.25(#16)			
3.5.3	Termination Resistance (Low Level)	10mΩ max. (initial) 20mΩ max. (final)		Subject mated contacts assembled in housing to closed circuit current of 10mA DC at open circuit voltage of 20mV DC Fig.3 AMP Spec. 109-5311-1	
3.5.4	Dielectric Strength	No creeping discharge nor flashover shall occur.			1kV AC for 1 minute. Test between adjacent circuits and between contacts and housing of mated connectors. Fig.4 AMP Spec. 109-5301
3.5.5	Insulation Resistance	100MΩ min. (initial)			500V DC impressed. Test between adjacent circuits and between contacts and housing of mated connectors. Fig.4 AMP Spec. 109-5302
3.5.6	Current Leakage	0.1mA max.			14V DC impressed to mated connectors for 1 minute. Fig.4(a) AMP Spec. 109-5312
3.5.7	Temperature Rising	60°C max. under loaded current specified in Fig.5			Measure temperature rising of wire barrel of contact by energized current. AMP Spec. 109-5310
3.5.8	Current Cycling	20mΩ max. (final) No ignition is allowed during the test.			Applied current : Fig.5 45 minutes ON, 15 minutes OFF, 300 cycles AMP Spec. 109-5308
<b>Physical Requirements</b>					
3.5.9	Vibration (High frequency)	All contacts are connected in series and current of 12V (open voltage) 0.1A DC applied under vibration, no electrical discontinuity greater than 1 μ sec. shall occur. 20mΩ max. (final)			Vibration frequency : 20-200-20 Hz/3min Accelerated velocity : 44.1m/s <sup>2</sup> Vibration direction and time : Up and down, back and forth, Right and left (3 directions) 3 hours/direction. Fig.6 AMP Spec. 109-5202

Fig.2 (CONT)

Para	Test Items	Requirements		Procedures
3.5.10	Contact Mating Force	0.49 - 2.45 N		Operation speed : 100mm/min Measure the force required to mate contacts.
3.5.11	Contact Unmating Force	0.49 - 2.45 N		Operation speed : 100mm/min Measure the force required to mate contacts.
3.5.12	Connector Mating Force	40 positions 98N max.		Operation speed : 100mm/min Measure the force required to mate connectors. AMP Spec. 109-5206
	Tightening Torque of Bolt	80 positions 1.96N·m max.		With connector in pre-locked position, tighten bolt until fully mated while measuring the maximum torque. Operation speed : 15Rev./min
3.5.13	Connector Unmating Force	40 positions 98N max.		Operation speed : 100mm/min Measure the force required to mate connectors. AMP Spec. 109-5206 Condition : without locking mechanism
3.5.14	Connector Locking Strength	98N min.		Measure connector locking strength. Operation speed : 100mm/min. AMP Spec. 109-5210 40 Pos. Housing only.
3.5.15	Contact Insertion Force	14.7N max. per contact		Measure the force required to insert contact into housing. AMP Spec. 109-5211
3.5.16	Contact Retention Force (Secondary Lock)	78.4N min		Measure contact retention force with secondary lock set in effect. Operation speed : 100mm/min.
3.5.17	Crimp Tensile Strength	Wire Size mm <sup>2</sup> (AWG)	Crimp Tensile (min.) N	Apply an axial pull-off load to crimped wire of contact secured on the tester. Operation speed : 100mm/min. AMP Spec109-5205
		0.5 (#20)	88	
		0.85(#18)	127	
		1.25(#16)	177	
3.5.18	Durability (Repeated Mate/Unmating)	20mΩ max. (Final)		Manually operated (80 Pos. : To use manually torque wrench) No. of Cycles : 30 cycles. AMP Spec. 109-5213
3.5.19	Resistance to "Kojiri"	20mΩ max. (Final)		Manually repeat "Kojiri" insertion and extraction for 30 cycles. AMP Spec. 109-5215 (Only 40 Pos.)
3.5.20	Solderability	Wet solder coverage : 95% min		Solder Temperature : 230±5°C Immersion Duration : 3±0.5 seconds Flux : Alpha 100 AMP Spec. 109-5203 Solder : Sn 60 : Pb 40 (wt%)

Fig.2 (CONT)

