070 MLC Series

1. SCOPE

1.1. Content

This specification covers the requirements for product performance, test methods and quality assurance provisions of 070 MLC Series.

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

- 368500 : Customer Drawing (070 MLC PLUG HSG 3POS)
- 368503 : Customer Drawing (070 MLC 3P CAP HSG)
- 368501: Customer Drawing (070 MLC 4P REC HSG)
- 174929: Customer Drawing (070 SERIES MULTI-LOCK I/O CONNECTOR 4POSITION CAP HOUSING (W-W))
- 368502 : Customer Drawing (070 MLC PLUG HSG 6P)
- 368504 : Customer Drawing (070 MLC 6P TAB HSG. (SINGLE ROW))
- 368506 : Customer Drawing (070 MLC 10P CAP HSG)
- 174465 : Customer Drawing (070 SERIES MULTILOCK I/O CONNECTOR 10POS PLUG HOUSING)
- 368507 : Customer Drawing (070 MLC 12P CAP HSG)
- 173851 : Customer Drawing (070 SERIES MULTI-LOCK I/O CONNECTOR 12POSITION PLUG HOUSING)
- 368508 : Customer Drawing (070 MLC 14P CAP HSG)
- 173852 : Customer Drawing (070 SRS MLC 14POS PLUG HSG)
- 368509 : Customer Drawing (070 MLC 18P CAP HSG)
- 173853 : Customer Drawing (070 SERIES MULTI-LOCK I/O CONNECTOR 18POSITION PLUG HOUSING)
- 368510 : Customer Drawing (070 MLC 20P CAP HSG)
- 368511 : Customer Drawing (070 MLC PLUG 20P HSG)
- 368538 : Customer Drawing (070 MLC PLUG 2P HSG)
- 368539 : Customer Drawing (070 MLC PLUG HSG 6P(D.B))
- 368546 : Customer Drawing (070 MLC CAP HSG 6P(D.B))

| Indicates Change

- 368541 : Customer Drawing (070 MLC PLUG 10P HSG)
- 368542 : Customer Drawing (070 MLC PLUG 12P HSG)
- 368543 : Customer Drawing (070 MLC PLUG 14P HSG)
- 368544 : Customer Drawing (070 MLC PLUG 18P HSG)
- 368545 : Customer Drawing (070 MLC CAP 2P HSG)
- 85096 : Customer Drawing (070 MLC PLUG 22P HSG)
- 85097 : Customer Drawing (070 MLC 22P CAP 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.

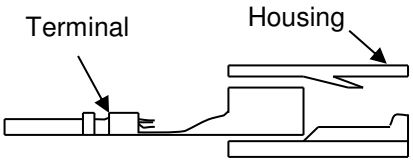
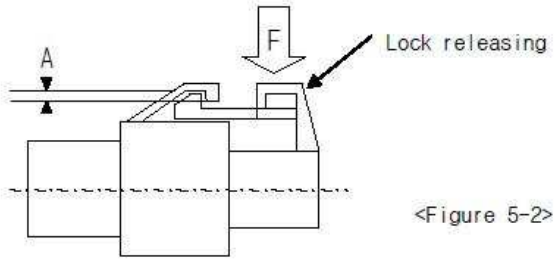
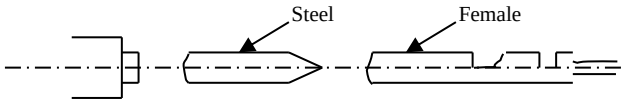
3.2. Ratings

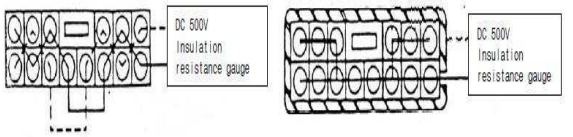
Voltage	Temperature	Humidity
12V DC	25±5℃	65±20%

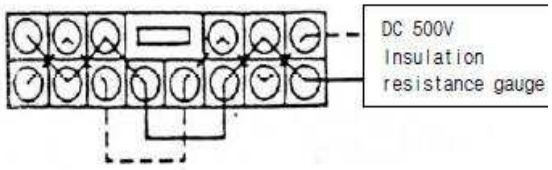
3.3. Test Requirements and Procedures Summary

