E-J/E-S MK-2 PLUG/CAP ASSEMBLY

1. SCOPE

1.1. Content

This specification covers the requirements for product performance, test methods and quality assurance provisions of E-J/E-S MK-2 Plug/Cap Assembly

1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 1 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

1.3. Qualification Test Results

Successful qualification testing on the subject product line has not been completed. The Qualification Test Report number will be issued upon successful qualification testing.

2. APPLICABLE DOCUMENTS AND FORMS

The following documents and forms constitute a part of this specification to the extent specified herein. Unless otherwise indicated, the latest edition of the document applies.

2.1. TE Documents

- 85222: Customer Drawing (E-J MK-2(+) 15P CAP DBL)
- 85223: Customer Drawing (E-J MK-2(+) 15P PLUG DBL)
- 368047: Customer Drawing (E-S MK-2(+) 16P PLUG ASSY)
- 368049: Customer Drawing (E-J MK-2(+) 16P PLUG DBL)
- 368050: Customer Drawing (E-S MK-2(+) 16P CAP HSG)
- 368051: Customer Drawing (E-J MK-2(+) 16P CAP DBL)
- 368123: Customer Drawing (E-S MK-2(+) 4P PLUG ASSY)
- 368261: Customer Drawing (E-S MK-2(+) 2P PLUG ASSY)
- 368513: Customer Drawing (E-J MK-2(+) 1P PLUG ASSY)
- 368523: Customer Drawing (E-J/S MK-2(+) 3P PLUG ASSY)
- 368530: Customer Drawing (E-S MK-2(+) 6P PLUG ASSY)
- 368533: Customer Drawing (E-S MK-2(+) 8P PLUG ASSY)
- 368536: Customer Drawing (E-S MK-2(+) 12P PLUG ASSY)
- 368537: Customer Drawing (E-S MK-2(+) 12P CAP HSG)
- 936049: Customer Drawing (COVER HSG FOR E-J 16P PLUG ASSY)
- 936053: Customer Drawing (COVER HSG FOR E-J 3P PLUG ASSY)
- 936418: Customer Drawing (CAP ASSEMBLY FOR BACK WARNING SENSOR 4P)
- 2005489: Customer Drawing (E-J MK-2(+) 3P CAP ASSY)

3. REQUIREMENTS

3.1. Design and Construction

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

3.2. Ratings

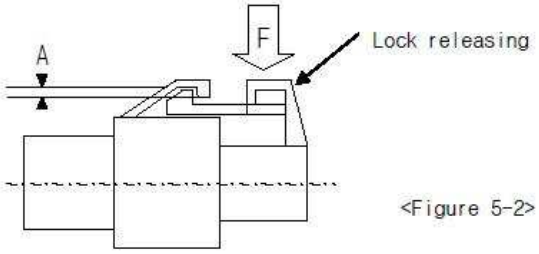
Voltage	Temperature	Humidity
12V DC	25±5℃	60±20%

3.3. Test Requirements and Procedures Summary

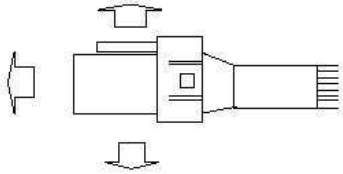
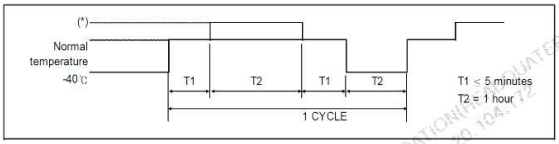
Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

3.3.1 ES91500-00

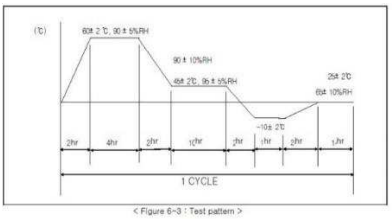
TEST DESCRIPTION	REQUIREMENT	PROCEDURE
Appearance	No crack, damage, distortion are permitted	Using sense of sight and touch.
CONN engage and disengage force	A1 Max 10kgf	Measure force by inserting and disengaging the connector with terminal assembled at constant 100 mm/min speed. However, remove lock part when measuring disengage force.
Reverse insertion between housings	It shall not be incorrectly inserted by applying force of 30kgf.	Insert the housing with terminal by pushing it in reverse direction with applying 30kgf.
Reverse insertion between terminal and housing	It shall not be incorrectly inserted b applying force of 5kgf.	Crimp cable of maximum size on terminal and then insert it into housing by applying force of 5kfg in the reserve direction.
Engage force between terminal and housing	Max 1.5kgf	Measure the weight while inserting terminal into fixed housing at 100mm/min speed.
Panel engage / disengage force of connector clip	Engage: Max 5kgf Disengage: Min 15kgf	Insert clip into the fixed plate that can be furnished with clip at 100mm/min and measure the force at that time. Pull clip 100mm/min and measure the force when destroyed or disengaged.
Strength of HSG lock	Min 10kgf	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 100mm/min. Then measure weight when lock structure is disengaged or destroyed.