Para	Test Items	Requirements	Procedures
3.5.21	Handling Ergonomics	No abnormalities allowed in manual mating/unmating handling.	Manually operated.
Environmental Requirements			
3.5.22	Thermal Shock	20m $\Omega$ max (Final)	Subject mated connectors to exposure of $-30 \pm 5^\circ\text{C}$ for 60 min., $80 \pm 5^\circ\text{C}$ for 60 min. AMP Spec. 109-5103
3.5.23	Humidity Steady State	20m $\Omega$ max (Final)	Mated Connector, 90-95% R.H. $60^\circ\text{C}$ , 96 hours AMP Spec. 109-5105
3.5.24	Salt Spray	20m $\Omega$ max (Final)	Subject mated connectors to 5% salt concentration for 96 hours : MIL-STD-202, Method 101 (Mated Connector) AMP Spec. 109-5101  After rinsing with tap water, dry at room temperature for 1 hour. Then make resis. Measurements.
3.5.25	Industrial Gas (SO <sub>2</sub> )	20m $\Omega$ max (Final)	Subject mated connectors to exposure of SO <sub>2</sub> Gas : 10 ppm, 95% R.H., room temperature for 24 hours. AMP Spec. 109-5107
3.5.26	Temperature Life (Heat Aging)	20m $\Omega$ max (Final)	Subject mated connectors to exposure of $120^\circ\text{C}$ for 120 hours. AMP Spec. 109-5104
3.5.27	Resistance to Cold	20m $\Omega$ max (Final)	Subject mated connectors to exposure of $-50 \pm 5^\circ\text{C}$ for 120 hours. AMP Spec. 109-5108
3.5.28	Water Immersion Testing	Current Leakage 0.1 mA max.	Subject mated connectors with mounting engine control unit (ECU) to immersion in tap water tub in accordance with the test patterns 1 and 2 as specified in Fig. 9 by using the new sample each time separately. Water immersion shall be done as shown in Fig. 10. During the test, test voltage of 14V DC is applied between the adjacent contact, and monitor the circuit for electrical current leakage.
3.5.29	Water Splash	Current Leakage 0.1 mA max.	Expose mated connectors under $80 \pm 3^\circ\text{C}$ for 40 minutes, splash water for 20 minutes. 48 cycles, Test voltage : 14V AMP Spec. 109-5109 Condition JIS D 0203 R1 Seal tab holes in CAP HSG by applying epoxy to rear surface of HSG.

Fig.2 (CONT)

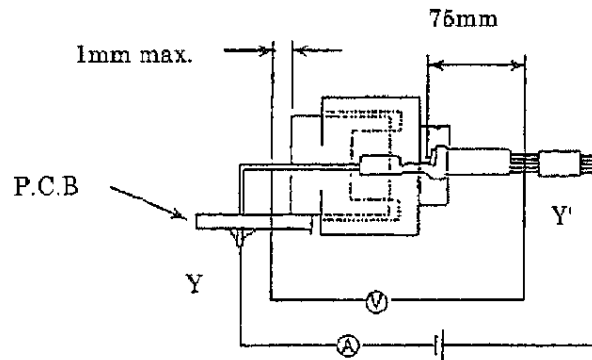
Para	Test Items	Requirements	Procedures
3.5.30	Icing	20mΩ max. (Final)	Immerse mated connectors in boiling water for 60 minutes, freeze at $-30 \pm 5^{\circ}\text{C}$
3.5.31	Resistance to Oil	20mΩ max. (Final)	Immerse mated connectors in oil. $50 \pm 5^{\circ}\text{C}$ Specified in Fig.8
3.5.32	Dust Bombardment	20mΩ max. (Final)	Subject JIS R5210 cement blow of 14.7N per 10 seconds in 15 minutes intervals for 90 minutes. AMP Spec. 109-5110 (Mated Connectors)
3.5.33	Resistance to Liquid Detergents	20mΩ max. (Final)	Immerse mated connectors into commercially suppliable car washer liquid detergent at $50 \pm 2^{\circ}\text{C}$ for 2 hours. After the durations, rinse in tap water for 5 minutes, and have it dried before subsequent measurement. (Mated Connectors)
3.5.34	Resistance to Coolant	20mΩ max. (Final)	Immerse mated connectors into commercially suppliable L.L.C (long life coolant) at $50 \pm 2^{\circ}\text{C}$ for 2 hours. After the duration, rinse in tap water for 5 minutes, and have it dried before subsequent measurement. (Mated Connectors)

Fig.2 (END)

Product Qualification and Requalification Tests.