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

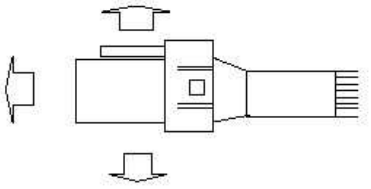
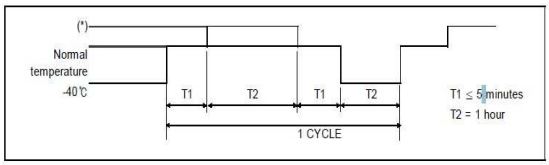
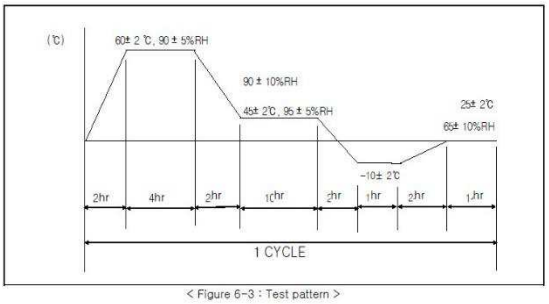
TEST DESCRIPTION	REQUIREMENT	PROCEDURE
Appearance	No crack, damage, distortion are permitted	Using sense of sight and touch.
CONN engage and disengage force	2P, 3P, 4P, 6P, 10P, 12P 10kgf or less	Measure force by inserting and disengaging the connector with terminal assembled at constant 50 mm/min speed. However, remove lock part when measuring disengage force.
	14P,18P, 20P, 22P 15kgf or less	
Reverse insertion between housings	It shall not be incorrectly inserted by applying force of 20kgf.	1) Insert terminal to housing 2) Fix housing of female connector to moving part of measuring instrument in reverse insertion direction. (Reverse insertion: 180 degree rotation on the locking part) 3) 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. 4) Check the insertion by housing modification of male connector after connector insertion.
Reverse insertion between terminal and housing	5kgf or more	Crimp cable of maximum size on terminal and then insert it into housing by end of insulation barrel in the reserve direction.
Engage force	Max 1.5kgf or less	As shown in the following figure 4-1, measure the weight while inserting terminal into fixed housing at 50mm/min speed.

between terminal and housing			 <Figure 4-1>
CONN Clip panel engage and retention force	Engage: Max 12kgf or less Retention: Min 15kgf or more		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 50mm.min and measure the force when destroyed or disengaged
Strength of HSG lock	Min 10kgf or more		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.
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	Min 10kgf		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.
Terminal engage and disengage force (kgf)	Engage	0.3~1.0kgf	As shown in figure 4-3, engage and disengage male terminal or steel gauge into or from female terminal at 50 mm/min speed. 
	Disengage	0.15~1.0kgf	
Crimp strength (kgf)	0.85SQ: Min 13kgf or more 2.0SQ: Min 20kgf or more		Fix the crimped terminal, and draw the cable at a position 50~100 mm 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
Voltage Drop	030~070: Max 5mV/A		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 (VD) in terminal by subtracting cable resistance (L) from the circuit voltage drop (V).

<table>
<tr><td></td><td></td><td>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 14V between neighboring terminals (figure 5-6).
 

<Figure 5-6: Between neighboring terminals></td></tr>
<tr><td>High voltage test</td><td>No allowed insulation breakdown</td><td>Measured by applying test potential of 1000 V AC between the adjacent contact between the contact and housing.</td></tr>
<tr><td>Temperature rise</td><td>Max 30℃</td><td>Apply basic current (I = Io *K) of clause 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>Twisting Test
- Connector Engage and Disengage Endurance Test</td><td>Appearance: No crack, damage, distortion are permitted
Max 10mV/A</td><td>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>Overcurrent cycle test</td><td>Appearance: No crack, damage distortion are permitted
Voltage Drop: Max 10mV/A — Condition A / Condition B
Temp rise — Condition A</td><td>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.
<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>
</table>

