1. SCOPE

This specification applies to the Water Sealed ECU Connector

2. APPLIED STANDARD

The following standards are applied as a part of this specification sheet.

Standard No.	Designation
JIS D0203	Wet-Proof & Water-Proof Test Method Automobile Parts
MIL 202	Test Methods for Electronic and Electrical Component Parts

3. PRODUCT TYPES

	Structure	No. of Pos.	Part No.
※1 Plug Housing Connector	Receptacle Contact Ass'y	—	5-1437285-7/8-1447232-7 1437278-2/8-1447232-8
	Plug Housing Ass'y	10	6-1447232-6
		18	6-1447232-7
		24	6-1447232-8
	Bushing	10	4-1447232-8 5-1447232-1
		18	4-1447232-9 5-1447232-2
		24	5-1447232-0 5-1447232-3
	Seal Ring	10	5-1447232-7
		18	5-1447232-8
		24	5-1447232-9

Contact Part No. Tin Plating ／ Gold Plating.

※1 Refer to customer drawing 2-1437290-2 for kit part number

3. PRODUCT TYPES

	Structure	No. of Pos.	Part No.
Cap Housing Connector	Cap Housing Ass'y	10	9-6447232-4/9-1447232-5
		18	5-6437288-5/5-1437288-6 1-6447233-8/1-1447233-9
		24	9-6447232-8/7-1437292-5 5-6437285-8/1447233-1
		28	1-6447233-3/1-1447233-4
		34	6447233-9 1-1447233-0/1-1447233-2
		(36) 38	7-6447232-2/7-1447232-3 7-1447232-5
		(36) (39) 42	4-1447232-4 4-1447232-2 4-1447232-0/4-6447232-1 4-1447232-6/4-6447232-7
		52	9-6447232-6/9-1447232-7
Accessory	Cavity Plug	—	7-1437292-4/4-1437284-3
	Hole Plug	—	7-1447232-6
	Bushing 10Pos. (for Cavity Plug)	—	7-1447232-7

Cavity plug number 4-1437284-3 is not applicable to bushing number 4-1447232-8, 4-1447232-9 and 5-1447232-0 (Color=Black)

4. RATING

Item	Rating & Condition
Current	Refer to the table below
Voltage	250V (AC,DC)
Temperature	-30～+80℃ ／ -50～+125℃ (Tin) (Gold)
Wire	Conductor 0.3～1.25㎟ Insulation Cover ϕ 1.6～ ϕ 2.9(1)
Board	ϕ 1.2 Through Hole

Connector Allowable Current

(Allowable maximum temperature in the vicinity of the contacting point is 100℃)

(Tin)

(A)

Measurement Set-up \ Ambient Temperature (℃)		20	40	60	80
10Pos. block (Wire Size 1.25mm^2)	All positions active	10	8.5	7	5
	Only single position active	15	13	10	7.5
18, 24Pos. blocks (Wire Size 0.85mm^2 min.)	All positions active	8	7	6	4
	Only single position active	15	13	10	7.5

Connector Allowable Current

(Allowable maximum temperature in the vicinity of the contacting point is 130℃)

(Gold)

(A)

Measurement Set-up \ Ambient Temperature (℃)		50	75	100	125
10Pos. block (Wire Size 1.25mm^2)	All positions active	11	9	6.5	3
	Only single position active	19	15	12	5
18, 24Pos. blocks (Wire Size 0.85mm^2 min.)	All positions active	9	7.5	5.5	2.5
	Only single position active	19	15	12	5

Note(1)：In case of (a) and (b) shown as following table, rated temperature and Test condition of high temperature test should be changed.
(According Tin plating to the spec. of type)

	Example of applicable wire or cavity plug	Bushing Cat No. (COLOR)
(a)	AVS 0.3 AVS 0.5 4-1437284-3	5-1447232-1(Brown), 5-1447232-2(Brown) 5-1447232-3(Brown)
(b)	AV 0.5	4-1447232-8(Black), 4-1447232-9(Black) 5-1447232-0(Black)

