375 1P CONNECTOR

Tyco Electronics Corporation, KOREA		This specification is a controlled document. 	

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Specification Approval

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CONTENT

1. Scope of Application

This specification provides the method to test connectors for low voltage cable(hereinafter referred to as "connector") and the terminal for low voltage cable(hereinafter referred to as "terminal") which are used for automobiles.

2. Quality

Quality of connector shall satisfy the characteristics of each item described in clause 3 after performing the test.

3. Requirements

NO	Items	Characteristics									Measuring method
1	Appearance	There shall be no crack, rust, burr, damage, deformation, discoloration, etc. which is harmful to function.									5.1
2	CONN engage and disengage force	Engage	Max 10 kgf								5.2
		Disengage	Max 10 kgf								
3	Reverse insertion between housings	It shall not be incorrectly inserted by applying force of 20 kgf of with hands.									5.3
4	Reverse insertion between terminal and housing	5 kgf or more									5.4
5	Engage force between terminal and housing	7.5 kgf or less									5.5
6	Connector clip, panel engage and retention forces	Engage force : 12kgf or less Retention force : 15kgf or more									5.6
7	HSG lock strength	10 kgf or more									5.7
8	Lock release force	Force on release force point of lock part shall be 6kgf or less.									5.8
9	Terminal retention force	14kgf or more									5.9
10	Terminal engage and disengage force (kgf)	Terminal type	375								5.10
		Engage	0.5~4.0 kgf								
		disengage	0.5~4.0 kgf								
11	Crimp strength (kgf)	SQ	0.2	0.3	0.5	0.85	1.25	2.0	3.0	5.0	8.0	5.11
		More than	4	6	9	13	17	20	35	40	50	

12	Voltage drop	Division	Initial	After endurance	5.12
		375	3 mV/A or less	10 mV/A or less	
13	Insulation resistance	Initial	After endurance		5.13
		250 ㏁ or more	100 ㏁ or more		
14	Leakage current	Initial	After endurance		5.14
		1 ㎂ or less	1 ㎂ or less		
15	High voltage test	There shall be no insulation break.			5.15
16	Temperature rise	After endurance			5.16
		60℃ or less			
17	Instant short circuit	There shall be no 10 ㎲ or more instant short circuit.			5.17
18	Sealing Test	After endurance 0.5 kgf/cm^2 or more			5.18
19	Engage/Disengage force between HSG and CLIP	Engage force : 6kgf or less Retention force : 11kgf or more			5.19

< Table 1 : Test items >

Test items	Appearance	CONN insertion and drawing force	HSG reverse insertion	Reverse insertion between terminal and HSG	Engage force between terminal and HSG	Connector clip engage/disengage force	Strength of HSG LOCK	HSG LOCK release force	Terminal retention force	Terminal engage/disengage force	Crimp strength	Voltage drop	Insulation resistance	Leakage current	High voltage	Temperature rise	Instant short circuit	Sealing	Engage/Disengage force between HSG and CLIP
Initial test	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				0
Twisting test	0											0							
Connector engage /disengage endurance test	0											0							
Overcurrent cycle test A	0											0				0			
Overcurrent cycle test B	0											0				0			
Cold temperature test	0											0	0	0		0		0	
Cold and hot temperature shock test	0											0						0	
High temperature test	0											0						0	
Soldering test	0																		
Temperature and humidity cycle test	0											0	0	0					
Dust test												0						0	
Waterproof test	0												0	0				0	
Oil and liquid test	0											0						0	
Ozone test	0											0						0	
Salt water test	0											0	0	0					
Sulfur test	0											0						0	
Mechanical shock test																	0		
Complex environment endurance test A	0										0	0				0	0		
Complex environment endurance test B	0										0	0				0	0	0	

4. Test Conditions

4.1 Specimen

Unless specifically mentioned, initial sample shall be used for test specimen. Test specimen shall be 5EA or more for each cavity. However, if performance is expected to be clearly satisfactory even by applying load to the same specimen in turn, it is possible to apply multiple test items to the same specimen. In such case, performance shall be satisfactory for each item.

4.2 Laboratory condition

Perform each test at designated temperature and humidity. And control humidity at designated absorption ratio for the connector which uses absorbent resin housing.

