MQS PLUG/HEADER ASSEMBLY

1. SCOPE

1.1. Content

This specification covers the requirements for product performance, test methods and quality assurance provisions of MQS Plug/Header 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

- 1743282: Customer Drawing (MQS 8P PLUG HSG)
- 1743283: Customer Drawing (MQS 8P PLUG DBL)
- 1743284: Customer Drawing (MQS 8P HEADER ASSEMBLY H-TYPE)
- 1743386: Customer Drawing (MQS 8P HEADER ASSEMBLY V-TYPE)
- 936289: Customer Drawing (MQS 6P PLUG HSG)
- 936640: Customer Drawing (MQS 6P HEADER ASSEMBLY V-TYPE)
- 936119: Customer Drawing (MQS 4P PLUG ASSEMBLY)
- 1743218: Customer Drawing (MQS 4P HEADER ASSEMBLY)
- 1743164: Customer Drawing (MQS 3P PLUG HSG)

3. REQUIREMENTS

3.1. Design and Construction

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

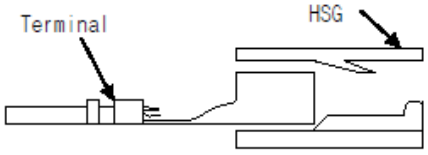
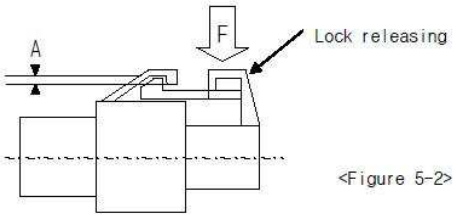
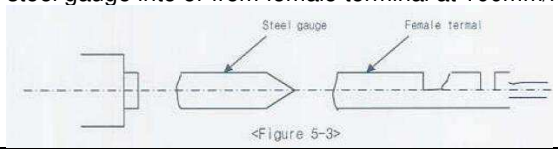
3.2. Ratings

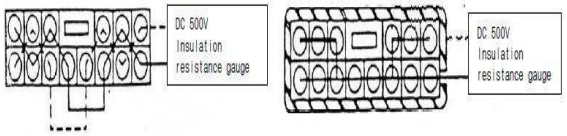
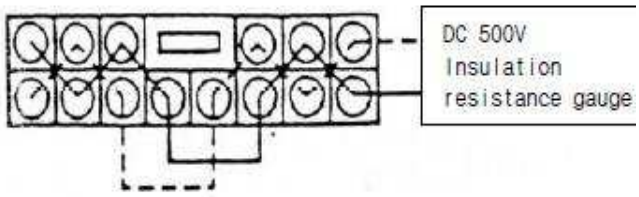
Voltage	Temperature	Humidity
12V DC	25±5℃	60±20%

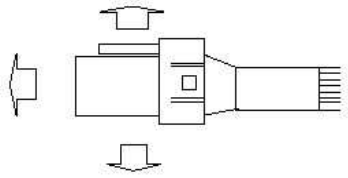
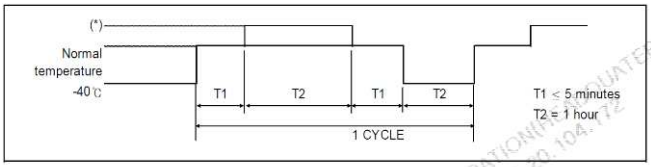
3.3. Test Requirements and Procedures Summary

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

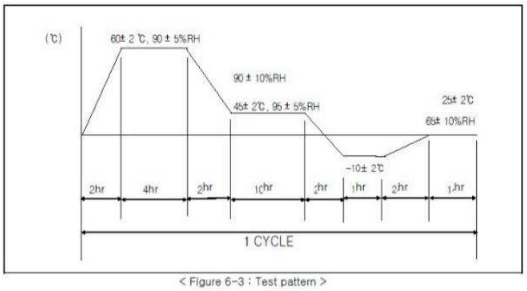
3.3.1 ES91500-00 (MQS 8P / 4P /3P)