5. MEASUREMENT METHOD AND PERFORMANCE

No.	ITEM	MEASUREMENT METHOD	PERFORMANCE
5.1	External Appearance	Visual and touch feeling inspection.	There shall be no detrimental crack,rust,play, scratch,deformation and etc.
5.2	Feeling on Mating /Unmating	Feeling is verified by mating and unmating the contact,housing and connector	There should be no detrimental binding.
5.3	Insertion Force	Pin contact or cap housing connector is fastened first,then receptacle contact or plug housing and plug connector are mated at a constant mating speed of approx. 100mm/min. or less toward the axis. (The plug housing shall be installed with locking spring and seal ring.)	Contact 4.9N or less / 0.98～4.9N Housing 49N / 49N or less 10pos. 88.2N / 58.8N or less 18pos. 127.4N / 78.4N or less 24pos. 147N / 98N or less (TIN / GOLD)
5.4	Withdrawal Force	Pin contact or cap housing connector is fastened first,then mated receptacle contact or plug housing and the connector is pulled at a constant speed of approx. 100mm/min. or less toward the axis. (Plug housing should be installed with locking spring and seal ring.)	Contact 4.9N or less / 0.98～4.9N Housing 49N / 49N or less 10pos. 88.2N / 58.8N or less 18pos. 127.4N / 78.4N or less 24pos. 147N / 98N or less (TIN / GOLD)