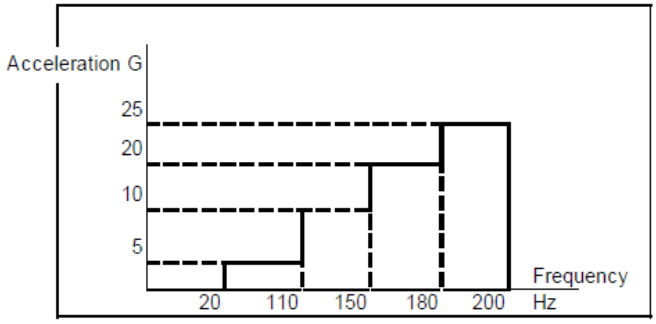
<table>
<tr><td>HSG lock releasing force</td><td>Max 6kgf</td><td>Apply force (F) to lock releasing part, and measure weight on the point of A=0. However, cut connector and then perform test at the section in order to secure visibility.
 

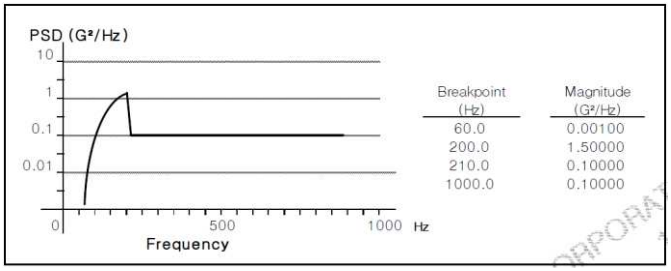
<Figure 5-2></td></tr>
<tr><td>Terminal retention force</td><td>Min 6kgf</td><td>Fix the housing after inserting crimped terminals. Extend one line of cable in axial direction at a speed of 100mm/min at a position 50~100mm away from crimped part, and measure weight when terminal is disengaged from the housing.</td></tr>
<tr><td>Engage and disengage force of terminal</td><td>Engage: 0.3~1kgf
Disengage: 0.15~1kgf</td><td>Engage and disengage male terminal or steel gauge into or from female terminal at 100mm/min speed</td></tr>
<tr><td>Crimp strength</td><td>0.85SQ: Min 13kgf
0.5SQ: Min 9kgf</td><td>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 disengage from the crimped part.</td></tr>
<tr><td>Voltage Drop</td><td>090~375series: Max 3mV/A
030~070series: Max 5mV/A</td><td>Measure the circuit voltage drop (V) by sending voltage and current described in the table -1 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).
<table>
<tr><th>Application</th><th>Open voltage</th><th>Short circuit current</th><th>Division</th></tr>
<tr><td>Signal circuit</td><td>20 ± 5 mV</td><td>10 mA</td><td>ECU, Sensor</td></tr>
<tr><td>Power circuit</td><td>13 V</td><td>1 A</td><td>Other than the above</td></tr>
</table>
<Table5-1></td></tr>
<tr><td>Insulation resistance</td><td colspan="2">Min 250 MΩ</td><td>Measure resistance between neighbor terminals and between terminal and housing surface with DC 500V insulation resistance gauge with connector combined.</td></tr>
<tr><td>Leakage current</td><td colspan="2">Max 1㎂</td><td>Measure it by applying DC 13V between neighboring terminals.</td></tr>
<tr><td>High voltage test</td><td colspan="2">There shall be no insulation break</td><td>Apply AC 1000V voltage of normal frequency 1 minute between neighboring terminals, and between housing surfaces of terminal, with connector combined.</td></tr>
<tr><td>Temperature rise</td><td colspan="2">General Connector Max 30℃</td><td>Apply basic current 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.</td></tr>
<tr><td>Sealing test (for waterproof connector)</td><td colspan="2">Min 1.0kg/cm²</td><td>Put the combined connector in water and supply 10Kpa (0.1kg/cm²) to connector for 30 seconds. Then increase it by 10Kpa (0.1kg/cm²) until 200Kpa (2kg/cm²) is reached or until air bubbles rise on the connector & wire seal.</td></tr>
<tr><td rowspan="2">Twisting test</td><td>Appearance</td><td>No crack, damage, distortion are permitted</td><td rowspan="2">Apply 8kgf force on the end part of combined connector 10 times each in the (front, rear, left, right) directions perpendicular to axial direction.</td></tr>
<tr><td>Voltage Drop</td><td>Max 10mV/A</td></tr>
</table>