TEST DESCRIPTION	REQUIREMENT	PROCEDURE
Appearance	No crack, damage, distortion are permitted	Using sense of sight and touch.
CONN engage and disengage force	Max 10kgf	Measure force by inserting and disengaging the connector with terminal assembled at constant 50 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 20kgf.	Insert the housing with terminal by pushing it in reverse direction with applying 20kgf.
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	As shown in the following figure 5-1, measure the weight while inserting terminal into fixed housing at 50mm/min speed.  < Figure 5-1>
Contact to HSG Inverse Force	Min 1.5kgf	Crimp cable of maximum size on terminal and then insert it into housing by end of insulation barrel in the reserve direction.
Strength of HSG lock	Min 8kgf	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.
HSG lock releasing force	Max 6kgf	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>
Terminal retention force	1) Min 6kgf 2) Min 5kgf (Only MQS 4P)	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.
Engage and disengage force of terminal	Engage: 0.1~0.5kgf Disengage: 0.1~0.5kgf	As shown in figure 5-3, engage and disengage male terminal or steel gauge into or from female terminal at 100mm/min speed  <Figure 5-3>

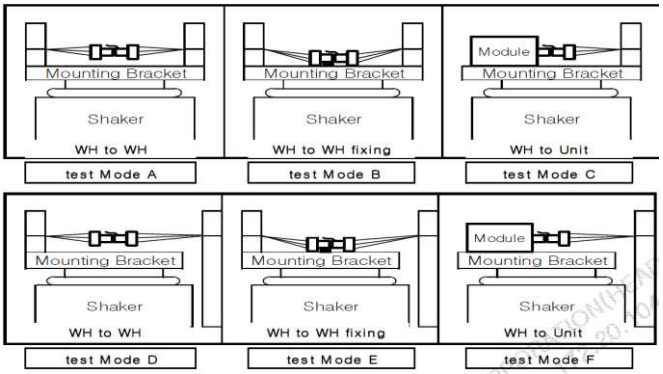
<table>
<tr><td>Crimp strength</td><td>0.5SQ: Min 9kgf</td><td>Fix the crimped terminal and draw the cable at a position 50~100mm away from crimped part in axial direction at 100mm/min speed. Then measure the weight when cable is cut or disengage from the crimped part.</td></tr>
<tr><td>Voltage Drop</td><td>Max 10mV/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).
1) HARNESS versus UNIT: VD = V – (L3+L4)
<table><tr><td>Application</td><td>Open voltage</td><td>Short circuit current</td><td>Division</td></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>Min 100 MΩ</td><td>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></td></tr>
<tr><td>Leakage current</td><td>10 μA or less</td><td>Measure it by applying DC 13V between neighboring terminals (figure 5-6).
 
<Figure 5-6: Between neighboring terminals></td></tr>
<tr><td>High voltage test</td><td>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>General Connector Max 30℃</td><td>Apply basic current (I=I0*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.</td></tr>
<tr><td rowspan="2">Twisting Test
Connector Engage and Disengage Endurance 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.
Make combine connectors engage and disengage at 100mm/min. Perform it 50 times.
(Do not use locking device)</td></tr>
<tr><td colspan="2">1) Max 10mV/A
2) Max 20mV/A (Only MQS 4P)</td></tr>
</table>

<table>
<tr><td rowspan="4">Overcurrent cycle test</td><td>Appearance</td><td colspan="2">No crack, damage, distortion are permitted</td><td rowspan="4">Engage and disengage connector with terminal assembled 10 times with hands, and 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">1) Max 10mV/A
2) Max 20mV/A (Only MQS 4P)</td><td>Condition A(8.8A)</td></tr>
<tr><td>Condition B(22A)</td></tr>
<tr><td rowspan="2">Temperature Rise</td><td rowspan="2">Max 40 ℃</td><td>Condition A(8.8A)</td></tr>
<tr><td>Condition B(22A)</td></tr>
<tr><td rowspan="3">Cold temperature test</td><td>Appearance</td><td colspan="2">No crack, damage, distortion are permitted</td><td rowspan="3">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. (Voltage drop & Temperature rise test perform at normal temperature) :
 