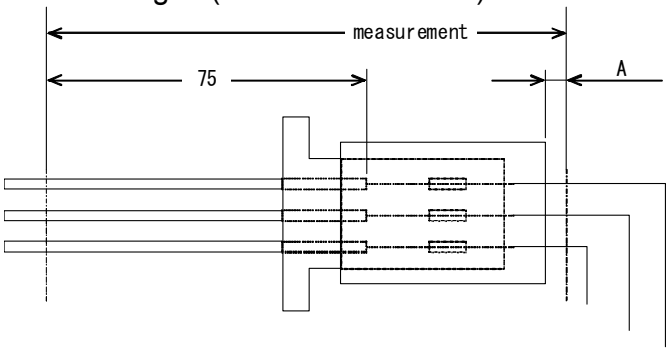
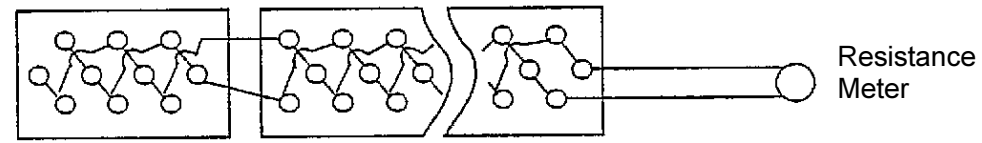
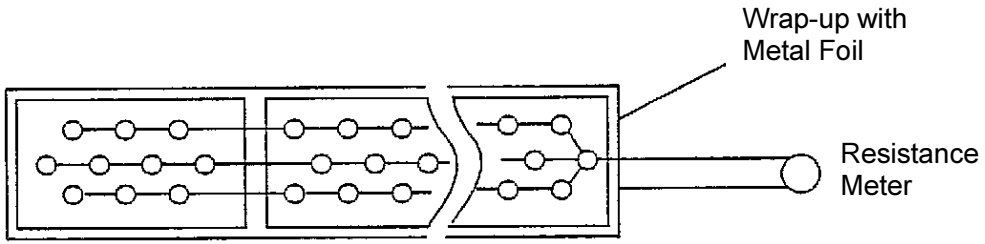
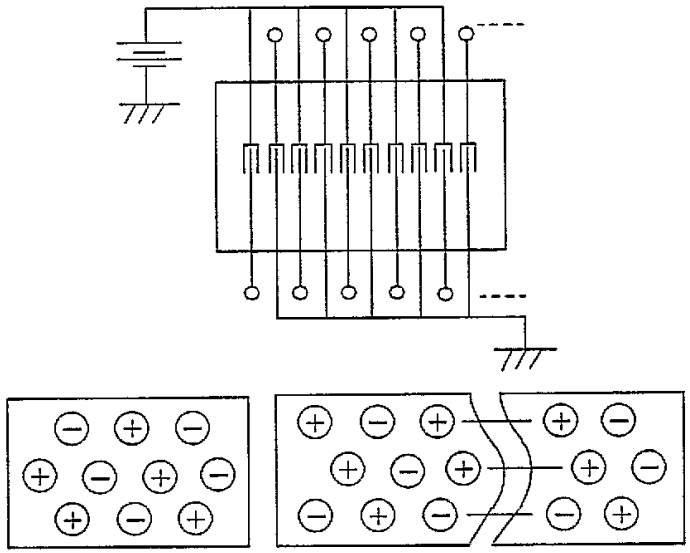
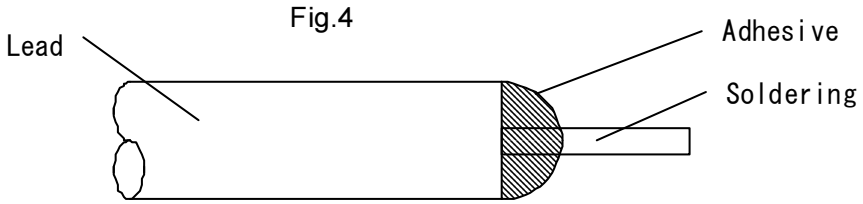
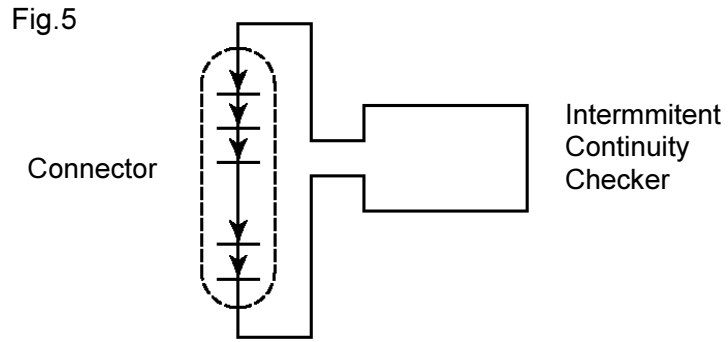
<table>
<tr><th>No.</th><th>ITEM</th><th>MEASUREMENT METHOD</th><th>PERFORMANCE</th></tr>
<tr><td>5.5</td><td>Voltage Drop</td><td>As shown in Fig.1 while feeding open voltage of 12±1V and short circuit current of 1±0.05A to the mated conector, measurement is taken at the point 75mm apart from the crimped barrel when temperature of the mated contact has saturated and then voltage drop by the wire is subtracted.(Resistance of wire is per Table 1.)
Fig. 1 (A is made minimum)
 

Table 1
<table>
<tr><th>Wire Size</th><th>Resistance (mΩ/75mm)</th></tr>
<tr><td>0.3</td><td>3.77</td></tr>
<tr><td>0.5</td><td>2.44</td></tr>
<tr><td>0.85</td><td>1.54</td></tr>
<tr><td>1.25</td><td>1.05</td></tr>
</table></td><td>Initial : 5mV/A / 3mV/A or less
After Durability Test : 10mV/A / 6mV/A or less
(TIN / GOLD)</td></tr>
<tr><td>5.6</td><td>Low Level Voltege and Current Resistance</td><td>As shown in Fig.1, measurement is taken at the point 75mm apart from the crimped barrel with open voltage of 20±5mV and short circuit current of 10±0.5mA fed to the mated conector and then voltage drop by the wire is subtracted.
(Resistance of wire is per Table 1.)</td><td>Initial : 5mΩ / 3mΩ or less
After Durability Test : 10mΩ / 6mΩ or less
(TIN / GOLD)</td></tr>
</table>