Temperature: 25 ± 5 ℃

Humidity: 60 ± 20%

Standard absorption ratio (reference value)

6 NYLON: 2 ~ 4%

66 NYLON: 1.5 ~ 3%

4.3 Basic current

Basic current value "I" shall be based on the following. ($I = I_0 * K$)

Cable size (SQ)	I_0		Remarks
	General	L TYPE (375)	
0.3	6 A		4A for signal
0.5	8 A		5A for signal
0.85	10 A		
1.25	14 A		
2.0	18 A		
3.0	22 A	34 A	
5.0	25 A	46 A	
8.0		60 A	

< Table 4.1 >

Number of simultaneous electrode within the same connector	K
	Reduction factor
1	1
2 ~ 3	0.75
4 ~ 5	0.6
6 ~ 8	0.55
9 ~ 10	0.5
11 ~ 25	0.4
26 or more	0.3
-	-

< Table 4.2 >

4.4 Evaluation

Evaluation of connectors shall be represented by evaluation of connectors of the maximum number of poles in the same series.

4.5 Cable size

The size of connector lead wire used in each test shall be represented by the maximum cable size which can convey current in the connector design.

5. Measuring Method

5.1 Appearance

Using sense of sight and touch.

5.2 CONNECTOR insertion and drawing force

Measure force by inserting and disengaging the connector with terminal assembled at constant100 mm/min speed. However, remove lock part when measuring disengage force.

5.3 Reverse insertion between housings

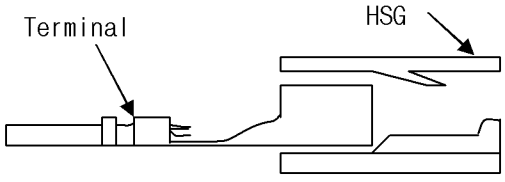
Insert the housing with terminal by pushing it in reverse direction with hand or applying 20kgf.

5.4 Reverse insertion between terminal and housing

Crimp cable of maximum size on terminal and then insert it into housing by applying force of 5kgf or with hand in the reserve direction.

5.5 Engage force between terminal and housing

As shown in the following figure 5-1, measure the weight while inserting terminal into fixed housing at 50mm/min speed.



< Figure 5-1>

5.6 Panel engage/disengage forces of connector clip

1) Insert clip into the fixed plate that can be furnished with clip at 50mm/min and measure the force at that time.

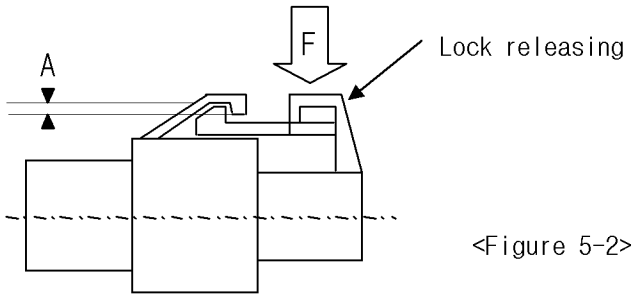
2) Pull clip at 100mm/min and measure the force when destroyed or disengaged.

5.7 Strength of HSG lock

Combine housing only, fix the one side of housing in completely locked condition, and extend the other side in axial direction at a constant speed of 100 mm/min. Then measure weight when lock structure is disengaged or destroyed.

5.8 HSG lock releasing force

Apply force (F) to lock releasing part, and measure weight on the point of A=0. However, cut connector and then perform test at the section in order to secure visibility.



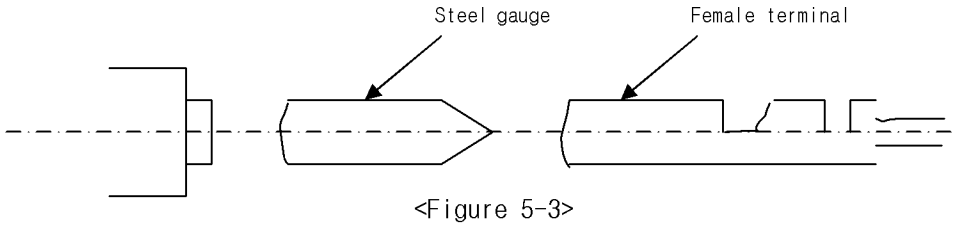
<Figure 5-2>

5.9 Terminal retention force

Fix the housing after inserting crimped terminals. Extend one line of cable in axial direction at a speed of 100mm/min at a position 50~100mm away from crimped part, and measure weight when terminal is disengaged from the housing.