<Figure 6-1></td></tr>
<tr><td>Insulation Resistance</td><td colspan="2">Non-waterproof connector
Min 10 kΩ</td></tr>
<tr><td>Current Leakage</td><td colspan="2">Non-waterproof connector
Max 1 mA</td></tr>
<tr><td rowspan="2">Cold and hot temperature shock test</td><td>Appearance</td><td colspan="2">No crack, damage, distortion are permitted</td><td rowspan="2">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 >
<table><tr><td>Division</td><td>High temperature (*)</td><td>Connector using part</td></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">1) Max 10mV/A
2) Max 20mV/A (Only MQS 4P)</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">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.
<table><tr><td>High temperature(*)</td><td>Connector using part</td></tr><tr><td>80℃</td><td>Non-waterproof connector</td></tr></table></td></tr>
<tr><td>Voltage Drop</td><td colspan="2">1) Max 10mV/A
2) Max 20mV/A (Only MQS 4P)</td></tr>
<tr><td>Soldering test</td><td>Appearance</td><td colspan="2">Satisfied an appearance quality and apply 95% or more</td><td>Deposit the soldering part of TM'L post coming out of connector in the solder deposition tank at 250±5 ℃ or less seconds. Deposition depth is up to 1.5mm from connector main body</td></tr>
</table>

Temperature Humidity Test	Appearance	No crack, damage, distortion are permitted	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 >
	Voltage Drop	1) Max 10mV/A 2) Max 20mV/A (Only MQS 4P)	
	Insulation Resistance	Non-waterproof connector Min 10 kΩ	
	Current Leakage	Non-waterproof connector Max 1 mA	
Dust Test	Voltage Drop	1) Max 10mV/A 2) Max 20mV/A (Only MQS 4P)	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.
Oil and liquid test	Appearance	No crack, damage, distortion are permitted	Engage and disengage connector with terminal assembled 10 times with hands, and 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	1) Max 10mV/A 2) Max 20mV/A (Only MQS 4P)	
Ozone Test (Only MQS 4P)	Appearance	No crack, damage, distortion are permitted	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.
	Voltage Drop	Max 20mV/A	
	Sealing	Min 0.5kgf/cm^2	
Sulfur (SO2) gas test	Appearance	No crack, damage, distortion are permitted	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.
	Voltage Drop	1) Max 10mV/A 2) Max 20mV/A (Only MQS 4P)	

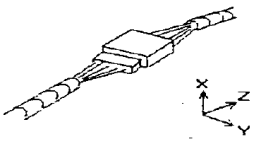
Complex environment endurance test	Appearance	No crack, damage, distortion are permitted	Engage and disengage connector with terminal assembled 10 times with hands, and leave it in combined state in the temperature chamber of 80℃ for 48 hours. And then perform the following vibration test. Then measure instant short circuit according to the method of below for 4 hours for X, Y, Z each. Follow figure 6-7 for connector attaching method.
	Crimp Tensile Strength	0.5SQ: Min 9kgf	
	Voltage Drop	1) Max 10mV/A 2) Max 20mV/A (Only MQS 4P)	
	Temperature Rise	General Connector Max 40℃ (4.4A)	
	Instant short circuit	Max 10㎲	



<Figure 6- 7 Connector attaching method>

■ Vibration test A (for non-waterproof connector)

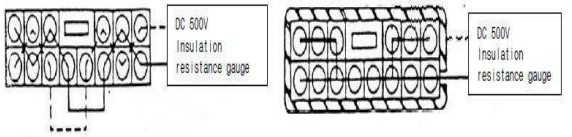
Division	Condition
Ambient temperature/humidity	80℃, 90~95%
Applied current	Basic current (Connector electrodes in series.)
Current application cycle	120 CYCLE (45 minutes-ON, 15 minutes-OFF)
Vibration acceleration	4.4g
Frequency	20Hz ~ 200Hz (sweep time: 3 minutes or less)
Vibration time	40 hours for X, Y, Z each
Connector attaching method	Test mode A, B, C