No.	ITEM	MEASUREMENT METHOD	PERFORMANCE
5.7	Insulation Resistance	As shown in Fig.2 the connector is mated and insulation resistances between neighboring contacts and between contact and earth are measured with insulation resistance meter of DC 500V. Fig. 2  Between Contacts  Between Contact and Earth	100MΩ or more
5.8	Dielectric Withstanding Voltage	As shown in Fig.2 while the connector is mated, 1000V AC voltage of commercial power frequency is applied of duration of 1 minute between contacts and between contact and earth.	Insulation breakdown does not develop.

No.	ITEM	MEASUREMENT METHOD	PERFORMANCE
5.9	Leak curent	Peak value of leak curent and integrated quantity are measured while DC 28 volt is applied with the circuit shown in Fig.3. Fig. 3 	Peak Value: 3mA or less
5.10	Contact Solderability	Cap housing connector is tested basing on MIL-STD-202, Method 208.	MIL standard is met.
5.11	Contact Retention Force (Between Contact and Housing)	About 100mm long wire is crimped with the plug housing connector and the receptacle contact is fastened and then the load that causes separation of contact from the housing with the wire pulled toward the axis at a constant speed of approx. 100mm/min. is measured.	78.4N or more

No.	ITEM	MEASUREMENT METHOD	PERFORMANCE
5.12	Strength of Crimp Connection (Between Contact and Wire)	After the receptacle contact with wire crimped is fastened the load that causes wire breakage or separation of the wire from the crimped barrel with the wire pulled toward the axis at a constant speed of approx. 100mm/min. is measured.	Wire size 0.3 58.0N or more 0.5 88.2N or more 0.85 127.4N or more 1.25 176.4N or more
5.13	Housing Retention Force (Housing Locking Strength)	After the cap housing is fastened, mated plug housing (with locking spring installed) is pulled at a constant speed of approx. 100mm/min.	The lock mechanism shall not get released or broken less than 98N
5.14	Seal Ability	Seal Ability is measured with compressed air fed into the water-proof section of the connector. Before runnig the test, the tip of the wire is soldered and then sealed with adhesives. (Fig.4) Measurement is taken with 9800Pa(gage)(0.1kg/cm^2)compressed air fed into the connector submerged for duration of 30 seconds. If the air does not leak for 30 seconds, the pressure is raised each tine by an increment of 9800Pa(gage)(0.1kg/cm^2). Fig.4  	Initial: 49000Pa(gage) (0.5kg/cm^2)or more After Durability Test: 29400Pa(gage) (0.3kg/cm^2)or more

<table>
<tr><th>No.</th><th>ITEM</th><th>MEASUREMENT METHOD</th><th>PERFORMANCE</th></tr>
<tr><td>5.15</td><td>Over-Current Test</td><td>While the connector is held horizontally in a draft free chamber, current magnitube and time length for the over curent test are selected per the Table 2.
<table>
<tr><th rowspan="2">Wire size</th><th colspan="2">Test Ⅰ</th><th colspan="2">Test Ⅱ</th></tr>
<tr><th>Current Value(A)</th><th>Conduction Time(S)</th><th>Current Value(A)</th><th>Conduction Time(S)</th></tr>
<tr><td>0.3</td><td>25</td><td rowspan="4">60</td><td>50</td><td rowspan="4">5</td></tr>
<tr><td>0.5</td><td>30</td><td>80</td></tr>
<tr><td>0.85</td><td>40</td><td>110</td></tr>
<tr><td>1.25</td><td>55</td><td>170</td></tr>
</table></td><td>The housing shall not ignite.</td></tr>
<tr><td>5.16</td><td>Temperature Rise Magnitude</td><td>“Temperature Rise Test” of item No.7.14 is made and temperature of connector surface near the mated interface of the contact, is measured when the temperature has saturated.</td><td>Temperature rise: 60℃ or less.</td></tr>
<tr><td>5.17</td><td>Contact Force</td><td>The beam of receptacle contact is forced to flex to an extent that would result if the pin contact inserted and then mechanical load causing the deflection is measured.</td><td>1.47N or more</td></tr>
<tr><td>5.18</td><td>Intermittent Discontinuity</td><td>Power of 12V or less open voltage and 1A or less short circuit current is applied to the mated connector with the contacts in all positions connected in series and then intermittent discontinuity is monitored with an intermittent discontinuity detector. (Fig.5)
Fig.5
 