		Max 40℃	Condition b	
Cold temperature test	Appearance	No crack, damage, distortion are permitted		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>
	Current Leakage	Max 1mA		
Cold and hot temperature shock test	Appearance	No crack, damage, distortion are permitted		Engage and disengage Connector with terminal assembled 10 times with hands, this repeats 200 CYCLE by below test condition. (Non-Sealed : 80℃) 
	Voltage Drop	Max 10mV/A		
High temperature 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 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. High Temperature: 80℃ / Connector Using Part: Non - Waterproof Connector
	Voltage Drop	Max 10mV/A		
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	Max 10mV/A		
	Current Leakage	Max 1 mA		
Dust Test	Appearance	No crack, damage, distortion are permitted		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

<table>
<tr><td></td><td>Voltage Drop</td><td colspan="2">Max 10mV/A</td><td>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">Oil and liquid 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 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.</td></tr>
<tr><td>Voltage Drop</td><td colspan="2">Max 10mV/A</td></tr>
<tr><td rowspan="2">Sulfur (SO2) gas 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 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.</td></tr>
<tr><td>Voltage Drop</td><td colspan="2">Max 10mV/A</td></tr>
<tr><td rowspan="6">Complex environment endurance test</td><td>Appearance</td><td colspan="2">No crack, damage, distortion are permitted</td><td rowspan="6">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 4.16 for 4 hours for X, Y, Z each.
1) Sin Wave Test
<table>
<tr><th>Division</th><th>Condition</th></tr>
<tr><td>Ambient temperature/humidity</td><td>Refer to figure 4-8, 90~95%</td></tr>
<tr><td>Applied current</td><td>Basic current (Connector electrodes in series.)</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>
</table></td></tr>
<tr><td rowspan="2">Crimp Tensile Strength</td><td>0.85SQ</td><td>Min 13kgf</td></tr>
<tr><td>2.0SQ</td><td>Min 20kgf</td></tr>
<tr><td>Voltage Drop</td><td colspan="2">Max 10mV/A</td></tr>
<tr><td>Temperature Rise</td><td colspan="2">Max 40℃</td></tr>
<tr><td>Instant short circuit</td><td colspan="2">Max 10㎲</td></tr>
</table>

3.4. Applied Part No List

TE Part no	Description
0-368500-1/2	070 MLC PLUG HSG 3POS
0-368503-1	070 MLC 3P CAP HSG

0-368501-1	070 MLC 4P REC HSG
0-174929-1/2/4/5/6/7	070 SERIES MULTI-LOCK I/O CONNECTOR 4POSITION CAP HOUSING (W-W)
0-368502-1/2	070 MLC PLUG HSG 6P
0-368504-1	070 MLC 6P TAB HSG. (SINGLE ROW)
0-368506-1	070 MLC 10P CAP HSG
0-174465-1/2/4/5/6/7/8	070 SERIES MULTILOCK I/O CONNECTOR 10POS PLUG HOUSING)
0-368507-1	070 MLC 12P CAP HSG
0-173851-1/2/4/5/6/8 1-173851-1	070 SERIES MULTI-LOCK I/O CONNECTOR 12POSITION PLUG HOUSING
0-368508-1/2	070 MLC 14P CAP HSG
0-173852-1/2/4/5/6/7 1-173852-1	070 SRS MLC 14POS PLUG HSG
0-368509-1	070 MLC 18P CAP HSG
0-173853-1/2/4/5/6/7/8/9 1-173853-1	070 SERIES MULTI-LOCK I/O CONNECTOR 18POSITION PLUG HOUSING
0-368510-1/2	070 MLC 20P CAP HSG
0-368511-1/2	070 MLC PLUG 20P HSG
0-368538-1/2/5	070 MLC PLUG 2P HSG
0-368539-1	070 MLC PLUG HSG 6P(D.B)
0-368541-1	070 MLC PLUG 10P HSG
0-368542-1/9	070 MLC PLUG 12P HSG
0-368543-1/2	070 MLC PLUG 14P HSG
0-368544-1/2/4	070 MLC PLUG 18P HSG
0-368545-1/3	070 MLC CAP 2P HSG
0-368546-1	070 MLC CAP HSG 6P(D.B)
0-85096-1/7	070 MLC PLUG 22P HSG
0-85097-1/7 1-85097-1/7	070 MLC 22P CAP HSG