5.10 Engage and disengage force of terminal

As shown in figure 5-3, engage and disengage male terminal or steel gauge into or from female terminal at 50 mm/min speed.



<Figure 5-3>

5.11 Crimp strength

Fix the crimped terminal, and draw the cable at a position 50~100mm away from crimped part in axial direction at 100 mm/min speed. Then measure the weight when cable is cut or disengaged from the crimped part.

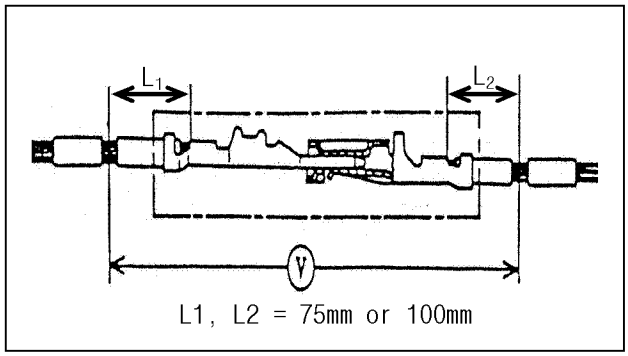
5.12 Voltage drop

Measure the circuit voltage drop (V) by sending voltage and current described in the table 5-1 with terminal combined on the connector. Then calculate a voltage drop (V_D) in terminal by subtracting cable resistance (L) from the circuit voltage drop (V).

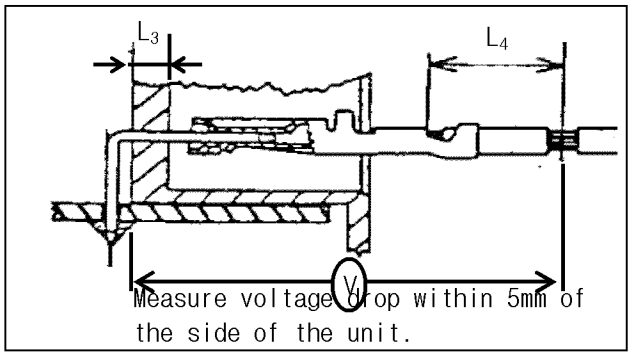
1) HARNESS versus HARNESS : $V_D = V - (L_1 + L_2)$
2) HARNESS versus UNIT : $V_D = V - (L_3 + L_4)$

Application	Open voltage	Short circuit current	Division
Signal circuit	20 ± 5 mV	10 mA	ECU, Sensor
Power circuit	13 V	1 A	Other than the above

< Table 5-1 >



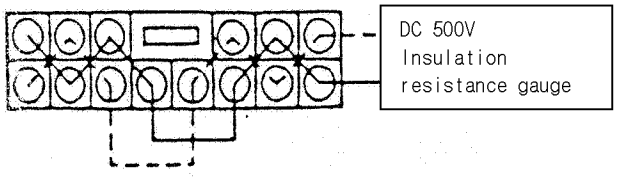
<Figure 5-4 : HARNESS versus HARNESS >



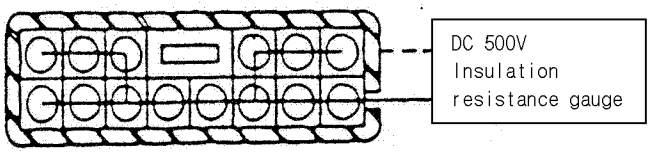
< Figure 5-5 : HARNESS versus UNIT >

5.13 Insulation resistance

Measure resistance between neighbor terminals (figure 5-6), and between terminal and housing surface (figure 5-7) with DC 500V insulation resistance gauge with connector combined.



<Figure 5-6: Between neighboring terminals>



<Figure 5-7: Between neighboring terminal and housing surface>

5.14 Leakage current

Measure it by applying DC 14V between neighboring terminals (figure 5-6).

5.15 High voltage test

Apply AC 1000V voltage of normal frequency for 1 minute between neighboring terminals (figure 5-6), and between housing surfaces of terminal (figure 5-7), with connector combined.