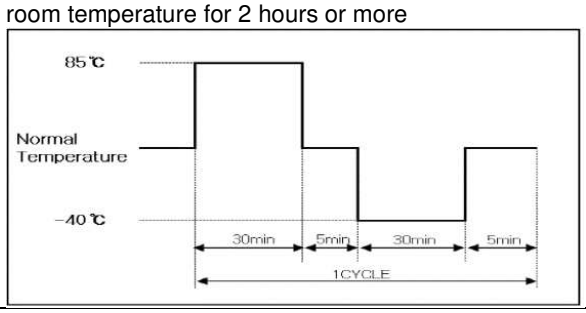


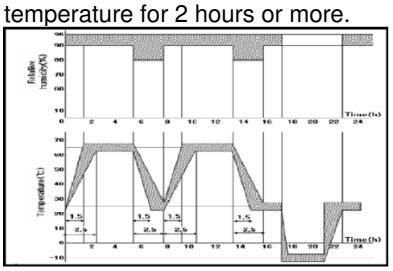
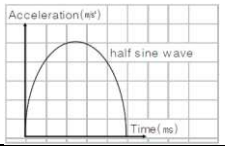
<Figure 6- 8 : X, Y, Z vibration direction>

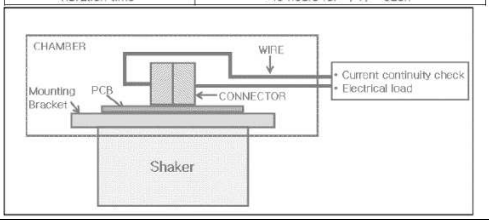
3.3.2 ES91500-03 (MQS 6P)

TEST DESCRIPTION	REQUIREMENT	PROCEDURE
Appearance	No crack, damage, distortion are permitted	Using sense of sight and touch.
CONN engage and disengage force	1) Min 10kgf 2) Min 7.6kgf (Only MQS 6P)	Measure force by inserting and disengaging the connector with terminal assembled at constant 50 mm/min speed. However, remove lock part when measuring disengage force.

<table>
<tr><td>Reverse insertion between housings</td><td colspan="2">It shall not be incorrectly inserted by applying force of 10kgf.</td><td>Insert the housing with terminal by pushing it in reverse direction with applying 10kgf.</td></tr>
<tr><td>Strength of HSG lock</td><td colspan="2">4P or more: Max 4kgf</td><td>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 50mm/min. Then measure weight when lock structure is disengaged or destroyed.</td></tr>
<tr><td>Voltage Drop</td><td colspan="2">Max 30mΩ</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).
HARNESS UNIT: VD = V – (L1+L2)
<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></table></td></tr>
<tr><td>Insulation resistance</td><td colspan="2">Min 100 MΩ</td><td>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〉</td></tr>
<tr><td>High voltage test</td><td colspan="2">There shall be no insulation break</td><td>Apply AC 500V voltage of normal frequency 1 minute between neighboring terminals, and between housing surfaces of terminal, with connector combined.</td></tr>
<tr><td>Connector solderability</td><td colspan="2">No crack, damage, distortion are permitted</td><td>Fluxed soldering section of a specimen shall be dipped in solder of the following conditions.
1) Sn / Pb conditions
- Solder temperature : 230 +/-5℃
- Immersion period : 3 +/-0.5sec
2) Pb free conditions
- Solder temperature : 245 +/-5℃
- Immersion period : 3 +/-0.5sec</td></tr>
<tr><td rowspan="2">Cold and hot temperature shock test</td><td>Appearance</td><td>No crack, damage, distortion are permitted</td><td rowspan="2">Engage and disengage connector 10 times by hand, and perform 200 cycles. Then pick specimen out of chamber and leave at room temperature for 2 hours or more
 
</td></tr>
<tr><td>Voltage Drop</td><td>Max 50mΩ</td></tr>
<tr><td rowspan="2">High temperature test</td><td>Appearance</td><td>No crack, damage, distortion are permitted</td><td rowspan="2">Engage and disengage connector 10 times by hand, and leave it in combined state at the temperature chamber of 85℃ for 300 hours. Then pick specimen out of chamber and leave at room temperature for 2 hours or more.</td></tr>
<tr><td>Voltage Drop</td><td>Max 50mΩ</td></tr>
</table>

