

025/RF 13P & 19P CONNECTOR

Part Number	Description
2308332-X	025RF 13P CAP ASS'Y
2308328-X	025RF 13P PLUG ASS'Y
2319294-X	025RF 19P CAP ASS'Y
2319297-X	025RF 19P PLUG ASS'Y

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1. Scope

This SPEC defines the test methods of low voltage wire connectors and low voltage wire terminals for vehicles

2. Quality

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

3. Requirements Measuring Method
3.1 General Requirements

NO	Items	Characteristics								Measuring
1	Apperance	No harmful crack, rust, burr, damage, deformation, discoloration etc.								5.1
2	CONN engage and disengage force	7.6kgf or less (CAP type Joint connector : 10kgf or less)								5.2
3	Reverse insertion between housing	It shall not be incorrectly inserted and flowed current between terminal by housing deformation on applying force of 20kgf								5.3
4	Reverse insertion between terminal and housing	030 or more : 5kgf or more, 025 or less : 2.4kgf or more								5.4
5	Engage force between terminal and housing	Terminal Series	General terminal (Less than 375)				375 or more			5.5
		Engage force (kgf)	0.8 or less				Non-waterproof : 1.5 or less Waterproof : 3.0 or less			
6	Connector clip panel engage and retention forces and sealing	Engage force : 12 kgf or less Retention force : 15 kgf or more Sealing : No water leakage								5.6
7	HSG lock strength	10kgf or more				(Test condition 60℃) All kinds of terminals : 5kgf or more				5.7
8	Lock release force	Force on release force point of lock part shall be 0.5~6kgf								5.8
9	Terminal retention force	D/Lock Conn	TML Type	025 or less			Coaxial cable			5.9
			After Assy TPA	6 kgf or more			10kgf or more			
			Before Assy TPA	060 or less			Coaxial cable			
				3.5 kgf or more			6 kgf or more			
10	Terminal engage and Disengage force (kgf)	Terminal type	025	030	040 060	070 090	110 187	250	312 375	5.10
		Engage	0.1~0.5	0.15~0.5	0.2~0.8	0.3~1.0	0.3~1.5	0.5~2.0	0.5~4.0	
		disengage	0.1~0.5	0.1~0.5	0.15~0.8	0.15~1.0	0.15~1.5	0.5~2.1	0.5~4.0	

11	Crimp strength (kgf)	Satisfy ES91100-00			5.11
12	Voltage drop	Division	Initial	After endurance	5.12
		090 ~ 375	3 mV/A or less	10 mV/A or less	
		030 ~ 070	5 mV/A or less		
		025 or less	10 mV/A or less	20 mV/A or less	
13	Insulation resistance	Division	Initial	After endurance	5.13
		Non-waterproof	100 MΩ or more	100 MΩ or more	
		waterproof	100 MΩ or more	100 MΩ or more	
14	Leakage current	Division	Initial	After endurance	5.14
		Non-waterproof	1 μA or less	1 μA or less	
		waterproof	1 μA or less	1 μA or less	
15	High voltage test	There shall be no insulation break.			5.15
16	Temperature rise	Division	After endurance		5.16
		General conn.	40℃ or less		
17	Instant short circuit	There shall be no 10 μs or more instant short circuit for all test section			5.17
18	Engage/disengage force between HSG and Clip and stiffness of clip clamped	Engage force : 6kgf or less Disengage force : 11kgf or more Point of departure and damage of clip : 11kgf or more			5.18
19	Conn coupling sounds	Connector coupling sounds : 65dB(A) or more at 700±10mm			5.19
20	Characteristic Impedance	Coaxial cable HSD connector	Satisfy ES96200-03		5.20
21	Standing wave ratio				5.21
22	Insertion loss				5.22