<table>
<tr><td rowspan="2">Connector engage and disengage endurance test</td><td>Appearance</td><td colspan="2">No crack, damage, distortion are permitted</td><td rowspan="2">Make combine connectors engage and disengage at 100mm/min. Perform it 50 times. (Do not use locking device)</td></tr>
<tr><td>Voltage Drop</td><td colspan="2">Max 10mV/A</td></tr>
<tr><td rowspan="5">Overcurrent cycle test</td><td>Appearance</td><td colspan="2">No crack, damage, distortion are permitted</td><td rowspan="5">Apply to following current 1000 cycles for the connector with electrodes in series at 60℃ of ambient temperature.
<table><tr><td rowspan="2">Current application condition A</td><td>Applied current</td><td>2 times of basic current</td></tr><tr><td>Current application time</td><td>1 minute - ON, 9 minutes - OFF</td></tr><tr><td rowspan="2">Current application condition B</td><td>Applied current</td><td>5 times of basic current</td></tr><tr><td>Current application time</td><td>10 seconds - ON, 590 seconds - OFF</td></tr></table></td></tr>
<tr><td rowspan="2">Voltage Drop</td><td rowspan="2">Max 10mV/A</td><td>Condition A</td></tr>
<tr><td>Condition B</td></tr>
<tr><td rowspan="2">Temperature Rise</td><td rowspan="2">Max 40 ℃</td><td>Condition A</td></tr>
<tr><td>Condition B</td></tr>
<tr><td rowspan="2">Cold temperature test</td><td>Appearance</td><td colspan="2">No crack, damage, distortion are permitted</td><td rowspan="2">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. (Voltage drop & Temperature rise test perform at normal temperature) :
 
<Figure 6-1></td></tr>
<tr><td>Sealing</td><td colspan="2">Min 0.5kg/cm²</td></tr>
<tr><td rowspan="3">Cold and hot temperature shock test</td><td>Appearance</td><td colspan="2">No crack, damage, distortion are permitted</td><td rowspan="3">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 >
<table><tr><th>Division</th><th>High temperature (*)</th><th>Connector using part</th></tr><tr><td>A</td><td>120℃</td><td>waterproof connector</td></tr><tr><td>B</td><td>80℃</td><td>Non- waterproof connector</td></tr></table>
< Table 6- 1 ></td></tr>
<tr><td>Voltage Drop</td><td colspan="2">Max 10mV/A</td></tr>
<tr><td>Sealing</td><td colspan="2">Min 0.5kg/cm²</td></tr>
<tr><td rowspan="2">High temperature test</td><td>Appearance</td><td colspan="2">No crack, damage, distortion are permitted</td><td rowspan="2">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.
<table><tr><th>Division</th><th>High temperature (*)</th><th>Connector using part</th></tr><tr><td>A</td><td>120℃</td><td>waterproof connector</td></tr><tr><td>B</td><td>80℃</td><td>Non- waterproof connector</td></tr></table>
< Table 6- 1 ></td></tr>
<tr><td>Voltage Drop</td><td colspan="2">Max 10mV/A</td></tr>
<tr><td>Temperature humidity test</td><td>Appearance</td><td colspan="2">No crack, damage, distortion are permitted</td><td>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</td></tr>
</table>

	Voltage Drop	Max 10mV/A	hours or more.  < Figure 6-3 : Test pattern >
	Current Leakage	Waterproof connector Max 100 ㎂	
Dust test	Voltage Drop	Max 10mV/A	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, Engage and disengage connector with terminal assembled 3 times with hands. And measure it.
	Sealing	Min 0.5kg/cm²	
Waterproof test	Appearance	No crack, damage, distortion are permitted	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.
	Current Leakage	Waterproof connector Max 100 ㎂	
	Sealing	Min 0.5kg/cm²	
Oil and liquid test	Appearance	No crack, damage, distortion are permitted	Perform test each sample with connector combined. A. Immerge connector in combined state for 2 hours in mixed oil of 50± 2℃ ENG oil (SAE10W) 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.
	Voltage Drop	Max 10mV/A	
	Sealing	Min 0.5kg/cm²	
Ozone test	Appearance	No crack, damage, distortion are permitted	Expose it in combined state to ozone of 40℃ 50±5pphm for 100 hours.
	Voltage Drop	Max 10mV/A	
	Sealing	Min 0.5kgf/cm²	
Salt water test	Appearance	No crack, damage, distortion are permitted	Put it in 35℃ temperature regulation chamber, spray 5% salty water for 24 hours according to JIS Z2371, and maintain room temperature without spray for 1 hours. Then repeat this four times.
	Voltage Drop	Max 10mV/A	
Sulfur (SO2) gas test	Appearance	No crack, damage, distortion are permitted	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.
	Voltage Drop	Max 10mV/A	
Mechanical shock test	Instant short circuit	Max 10 ㎲	Apply 1960, 3920, 5880, 9822m/s² shock in each direction assembled male and female samples. Perform test in current application condition of DC13V open voltage and 10mA short circuit current.