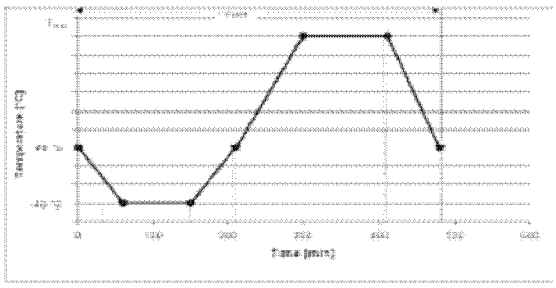
5.16 Temperature rise

Apply basic current ($I=I_0*K$) of clause 4.3 to the connector with electrodes in series in the room free from wind (normal temperature). And measure a temperature of crimped part after reaching saturation temperature. Then calculate a temperature of crimped part by subtracting ambient temperature from the temperature.

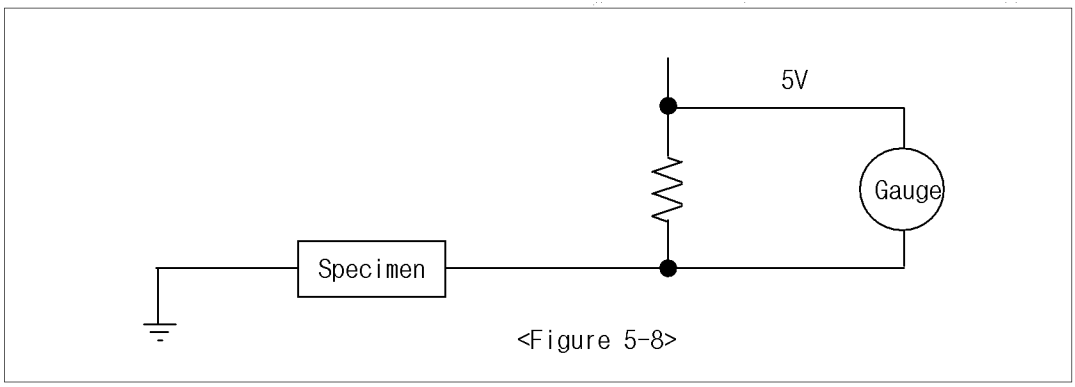
5.17 Instant short circuit

It is instant short circuit, when 4.3V or less voltage continues for 10 ㎲ or more in gauge by applying 100 ㎃, 5V open voltage. Figure 5-8 is an example of measured circuit.

T_MAX : 120 °



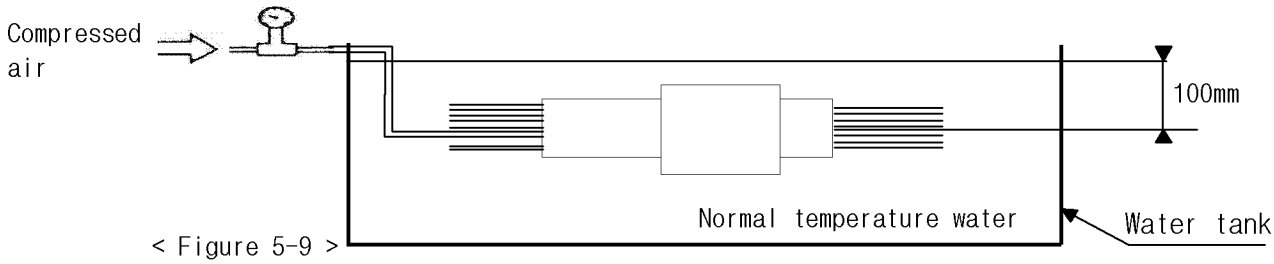
Duration Min	Temperature °C
0	20
60	-40
150	-40
210	20
300	T_{max} °
410	T_{max} °
480	20



<Figure 5-8>

5.18 Sealing test (for waterproof connector)

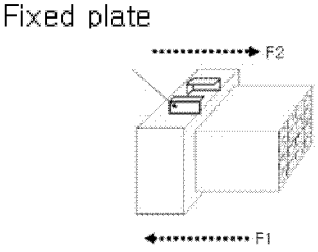
Engage and disengage connector with terminal assembled 10 times with hands, and shake wire 10 times each in the (front, rear, left, right) directions perpendicular to axial direction. And put the combined connector in water as shown in the figure 5-9 and supply 10Kpa(0.1kg/㎠) to connector for 30 seconds. Then increase it by 10Kpa(0.1kg/㎠) until 200Kpa(2kg/㎠) is reached or air bubbles appear in the connector joint or wire seal part. (Use a wire of which the pressure does not leak at the end)



< Figure 5-9 >

5.19 Engage/Disengage force between HSG and CLIP

Measure max force(F1) when Clip is inserted into the plate that can be furnished with clip at 50mm/min totally , and measure max force(F2) when clip is disengaged from the housing at 50mm/min



< figure 5-10>

6. Test Method

6.1 Twisting test

Apply 8kgf force on the end part of combined connector 10 times each in the (front, rear, left, right) directions perpendicular to axial direction.