Requirements Test Items (Test Method)	Appearance	CONN engage and disengage force	Reverse insertion between housing	Reverse insertion between terminal and housing	Engage force between terminal and housing	Connector clip panel engage and retention forces and sealing	HSG lock strength	Lock release force	Terminal retention force	Engage and disengage force of terminal	Crimp strength	Voltage drop	Insulation resistance	Leakage current	High voltage test	Temperature rise	Instant short circuit	Engage/disengage force between HSG and Clip and stiffness of clip clamped	Conn coupling sounds	Characteristic Impedance/ Standing wave ratio/ Insertion loss
Initial test	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Twisting test and Conn engage/Disengage endurance test	<input type="radio"/>											<input type="radio"/>						<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cold temperature test	<input type="radio"/>											<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>		<input type="radio"/>		<input type="radio"/>
Cold and hot temperature shock test	<input type="radio"/>											<input type="radio"/>								<input type="radio"/>
High temperature test	<input type="radio"/>											<input type="radio"/>								<input type="radio"/>
Temperature humidity test	<input type="radio"/>											<input type="radio"/>	<input type="radio"/>	<input type="radio"/>						<input type="radio"/>
Dust test	<input type="radio"/>											<input type="radio"/>								<input type="radio"/>
Ozone test	<input type="radio"/>											<input type="radio"/>								<input type="radio"/>
Sulfur gas test	<input type="radio"/>											<input type="radio"/>								<input type="radio"/>
Complex environment endurance test B	<input type="radio"/>											<input type="radio"/>				<input type="radio"/>	<input type="radio"/>			<input type="radio"/>

< Table 1 : Test items >

4. Test conditions

4.1 Specimen

Unless there is specific mention, initial sample should use for the specimen, and 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 satisfied with each item. If temperature is high ES temperature (120℃), measure in the actual temperature

4.2 Basic current

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

When using a other wire except the table, apply the basic current using interpolation.

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	18 A		
3	22 A	34 A	
5	25 A	46 A	
8		60 A	

< Table 2 >

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 3 >

4.3 Evaluation

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

4.4 Cable size

The SIZE of the WIRE used for each test can be represented by the maximum wire SIZE that can be energized in its connector design.

5. General Requirements

5.1 Appearance

After initial and endurance test, check defects on the exterior surfaces of connector
Visual inspect or use tools such as magnifying glass to check crack, corrosion, burr, damage, Deformations, discoloration that are harmful to functionality of connectors.

5.2 CONN engage and disengage force

Measure force by engaging and disengaging the connector with terminal assembled at constant 50 mm/min speed. However, remove lock part when measuring disengage force.

5.3 Reverse insertion between housing

Insert terminal to housing

Fix housing of female connector to moving part of measuring instrument in reverse insertion direction.
(Reverse insertion: 180 degree rotation on the locking part)

Set a measuring instrument to stop at force of 20kgf and insert that. At this moment, monitor resistance of one terminal matched to identify current carrying between terminals.

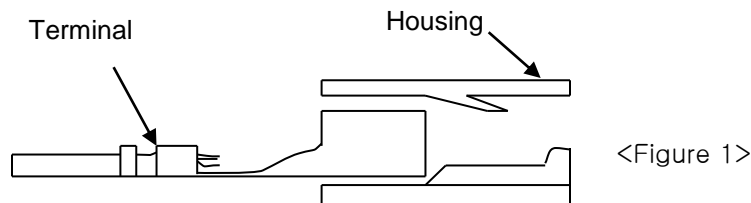
Check the insertion by housing modification of male connector after connector insertion.

5.4 Reverse insertion between terminal and housing

Crimp cable of maximum size on terminal and then, insert it into housing by the end of insulation.

5.5 Engage force between terminal and housing

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



5.6 Connector clip, panel engage and retention force

Panel engage/disengage forces of connector clip

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

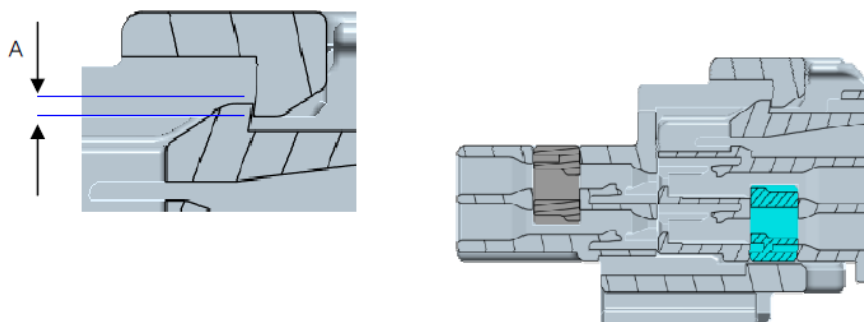
Pull clip at 50mm/min and measure the force when destroyed or disengaged.