</td><td>Intermittent discontinuity shall not last for 1ms or more.</td></tr>
</table>

6. TEST STRUCTURE AND SEQUENCE

6.1 Characteristic Test

The test is made basically in line with the sequence shown in the Table 3.

Table 3

Test Sample / Sequence	Contact	Housing	Accessory (Cavity Plug)	Connector	
1	External Appearance	External Appearance	External Appearance	External Appearance	
2	Insertion Force	Insertion Force	—	Insertion Force	
3	Separation Force	Separation Force	—	Low Voltage and Current Resistance	
4	Feeling of mating/unmating	Feeling of mating/unmating	—	Voltage Drop	
5	Strength of Crimped Connection	Housing mating/unmating	—	Temperature Rise	
6	Contact Force (Other Sample)	—	—	Insertion Resistance	
7	—	—	—	Directric Withstanding Voltage	
8	—	—	—	Seal Ability	
9	—	—	—	Withdrawal Force	
10	—	—	—	Contact Retention Force	Feeling of Mating/ Unmating
11	—	—	—	Contact Solderbility	Over Current
Sample Quantity	50(+10)	10	10	4	6
				10	

6.2 Durability Test

The test is made basically according to the Table 4.

Table 4

	BEFORE TEST	TEST Ⅰ	TEST Ⅱ	TEST Ⅲ	SAMPLE QUANTITY
A	—	"Kojiri" durability	Vibration	Current cycle	5
	Voltage drop	Voltage drop	Intermittent Discontinuity (1) Voltage drop	Voltage drop	
B	—	"Kojiri"durability	Temperature rise	—	5
	Voltage drop	Voltage drop	Temperature rise Magnitude (1) Voltage drop	—	
C	—	High temperature exposure	Low temperature exposure	—	10
	Insertion force Low level voltage and current resistance Seal ability Withdrawal force	Low level voltage and current resistance Seal ability Withdrawal force Insertion force	Low level voltage and Current resistance Seal ability Withdrawal force Insertion force	—	
D	—	Thermal shock	—	—	10
	Insertion force Low level voltage and current resistance Seal ability Withdrawal force	Low level voltage and current resistance Seal ability Withdrawal force Insertion force	—	—	
E	—	"Kojiri"durability	Water-proof	—	10
	Low level voltage and current resistance Seal ability	Low level voltage and current resistance Seal ability	Leak current (1) Low level voltage and current resistance Seal ability	—	
F	—	"Kojiri"durability	Oil-proof Solvent-proof	—	5
	Insertion force Low level voltage and current resistance Insulation resistance Withdrawal force	Low level voltage and current resistance	Low level voltage and current resistance Insulation resistance Withdrawal force Insertion force	—	
G	—	Freezing	Corrosion gas	Ozone deterioration	5
	External appearance Low level voltage and current resistance Dielectric withstanding Voltage Seal ability	Leak current (1) External appearance	Low level voltage and current resistance Seal ability	Low level voltage and current resistance Seal ability Dielectric withstanding voltage External appearance	
H	—	Salt Spray	—	—	10
	Low level voltage and current resistance	Leak current (1) Low level voltage and current resistance	—	—	
I	—	Weather-proof	—	—	5
	insertion force Low level voltage and current resistance Voltage drop Insulation resistance Withstanding voltage Withdrawal force	Low level voltage and current resistance Voltage drop Insulation resistance Withstanding voltage Withdrawal force Insertion force	—	—	

Note(1) : This measurement item is continually measured thru the test.