6.2 Connector engage and disengage endurance test

Make combine connectors engage and disengage at 100mm/min. Perform it 50 times. (Do not use locking device)

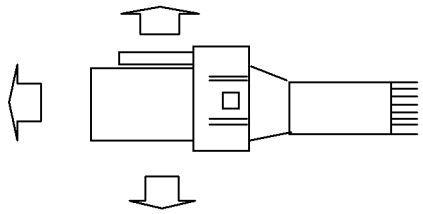
6.3 Overcurrent cycle test

Engage and disengage connector with terminal assembled 10 times with hands, and apply the following current 1000 cycles for the connector with electrodes in series at 60℃ of ambient temperature.

Current application condition A	Applied current	2 times of basic current
	Current application time	1 minute - ON, 9 minutes - OFF
Current application condition B	Applied current	5 times of basic current
	Current application time	10 seconds - ON, 590 seconds - OFF

6.4 Cold temperature test

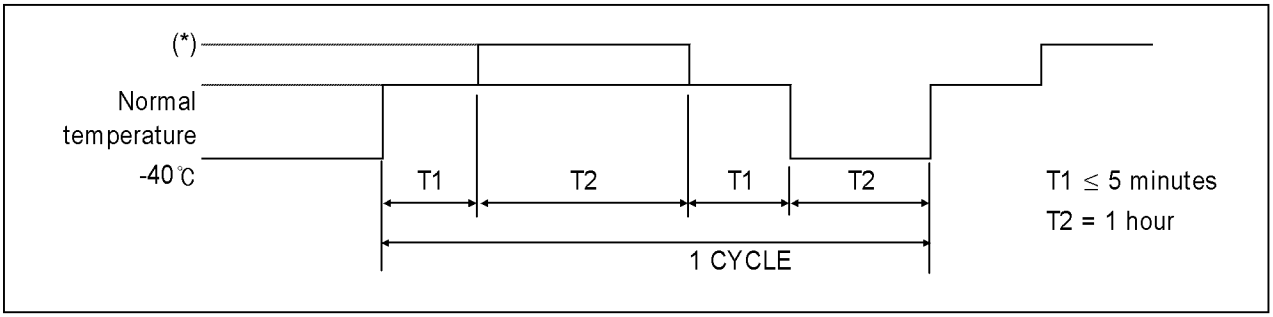
Engage and disengage connector with terminal assembled 10 times with hands, and leave it in temperature chamber of -40℃ for 120 hours. Make connector engaged and disengaged 5 times immediately, and drop it onto the concrete surface from 1m height 3 times in the direction of figure 6-1.



<Figure 6-1>

6.5 Cold and hot temperature shock test

Engage and disengage connector with terminal assembled 10 times with hands, and leave it in combined state at -40℃ for 2 hours, and perform 200 cycles according of the method specified in the figure 6-2. Then leave it at room temperature for 2 hours or more ((*) follows table 6-1.).