5.7 HSG Lock strength

Combine housing only, fix the one side of housing in completely locked condition, and extend the other side in axial direction and 30 angle direction at a constant speed of 100mm/min. Then measure weight when lock structure is disengaged or destroyed.

5.8 Lock release 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.



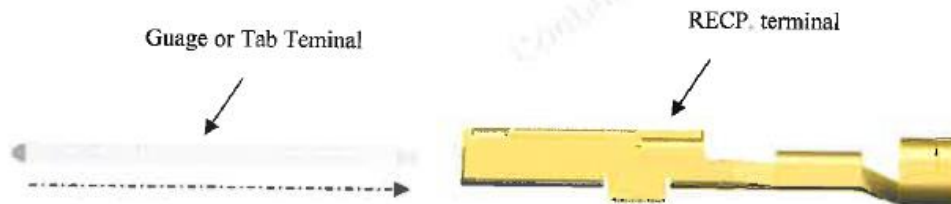
<Figure 2>

5.9 Terminal retention force

Fix the housing after inserting crimped terminals. Extend one line of cable in axial direction at a speed of 50mm/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 3, engage and disengage male terminal or steel gauge into or from female terminal at 50 mm/min speed. Before terminal contacts, single insert state, 10 insert state, attach the terminal contact feature as X ray of CT



<Figure 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 100mm/min speed. Then measure the weight when cable is cut or disengaged from the crimped part.

5.12 Voltage drop

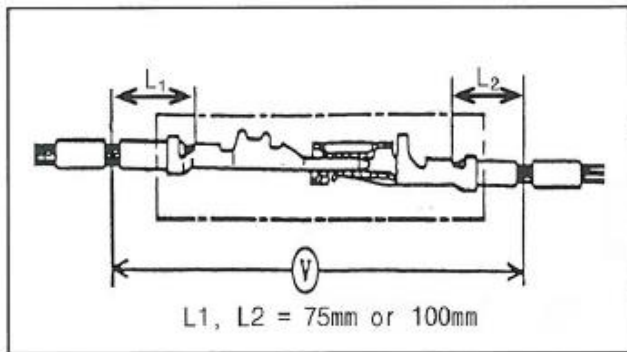
Measure the circuit voltage drop (V) by sending voltage and current described in the table 4 with terminal combined on the connector. Then calculate a voltage drop (VD) in terminal by subtracting cable resistance (L) from the circuit voltage drop (V).

HARNESS vs. HARNESS : $VD = V - (L1 + L2)$

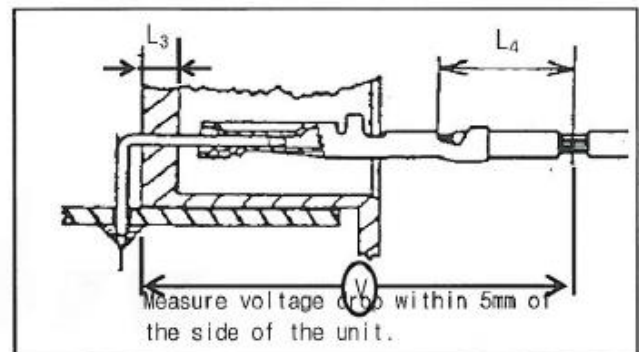
HARNESS vs. UNIT : $VD = V - (L3 + L4)$

Application	Open voltage	Short circuit current	Division
Signal circuit	$20 \pm 5 \text{ mV}$	10 mA	ECU, Sensor
Power circuit	13 V	1 A	Other than the above