<table>
<tr><td rowspan="4">High temperature and high humidity test</td><td>Appearance</td><td>No crack, damage, distortion are permitted</td><td rowspan="4">Leave assembled connector in chamber of 85±2℃ temperature and 85% humidity for 500 hours with standard voltage after insertion and separation of the connector repeatedly 10 times by hands. Then pick specimen out of the chamber and leave it at room temperature for 2 hours or more. After that, the specimen must meet the requirements of the applicable evaluation tests.</td></tr>
<tr><td>Voltage Drop</td><td>Max 50mΩ</td></tr>
<tr><td>Insulation Resistance</td><td>Min 10 kΩ</td></tr>
<tr><td>High voltage</td><td>There shall be no insulation break</td></tr>
<tr><td rowspan="3">Temperature and humidity cycle test</td><td>Appearance</td><td>No crack, damage, distortion are permitted</td><td rowspan="3">Engage and disengage connector 10 times by hands, and perform 10 cycles. Then pick specimen out of chamber and leave it at room temperature for 2 hours or more.
 
[Figure11.Temperature and humidity cycle test condition]</td></tr>
<tr><td>Voltage Drop</td><td>Max 50mΩ</td></tr>
<tr><td>Insulation Resistance</td><td>Min 10 kΩ</td></tr>
<tr><td>Dust Test</td><td>Voltage Drop</td><td>Max 50mΩ</td><td>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.</td></tr>
<tr><td rowspan="2">Sulfur test</td><td>Appearance</td><td>No crack, damage, distortion are permitted</td><td rowspan="2">Engage and disengage connector 10 times with hands, and expose it state of SO2, 10ppm density, 40±3℃ temperature and 90~95% humidity for 24 hours. Then pick specimen out of chamber and leave it at room temperature for 2 hours or more.</td></tr>
<tr><td>Voltage Drop</td><td>Max 50mΩ</td></tr>
<tr><td rowspan="3">Shock test</td><td>Appearance</td><td>No crack, damage, distortion are permitted</td><td rowspan="3">Connector shall be mounted in PCB board. After testing connector with half sine wave and following conditions, connector must meet the requirements of appearance, voltage drop and instantaneous short.
 

Test conditions :
1) Acceleration: 980㎨(100G)
2) Time of shock : 6ms
3) Axes : X,Y,Z
4) Number of test : 10 times per each axe</td></tr>
<tr><td>Voltage Drop</td><td>Max 50mΩ</td></tr>
<tr><td>Instant short circuit</td><td>Max 10 ㎲</td></tr>
<tr><td rowspan="4">Complex environment endurance test</td><td>Appearance</td><td>No crack, damage, distortion are permitted</td><td rowspan="4">Engage and disengage connector 10 times by hand, and then perform the test with the conditions of complex environment endurance test in combined with vibration tester as following below figure. Then measure instant short circuit.
<table><tr><th>Division</th><th>Conditions</th></tr><tr><td>Ambient temperature/humidity</td><td>80℃, 90~95%</td></tr><tr><td>Applied current</td><td>Basic current(Connect electrodes in series.)</td></tr><tr><td>Current application cycle</td><td>120 CYCLE(45minutes-ON, 15minutes-OFF)</td></tr><tr><td>Vibration acceleration</td><td>4.4 g</td></tr><tr><td>Frequency</td><td>20 Hz ~ 200 Hz (Sweep Time max3 minutes)</td></tr><tr><td>Vibration time</td><td>40 hours for , Y, each</td></tr></table> 
</td></tr>
<tr><td>Voltage Drop</td><td>Max 50mΩ</td></tr>
<tr><td>Temperature Rise</td><td>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
1743282-1 1-1743282-2	MQS 8P PLUG HSG
1743283-1	MQS 8P PLUG DBL HSG
1743284-1 1-1743284-2 2-1743284-2 9-1743284-1	MQS 8P HEADER ASSEMBLY (H-TYPE)
1743386-1 1-1743386-2 1-1743386-6	MQS 8P HEADER ASSEMBLY (V-TYPE)
936289-2/3/5 3-936289-4	MQS 6P PLUG HSG
936640-2/3	MQS 6P HEADER ASSEMBLY (V-TYPE)
1-936119-1/2/3	MQS 4P PLUG ASSY
1743218-5	MQS 4P HEADER ASSEMBLY
1743164-1/2	MQS 3P PLUG HSG