Remark : 1. The test subject and item to be measure are shown above and below the dotted line respectively in the Table 4.

2. The measurement items shall be measured one after another sequentially in each item.

7. TEST METHOD

7.1 “Kojiri”*(Rocking motion) Durability Test

After the cap housing connector is fastened, the plug housing is mated in the regular manner and then 196N force is applied to and fro twice as shown in Fig.6. This test is repeated with the connector half if pulled from other half with slide distance stepped up by an increment of 1mm each time until the connector is fully unmated. These test procedure is defined as one cycle and is repeated 25 cycles. Test with the force applied towards right and left, is also made in the same manner. (Test with the force applied towards combined direction of to/fro and right/left is also acceptable.)

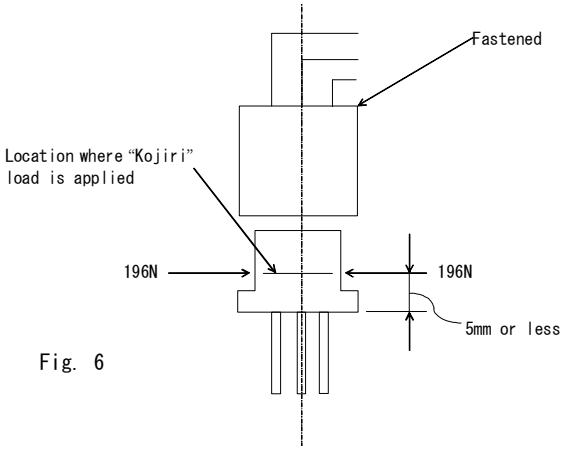


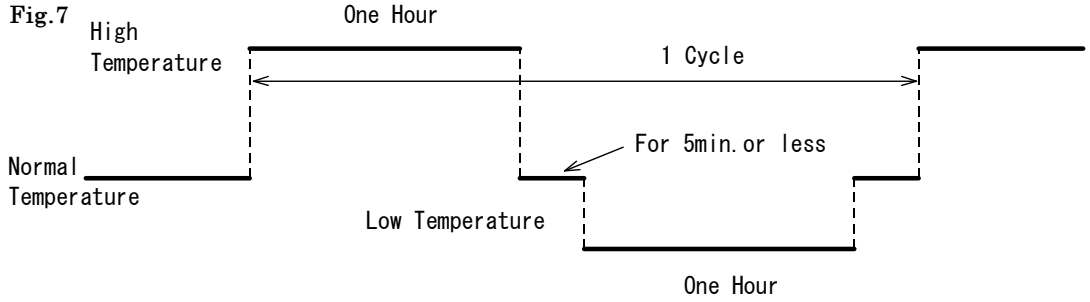
Fig. 6

7.2 High Temperature Exposure Test
The connector is kept in a thermostatic chamber for 120 hours and then Taken out to be exposed to the normal temperature until it cools off to the temperature. The chamber temperature is set at 80℃(Tin) / 125℃(Gold)

7.3 Low Temperature Exposure Test
The same test procedure as above is made except that the chamber Temperature is set at -30℃(Tin) / -50℃(Gold)

7.4 Thermal Shock Test
The connector is placed in a thermostatic chamber and given with 100 cycles of heating / cooling process in the heating / cooling pattern shown below and then is taken out of the chamber to be left in the normal temperature for more than 2 hours.

Fig.7



Termostatic chamber temperature is set at 100℃ as the high temperature and -20℃ as the low temperature

7.5 Salt Spray Test

The connector is hung in a sealed tank and sprayed with mist of salt water for 96hours and then hung in a humidity chamber to be left in there for 96hours. The salt water(35±5℃ temperature, 5±1% saltdensity, 1.0268～1.0413 specific gravity, PH 6.5～7.2) is sprayed at pressure of 68600～176500 Pa(gage) (0.7～1.8kg/cm²). The humidity chamber is set at temperature of 80±5℃ and relative humidity of 90～95%. Measurement is taken after the connector has dried up in normal temperature. During the salt water spray, 28 volt is applied across each contact of the connector to monitor leak current as shown in Fig.3.