< Table 4 >



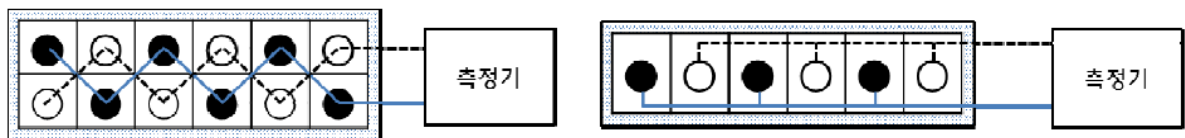
< Fig. 4 : HARNESS vs. HARNESS >



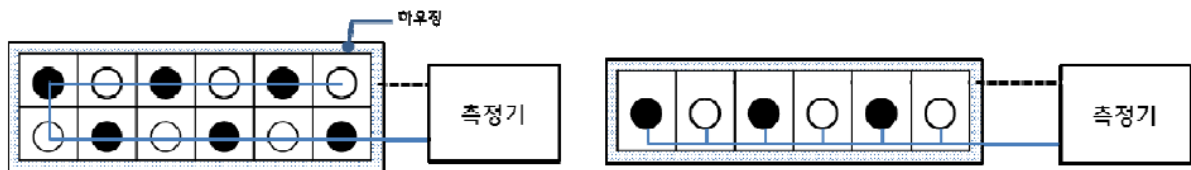
< Fig. 5 : HARNESS vs. UNIT >

5.13 Insulation resistance

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



<Figure 6 : Between neighboring terminals >



< Figure 7 : Between neighboring terminal and housing surface >

5.14 Leakage current

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

5.15 High voltage test

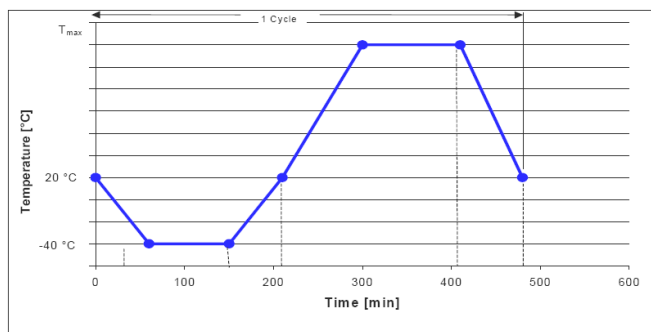
Apply AC 1000V voltage of normal frequency for 1 minute between neighboring terminals and between housing surfaces of terminal, with connector combined.

5.16 Temperature rise

Apply basic current ($I=I_0 \times K$) of clause 4.2 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.

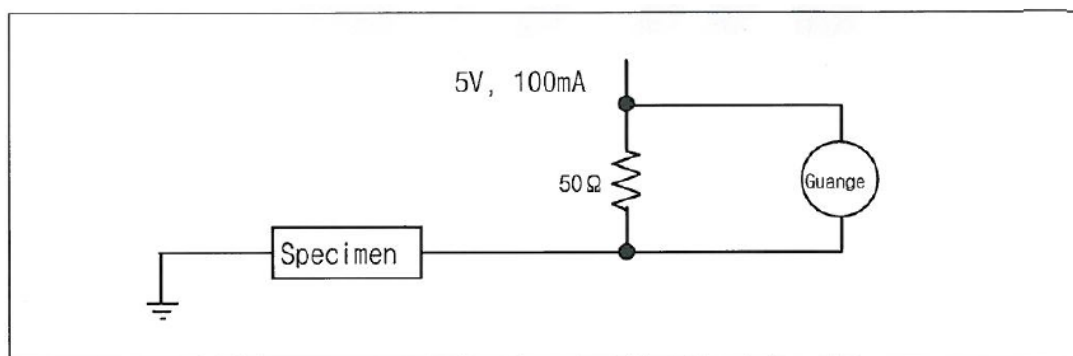
5.17 Instant short circuit

It is instant short circuit, when 3.5V or less voltage continues for 10 μ s or more in gauge by applying 1 mA, 5V open voltage. Figure 8 is an example of measured circuit.