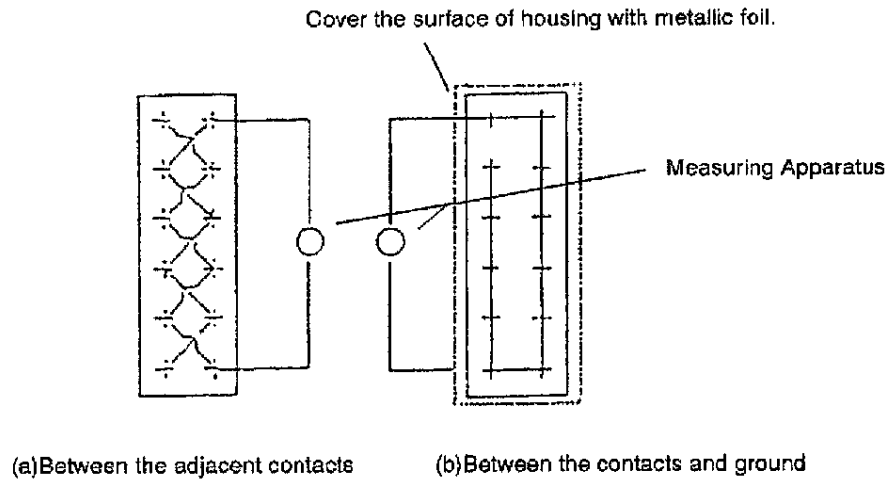
Test or Examination	Test Group													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Test Sequence (a)													
Confirmation of Product	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Termination Resistance (Specified Current)							3,6,8							
Termination Resistance (Low Level)				3,6,8 10,12		2,4,6 8,10	2		2,4	2,4	2,4,6	2,5		
Dielectric Strength					4									
Insulation Resistance					3									
Current Leakage					2									
Temperature Rising												3		
Current Cycling												4		
Vibration (High Frequency)											5			
Contact Unmating Force	2													
Contact Mating Force	3													
Connector Unmating Force				2										
Connector Mating Force				4										
Connector Locking Strength					5									
Contact Insertion Force													2	
Contact Retention Force (Secondary Lock)					6									
Crimp Tensile Strength		2												
Durability (Repeated Mate/Unmating)											3			
Resistance to "Kojiri"							5							
Solderability														2
Handling Ergonomics							4							
Thermal Shock				11										
Humidity Steady State				9										
Salt Spray										3				
Industrial Gas (SO <sub>2</sub> )									3					
Temperature Life (Heat Aging)				5										
Resistance to Cold				7										
Water immersion Testing			2											
Water Splash								2						
Icing							7							
Resistance to Oil						7								
Dust Bombardment						9								
Resistance to Liquid Detergents						5								
Resistance to Coolant						3								

(a) Numbers indicate sequence in which tests are performed.

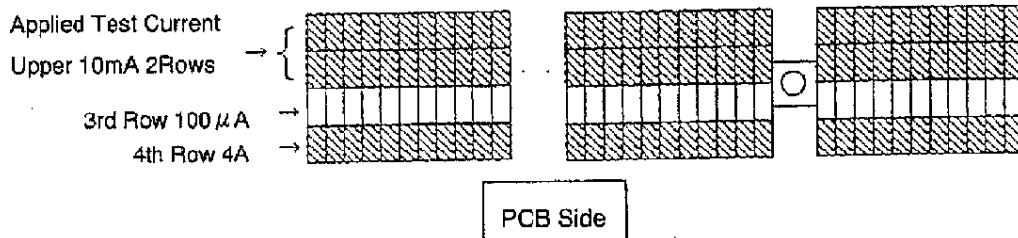


From the termination resistance measured readings, deduct the resistance of 75mm long wire used for termination. Apply test current of 12V, 1A when testing by using the rated current. For obtaining uniformity of current density across the contacting points of the testing parts, the wire end was soldered for probe detection.