< Figure 6-2 : Test pattern >

High temperature (*)	120℃

< Table 6-1 >

6.6 High temperature test

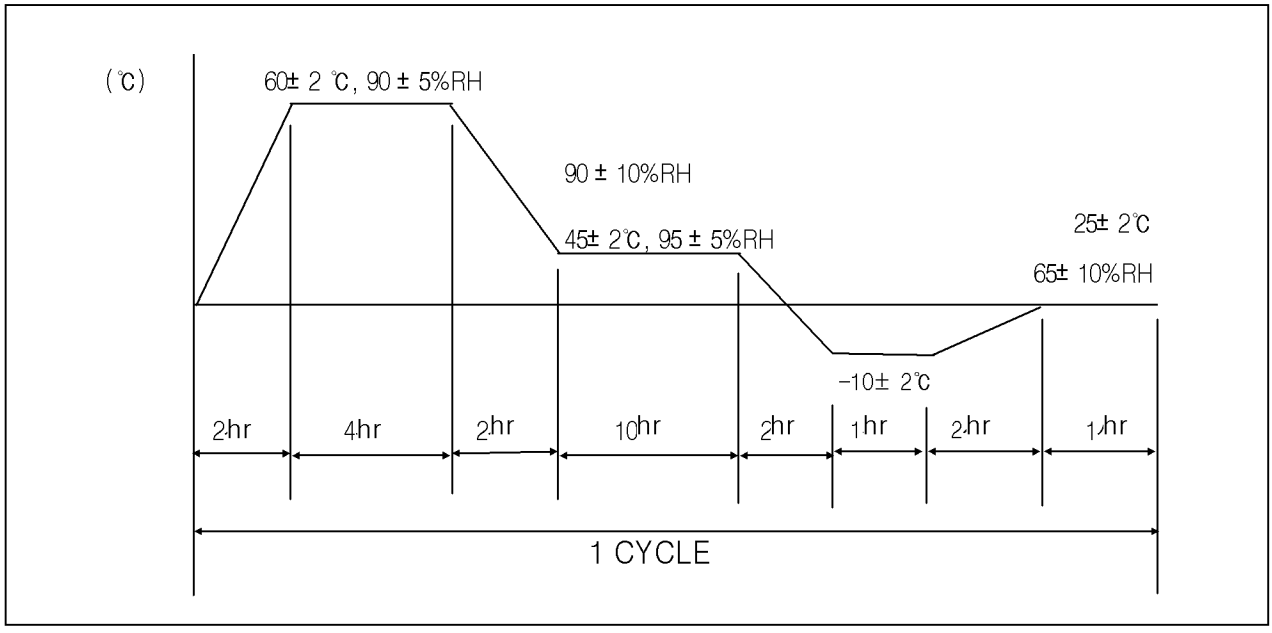
Engage and disengage connector with terminal assembled 10 times with hands, and leave it in combined state at the temperature chamber of the table 6-1 for 300 hours. Then pick it out and leave it until it returns to normal temperature.

6.7 Soldering test (Connector Attached to Unit Directly)

Deposit the soldering part of TM'L post coming out of connector in the solder deposition tank at 250± 5℃ for 5 or less seconds. Deposition depth is up to 1.5mm from connector main body. (Satisfied an appearance quality and apply 95% or more.)

6.8 Temperature Humidity Test

Engage and disengage connector with terminal assembled 10 times with hands, and leave it at 25℃ ambient temperature and 65% relative humidity for 25 hours. And perform 5 cycles of the method specified in figure 6-3. Then pick connector out of chamber and dry it for 2 hours or more.



< Figure 6-3 : Test pattern >

6.9 Dust test

Engage and disengage connector with terminal assembled 10 times with hands, and diffuse 1.5kg Portland cement(JIS R5210) with fan (or others) for 10 seconds per 15 minutes while maintaining 150mm distance from wall in the closed container of 900~1200mm length, width and height, with connector combined. After 1 hour, perform measurements.

6.10 Waterproof test (for waterproof connector)

Make combined connectors engaged and disengaged 10 times by hands, and leave it in combined state at 120℃ ambient temperature for 40 minutes and then spray water of normal temperature for 20 minutes according to S2 of JIS D0203. Repeat 48 cycles of this.

* JIS D0203 S2 condition: Attach specimen at 400mm distance from the waterproof pipe with water spray hole or water discharge hole, and rotate waterproof pipe 23 times per minute around the axis (XX).

6.11 Oil and liquid test

Engage and disengage connector with terminal assembled 10 times with hands, and perform test in the following order with connector combined.

A. Immerge connector in combined state for 2 hours in mixed oil of 50± 2℃ ENG oil (SAE 10W) or equivalent oil and

B. Immerge connector in combined state for1 hour in car gasoline (JIS K2202) at normal temperature, and then pick it out.

C. Immerge connector in combined state for 1 hour in brake liquid (pure product) at normal temperature, and then pick it out.

D. Immerge connector in combined state for 1 hour in 100% washer liquid (pure product) at normal temperature, and then pick it out.

E. Immerge connector in combined state for 1 hour in 50% LLC (Long life coolant) at normal temperature, and then pick it out.

6.12 Ozone test (for waterproof connector)

Engage and disengage connector with terminal assembled 10 times with hands, and expose it in combined state to ozone of 40℃ 50 ± 5 pphm for 100 hours. Then pick connector out of chamber and dry it for 2 hours or more.