7.6 Oil-Proof, Solvent-Proof Test

The connector is dipped in various oil. Oil temperature is set at 50±2℃. Test is made in the sequence shown below.

Torq.Con.Oil (Castle Auto Fluid Special)	Dipping for 1hour	→	Dipping in kerosene for 5min.
Transmission Oil(SAE 90)	Dipping for 1hour	→	Dipping in kerosene for 5min.
Engine Oil(SAE 10W-30)	Dipping for 1hour	→	Dipping in kerosene for 5min.
Clutch oil (Toyota Standard SHD)	Dipping for 1hour	→	Dipping in kerosene for 5min.
Brake Oil (Toyota Standard SHF)	Dipping for 1hour	→	Dipping in kerosene for 5min.

Another dipping test is also made on other sample in the following sequence with oil temperature set at 50±2℃.

Washer liquid (available in the market) Dipping for 1hour

→Rinsing and dipping with or in tap water for 5min.

→Antifreezing solution (Castle Long Life Coolant) Dipping for 1hour

→Rinsing and dipping with/or in tap water 5min.

→Drying while left in room temperature

7.7 Water-Proof Test

The connector is placed in the thermostatic chamber, heated up 40min. and then immediately sprayed with water of normal temp. for 20min. in an water-proof test chamber. This is defined as 1cycle. The cycle is repeated 48 times for the test. The spray is made according to S1 of JIS D0203. Potential of 28 volt is applied across each contact of the connector during the water spray by the circuit shown in the Fig.3 and leak current is monitored. At running the test, the leading end of the lead wire shall be pulled out from the test chamber after having been soldered and then sealed with adhesives. The thermostatic chamber is set at 80°C(Tin)/125°C(Gold).

7.8 Freezing Test

The conector is put in a thermostatic chamber set at -30±5°C immediately after dipped in boiling water for 1hour and then taken out of the chamber after the water stuck on the connector has freezed. Potential of 28 volts is applied across each contact of the conector during the test with the circuit shown in Fig.3, and leak current is monitored.

7.9 Corrosion Gas Test

The connector is left in the test chamber for 24hours. The chamber is fed with 10ppmSO_2 gas with 90% or more humidity and set at normal temperature.

7.10 Ozone Deterioration Test

The connector is left in the test chamber for 24hours. The chamber is fed with 50±5ppm ozone gas and set at normal temperature.
(Basing on JIS 6301 “Ozone” Deterioration Test”)

7.11 Vibration Test

The connector is fastened to vibration stand and vibrated in two directions along and perpendicular to the terminal axis. Other condition of the vibration is set by the Table 5. During the test electrical current is turned on as shown in Fig.5 and intermittent discontinuity is monitored.