<table>
<tr>
<td rowspan="5">Complex environment endurance test</td>
<td>Appearance</td>
<td>No crack, damage, distortion are permitted</td>
<td rowspan="5">Engage and disengage connector with terminal assembled 10 times with hands, and leave it in combined state in the temperature chamber of 120℃ for 48 hours.
(Just, Perform the random test at room temperature with the sample that completed the sign test.)
<table>
<tr><td rowspan="8">Condition A</td><td>Ambient temperature/humidity</td><td>80℃, 90~95%</td></tr>
<tr><td>Applied current</td><td>Basic current</td></tr>
<tr><td>Current application cycle</td><td>120 CYCLE (45 minutes-ON, 15 minutes-OFF)</td></tr>
<tr><td>Vibration acceleration</td><td>4.4G</td></tr>
<tr><td>Frequency</td><td>20Hz ~ 200Hz (sweep time: 3 minutes or less)</td></tr>
<tr><td>Vibration time</td><td>40 hours for X, Y, Z each</td></tr>
<tr><td>Connector attaching method</td><td>Test mode A, B, C</td></tr>
<tr><td rowspan="5">Condition B</td><td>Ambient temperature/humidity</td><td>80℃, 90~95%</td></tr>
<tr><td>Applied current</td><td>Continuous 5V, 1mA</td></tr>
<tr><td>Vibration acceleration</td><td>4.4G</td></tr>
<tr><td>Frequency</td><td>20Hz ~ 200Hz (sweep time: 3 minutes or less)</td></tr>
<tr><td>Vibration time</td><td>40 hours for X, Y, Z each</td></tr>
<tr><td rowspan="12">Condition C</td><td>Division</td><td>Sine wave test</td></tr>
<tr><td>Ambient temperature/humidity</td><td>120℃</td></tr>
<tr><td>Applied current</td><td>Continuous 5V, 1mA</td></tr>
<tr><td>Frequency</td><td>20Hz ~ 200Hz (sweep time: 3 minutes or less)</td></tr>
<tr><td>Vibration time</td><td>40 hours for X, Y, Z each</td></tr>
<tr><td>Connector attaching method</td><td>Test mode A, B, C</td></tr>
<tr><td>Division</td><td>Random wave test</td></tr>
<tr><td>Ambient temperature/humidity</td><td>normal temperature</td></tr>
<tr><td>Applied current</td><td>Continuous 5V, 1mA</td></tr>
<tr><td>Vibration time</td><td>8 hours for X, Y, Z each</td></tr>
<tr><td>Connector attaching method</td><td>Test mode D, E, F</td></tr>
</table>




</td>
</tr>
<tr>
<td>Crimp Tensile Strength</td>
<td>0.5SQ: Min 9kgf
0.85SQ: Min 13kgf</td>
</tr>
<tr>
<td>Voltage Drop</td>
<td>Max 10mV/A</td>
</tr>
<tr>
<td>Temperature Rise</td>
<td>General Connector Max 40℃</td>
</tr>
<tr>
<td>Instant Short Circuit</td>
<td>Max 10㎲</td>
</tr>
</table>

3.4 Applied Part No List

TE Part no	Description
85222-1	E-J MK-2(+) 15P CAP DBL
85223-1	E-J MK-2(+) 15P PLUG DBL
368047-1 1-368047-1/3	E-S MK-2(+) 16P PLUG ASSY
368049-1	E-J MK-2(+) 16P PLUG DBL
368050-1/3 2-368050-1/3	E-S/J MK-2(+) 16P CAP HSG
368051-1	E-J MK-2(+) 16P CAP DBL
368123-5	E-S MK-2(+) 4P PLUG ASSY
368261-2/3	E-S MK-2(+) PLUG 2P ASSY
368513-2	E-J MK-2(+) 1P PLUG ASSY
368523-1/3	E-S MK-2(+) 3P PLUG ASS'Y
368530-1	E-S MK-2(+) 6P PLUG ASS'Y
368533-1	E-S MK-2(+) 8P PLUG ASS'Y
368536-1	E-S MK-2(+) 12P PLUG ASS'Y
368537-1	E-S MK-2(+) 12P CAP HSG
1-936049-1	COVER HSG FOR E-J PLUG 16P
1-936053-1	COVER HSG FOR E-J PLUG 3P
936418-2	CAP ASSEMBLY FOR BACK WARNING SENSOR 4P
2005489-3	E-J MK-2(+) 3P CAP ASSY