**Fig.3 Termination Resistance Measurement**



**Fig.4**



**Fig.5**

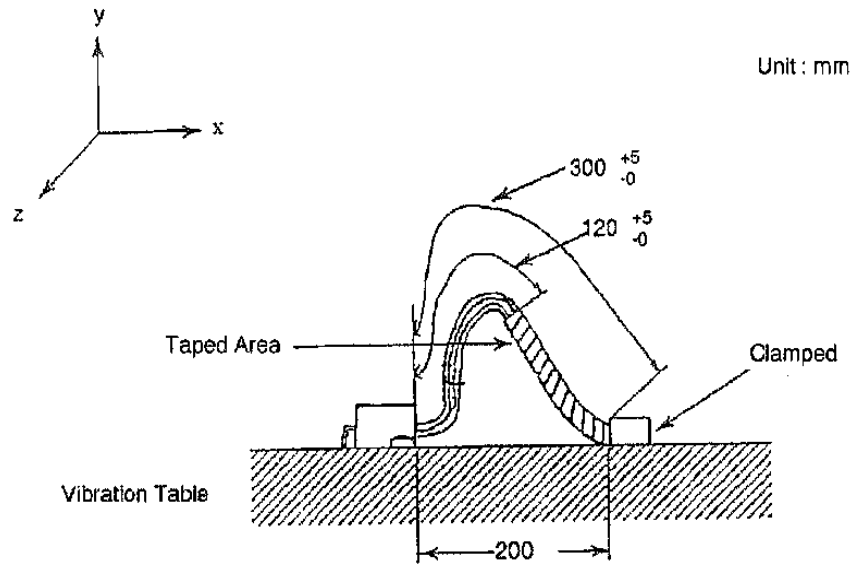


Fig. 6

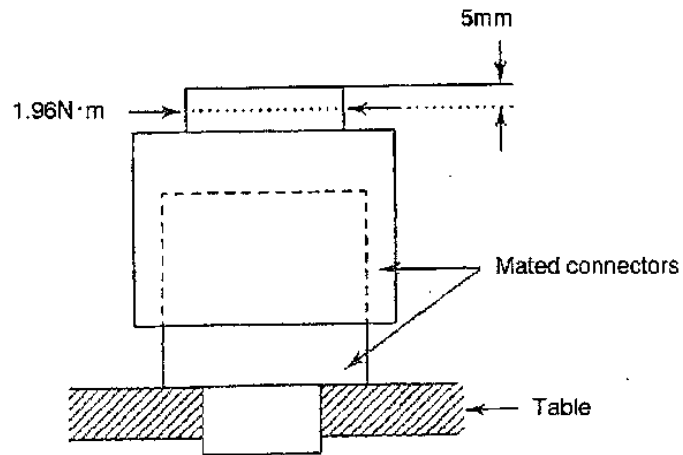


Fig.7

Test Sequence	Type of Oil	Duration (Hour)
1	Torque Converter Oil	1
2	Transmission Oil	1
3	Engine Oil	1
4	Clutch Oil	1
5	Brale Oil	1

Fig.8



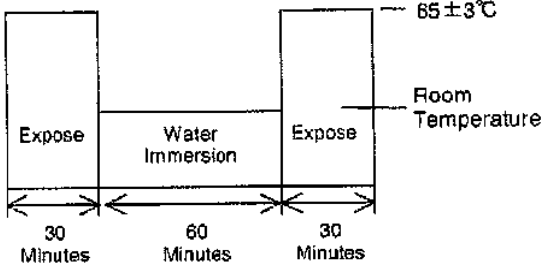
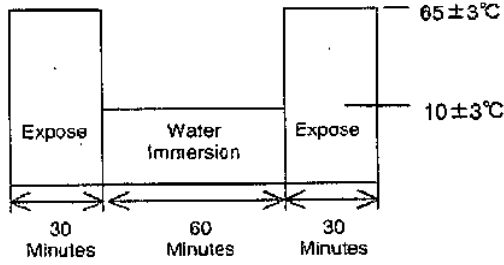
Check Item	Test conditions
Test Pattern 1	
Test Pattern 2	
No. of Immersion	1 Cycle
ECU Placement in Testing tub (ECU=Engine Control Unit)	Place ECU with connector side down. Immerse more than 1/2 part of ECU in tap water. During the test, female connector is left in mated condition.