Fig. 8

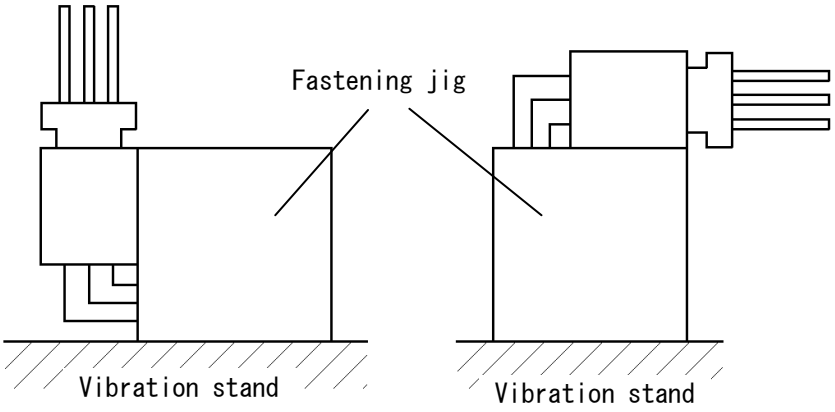


Table 5

	Acceleration (m/s^2)	Vibration Duration (h)	Vibration Frequency (Hz)
Tin Plating	44.1 (4.5G)	3 hours per direction, Total of 6 hours	20～200 Sweep Time 1min.
Gold Plating	98～245 (10～25G)		50～100 … $98m/s^2$(10G)constant 100～250 … Half vibration stroke of 0.2mm constant ～$245m/s^2$(25G)constant Sweep Time 3min.

7.12 Weather-Proof Test

The connector is left in sunny outdoors for 12 months.

7.13 Current Cycle Test

Contacts of all positions of the connector are turned on with the current I_1[(2)],Which is shown in the Table 6 and 7. Turning on current for 45min. and then turning off for 15min. are defined here as one cycle of test. The connector is tested with 200 cycles. Then curent I_2[(3)] is turned on to every other position of the connector (Fig.9) and this test cycle is repeated 50 times with vibration applied in draft free chamber according to the condition specified in the Table 8. (Application of vibration is only for Gold Plating) Measurement is taken perthe table every time when finishing 50, 100, 150 and 200 cycles.

Note (2) Current $I_1 = kd \cdot Imax$
(3) Current $I_2 = Imax$

Table 6 Maximum Allowable Current Imax

Wire size	Current Value(A)
0.3	9
0.5	11
0.85	15
1.25	19

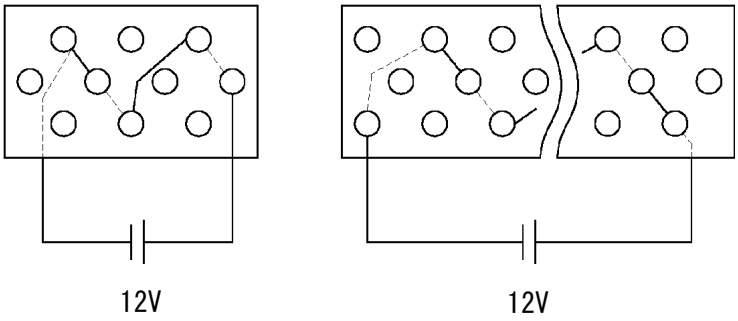
Table 7 Derating Factor kd

Position No.	Derating Factor
10	0.5
18	0.4
24	

Table 8

Vibration Condition		
Acceleration(m/s^2)	Vibration applied (Hz)	Vibration Direction
88.2(9G)	20～200 (Sweep Time 1 min.)	Toward Contact Axis

Fig. 9



7.14 Temperature Rise Test

Electric current I_2 shown in the Table 6 is turned on to an arbitrarily chosen potion of the connector in draft free chamber.

8. TEST CONDITION

(1) Contact and housing to be tested are to be selected randomly.
(2) Contact and housing to be tested are to be crimped with wire of the maximum size except when otherwise noted. Wire length shall be decided each time.
(3) Wire used in the tests should have enough performance of Heatstability and Solvent-resistance.
(4) Test is to be made in the normal temperature and humidity except when otherwise noted.
(5) Test is to be made with the connector mated except when otherwise noted.
(6) Tolerance of the test conditions is ±10% except when otherwise noted.
(7) Quantity of test sample is shown in Table 3 and 4. However, it may be adjusted depending on situation.
(8) Measurement for each test is to be made on 2 positions or more.

9. PACKAGING AND LABELLING

Packaging units will each contain suitable quantities of the product.
Arrangements for transport and storage shall be such that no loss or damage is suffered. The following labeling will be displayed.

- Product description or Part. No.
- Quantity contained
- Manufacturer's name or abbreviated name
- Date of manufacture or Lot No.