Duration Min	Temperature °C
0	20
60	-40
150	-40
210	20
300	Tmax * (see table 5)
410	Tmax * (see table 5)
480	20

<Table 5>

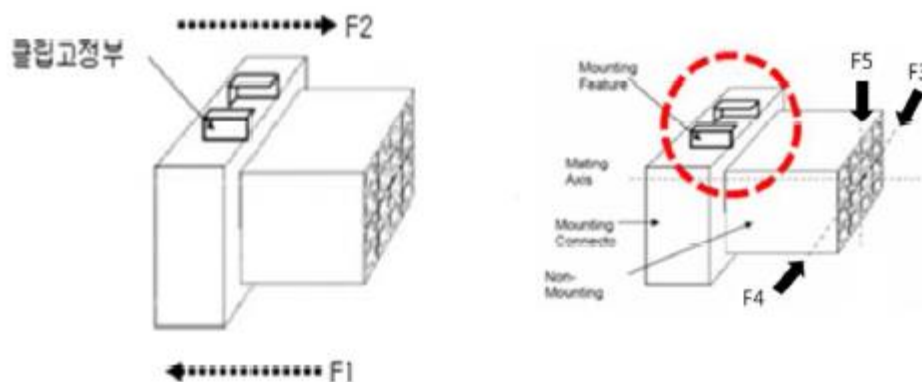


<Figure 8>

5.18 Engage/disengage force between HSG and Clip and stiffness of clip clamped

Engage/disengage force between HSG and Clip

Measure maximum force by engage (F1) and disengaging (F2) the clip at constant 50 mm/min speed



<Figure 9>

Stiffness of clip clamped part

After fixing connector to measuring instrument, apply force to housing up/down, left/right, and front/rear on the standard of connector clip and measure maximum force causing clip separation and breakdown (F1/F2/F3/F4/F5 direction)

Measure force in a point of clip separation and breakdown (Valuation basis : more than 11kgf)

5.19 Connector coupling sound

Put sound measurement equipment on 700 ± 10 mm away from the connector. Measure the peak Sound that occurs when you combine the connector. Sounds unit : dB(A)

5.20 Characteristic Impedance

After durability test, satisfy ES96200-03

5.21 Standing wave ratio

After durability test, satisfy ES96200-03

5.22 Insertion loss

After durability test, satisfy ES96200-03

6. Test Method

6.1 CONN endurance test (Twisting test+ CONN engage/Disengage endurance test)

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

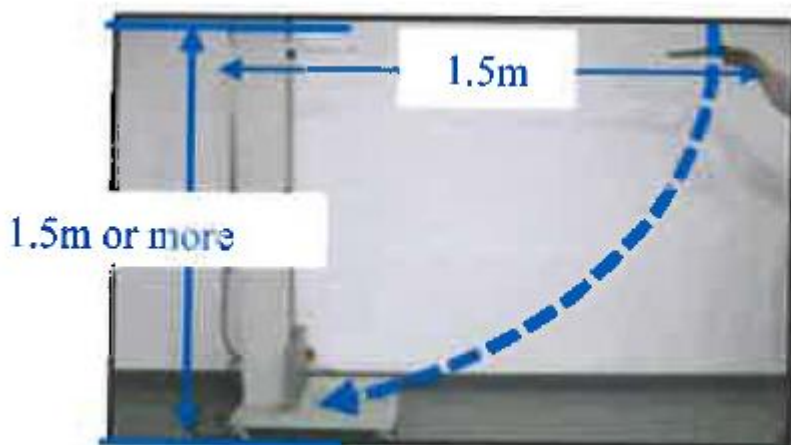
And make combine connectors engage and disengage. Perform it 50 times.

(Do not use locking device)

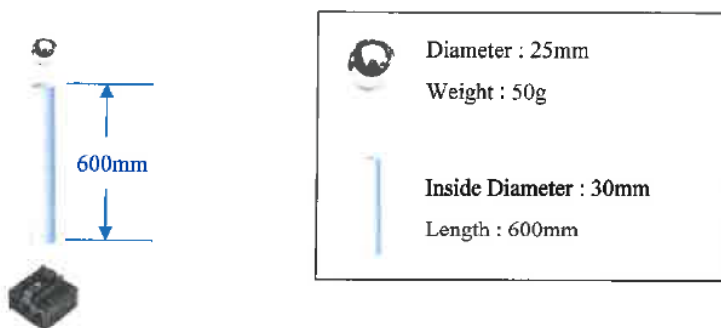
6.2 Cold temperature test

Leave connector with terminal assembled in temperature chamber of -40°C for 120 hours and estimate below items for each sample dividing two groups.

- A. Estimate voltage drop and leakage current assembled connector.
- B. Leave connector for 2 hours and separate connector with male and female, and then drop it onto the concrete surface more than 10T from 1.5m height 3 items. The method of connector drop follows figure 10.