6.13 Salt water test

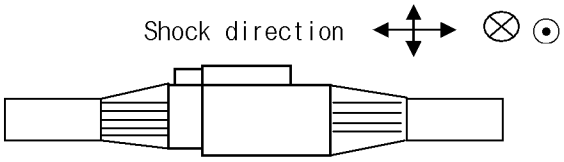
Engage and disengage connector with terminal assembled 10 times with hands, and put it in 35℃ temperature regulation chamber, spray 5% salty water for 24 hours according to JIS Z2371, and, maintain 35℃ without spray for 1 hour. Then repeat this four times. Then pick connector out of chamber and dry it for 2 hours or more.

6.14 Sulfur test

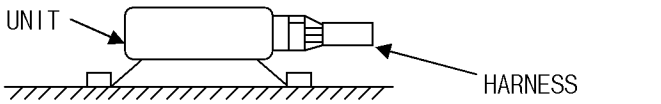
Engage and disengage connector with terminal assembled 10 times with hands, and expose it to SO2 gas of 40±3℃, 10 ppm, 90~95% humidity for 100 hours. Then pick connector out of chamber and dry it for 2 hours or more.

6.15 Mechanical shock test

Engage and disengage connector with terminal assembled 10 times with hands, and apply 1960,3920,5880,9822 ㎨ shock in each direction of figure 6-5 and 6-6 using assembled male and female samples. Perform test in current application condition of DC13V open voltage and 10mA short circuit current.