Fig.9

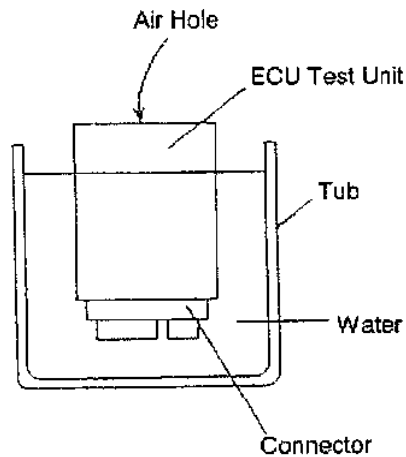
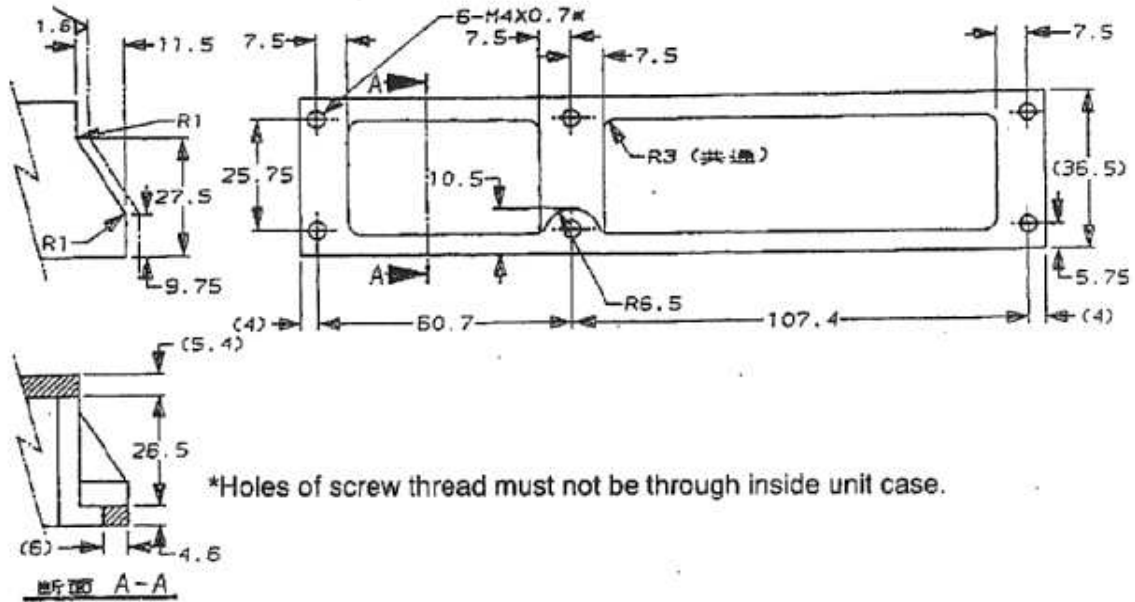


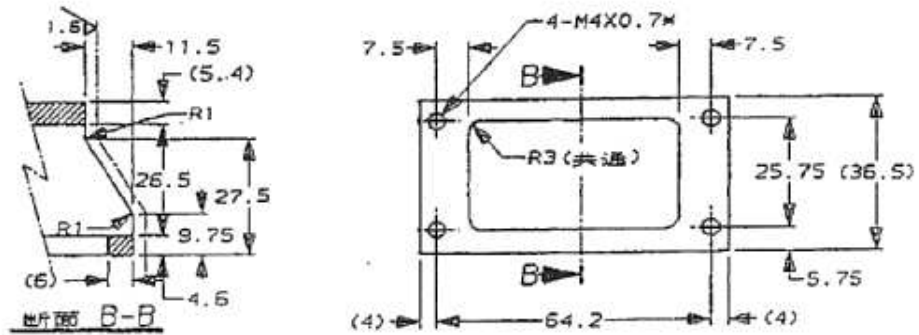
Fig.10

Reference Illustration (Mounting Side Feature)

120 Position Cap Assembly



40 Position Cap Assembly



\*Holes of screw thread must not be through inside unit case.

Unit : mm

Fig.11

The applicable product descriptions and part numbers are as shown in Appendix 1.

Appendix 1

Prod. P/N	Description
5178405-1	120 Position, Cap Assembly
1-178405-6	120 Position, Cap Assembly
178409-6	40 Position, Plug Assembly (B-Type)
178411-6	80 Position, Plug Assembly
178413-7	Double Lock Plate
178421-7	Cavity Plug
175197-2	040 Series, Receptacle Contact
1-177503-9	40 Position, Cap Assembly (A-Type)
6-177504-6	40 Position, Plug Assembly (A-Type)
1-179962-6	40 Position, Cap Assembly (B-Type)

\*Mating 40 position cap assembly and plug assembly shall have identical type.  
For 120 position cap assembly, B-Type of plug assembly shall be mated.