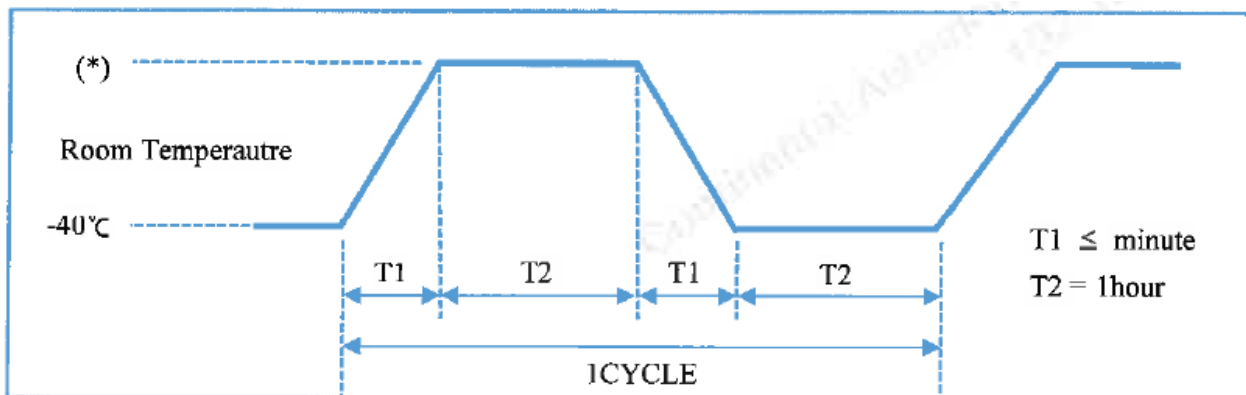
<Figure 10>



<Figure 11>

6.3 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°C for 2 hours, and perform 200 cycles according of the method specified in figure 12 and table 6. Then leave it at room temperature for 2 hours or more ((*) follows table 6.).



<Figure 12>

Division	High temperature (*)	Connector using part
A	120°C	ENG room
B	80°C	except ENG room

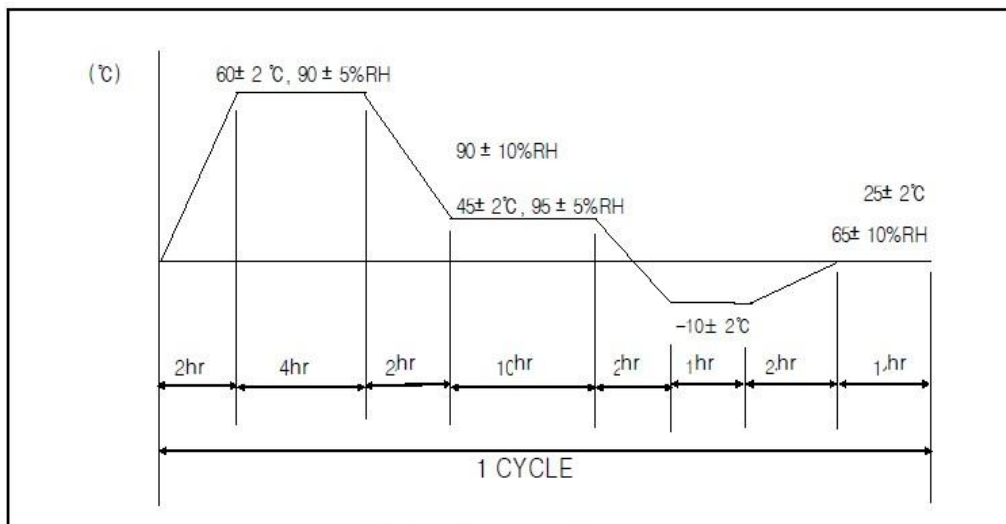
<Table 6>

6.4 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 for 300 hours. Then pick it out and leave it until it returns to normal temperature.

6.5 Temperature and humidity cycle test

Engage and disengage connector with terminal assembled 10 times with hands, and leave it at 25°C ambient temperature and 65% relative humidity for 25 hours. And perform 5cycles of the method specified in figure 13. Then pick connector out of chamber and dry it for 2 hours or more.