<Figure 6-5>

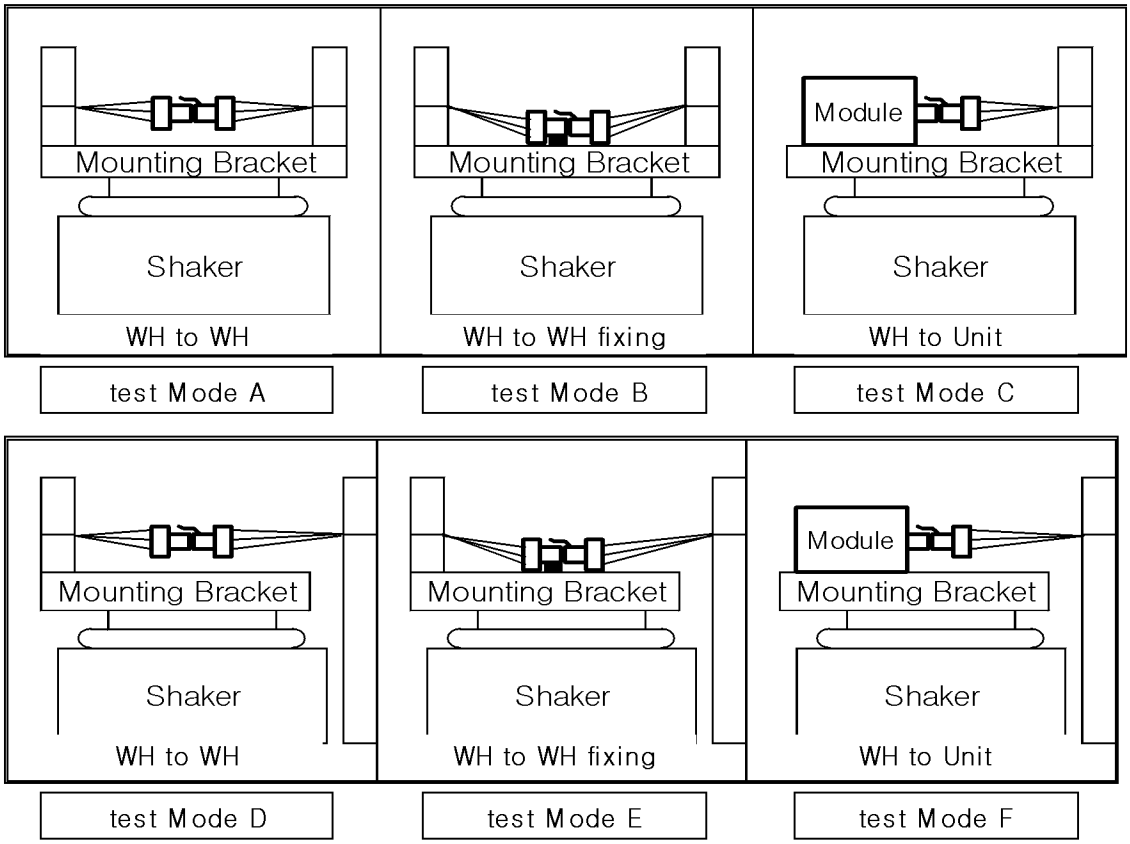


<Figure 6-6>

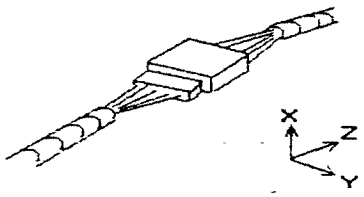
6.16 Complex environment endurance test (Refer to the attached test process #1)

Engage and disengage connector with terminal assembled 10 times with hands, and leave it in combined state in the temperature chamber of 120℃ (follows table 6-1) for 48 hours. And then perform the following vibration test. Then measure instant short circuit according to the method of clause 5.17 for 4 hours for X, Y, Z each.

Follow figure 6-7 for connector attaching method.



<Figure 6-7 Connector attaching method>



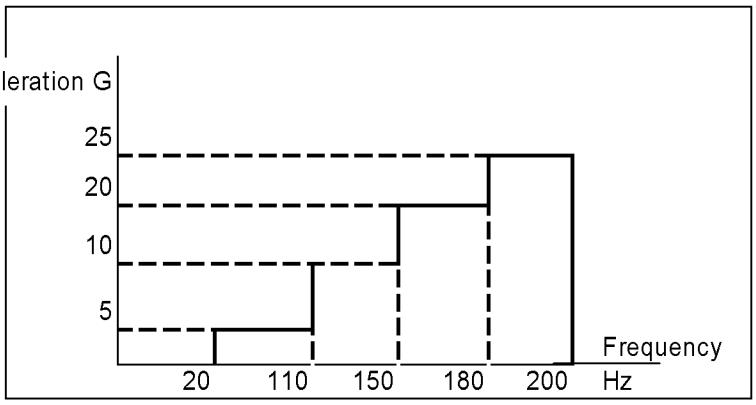
<Figure 6-8 : X, Y, Z vibration direction>

◈ Vibration test

Perform both of sine wave and random wave tests.

1) Sine wave test

Division	Condition
Ambient temperature	120℃
Applied current	Basic current (Connect electrodes in series.)
Current application cycle	120 CYCLE (45 minutes-ON, 15 minutes-OFF)
Vibration acceleration	Follow figure 6-9
Frequency	20 Hz ~ 200 Hz (Sweep time : 3 minutes or less)
Vibration time	40 hours for X, Y, Z each
Connector attaching method	Test Mode B

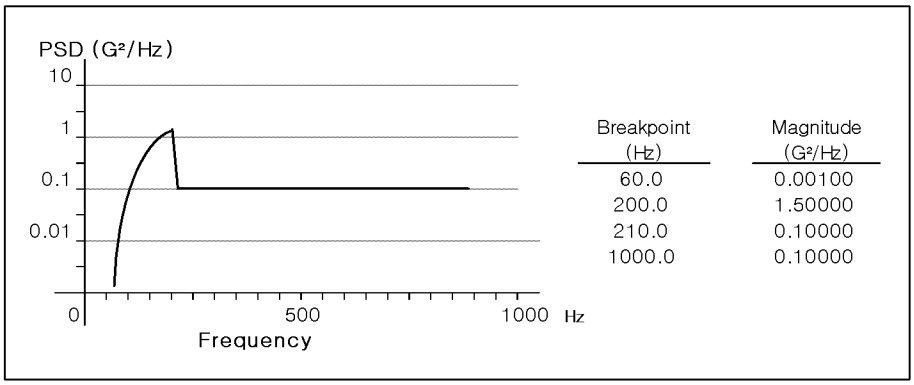


<Figure 6-9 >

2) Random wave test

Perform this test for the component of which sine wave test has been finished.

Division	Condition
Ambient temperature	120℃
Applied current	Basic current (Connect electrodes in series.)
Current application cycle	24 CYCLE (45 minutes-ON, 15 minutes-OFF)
Vibration acceleration	Follow figure 6-10
Vibration time	8 hours for X, Y, Z each
Connector attaching method	Test Mode E



<Figure 6-10>

Test process #1