<Figure 13>

6.6 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, measure it.

6.7 Ozone test

Engage and disengage Connector with terminal assembled 10 times with hands, and samples keep at 40℃ and 50±5pphm Ozone for 100hour. Then pick connector out of chamber and dry it for 2hours or more.

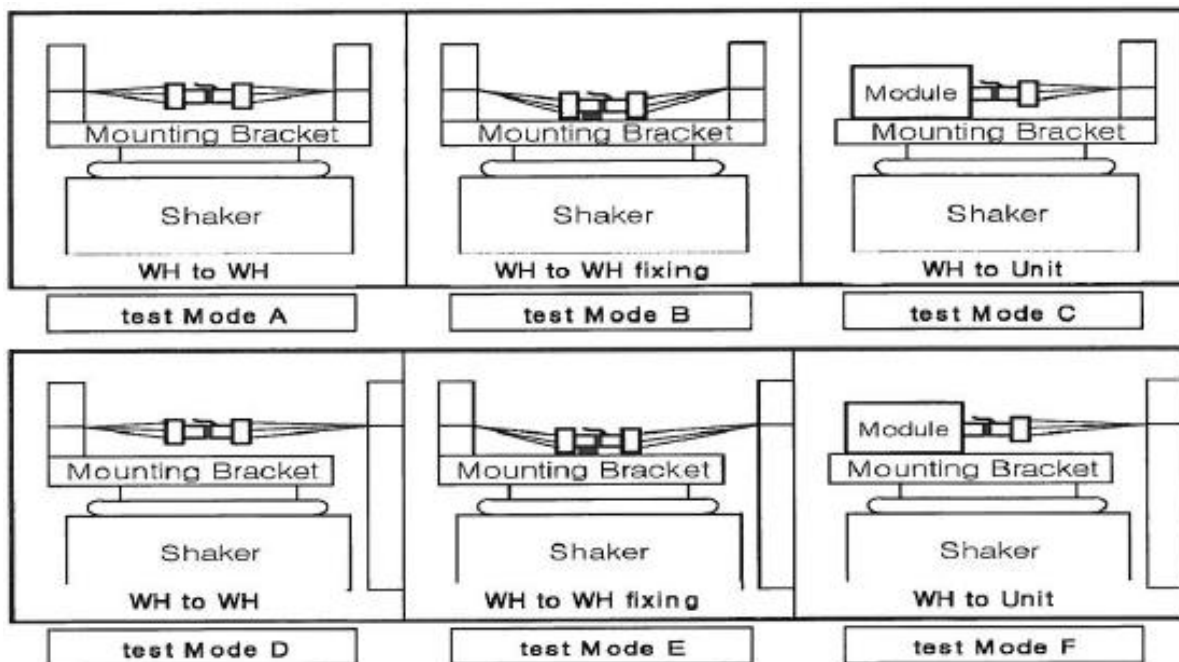
6.8 Sulfur (SO₂) gas test

Engage and disengage connector with terminal assembled 10 times with hands, and expose it in combined state to sulfur gas of 40±3℃,density 10ppm, humidity 90~95%, for 24 hours. Then pick connector out of chamber and dry it for 2 hours or more.

6.9 Complex environment endurance test A (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℃ or 80℃ (follows table 7) for 48 hours. And then perform the following vibration test. Then measure instant short circuit according to the method of clause 4.14 for 4 hours for X, Y, Z each.

Follow figure 14 for connector attaching method.

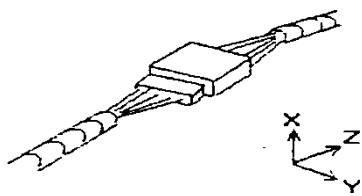


<Figure 14>

◆ Vibration test A (for non-waterproof connector)

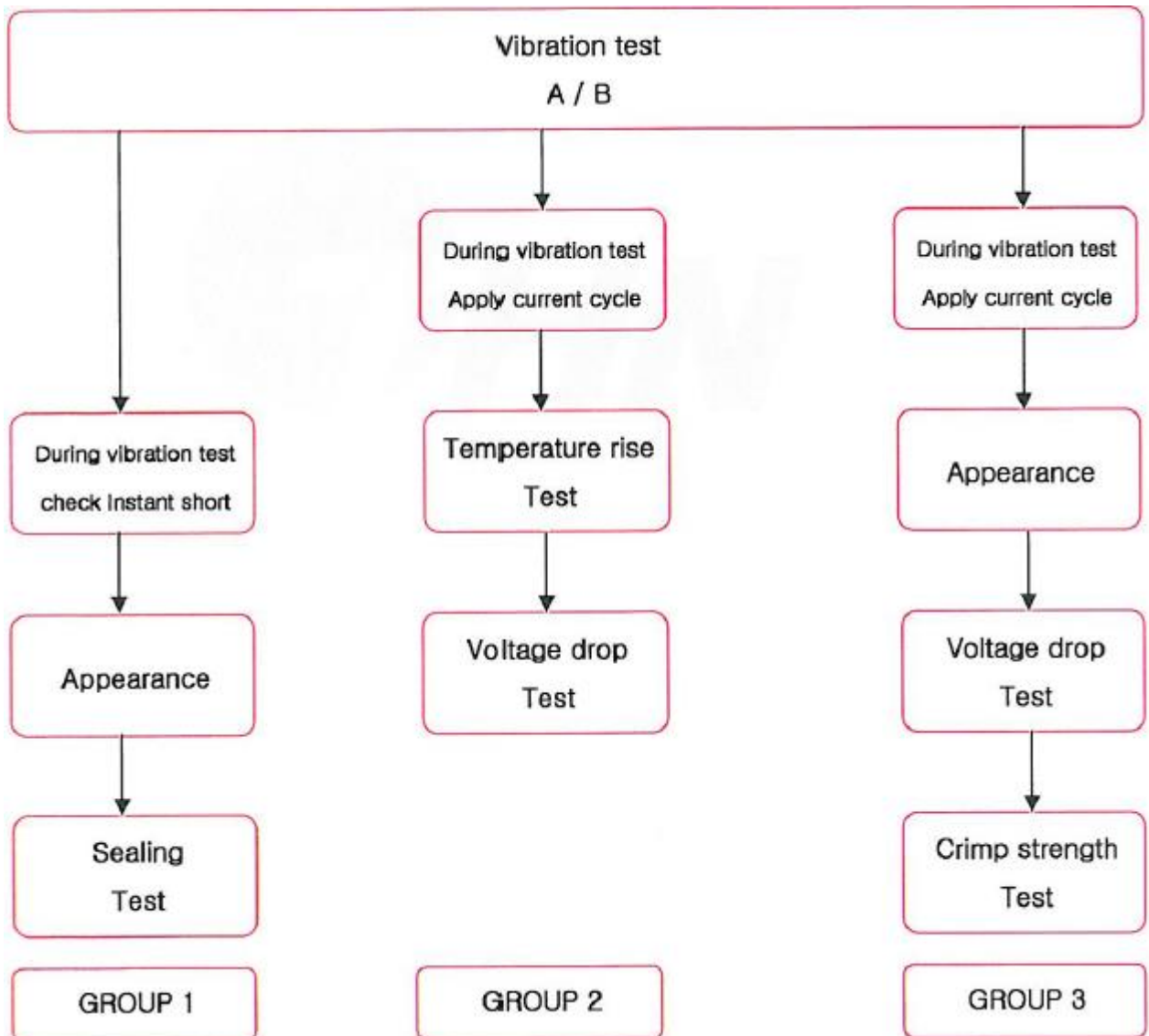
Division	Condition
Ambient temperature/humidity	Refer to figure 8, 90~95%
Applied current	Basic current (Connector electrodes in series.)
Current application cycle	120 CYCLE (45 minutes-ON, 15 minutes-OFF)
Vibration acceleration	4.4g
Frequency	20Hz ~ 200Hz (sweep time: 3 minutes or less)
Vibration time	40 hours for X, Y, Z each
Connector attaching method	Test mode A, B, C

< Table 7 >



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

Test process #1



Rev	Change	Description	Date
A		Initial Released	07.Feb.'17

Prepared by,	Checked By,	Approved by
JH KIM	GC KWON	GC KWON
Product Engineer	Senior Product Engineer	Product Engineering Manager