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025/060/110 HYBRID CONNECTOR

1. SCOPE

1.1. Content

This specification covers the requirements for product performance, test methods and quality assurance provisions of 025/060/110 HYBRID CONNECTOR 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

- 2188208: Customer Drawing (025/060/110 HYBRID 60P PLUG ASSY)
- 2188204: Customer Drawing (025/060/110 HYBRID 60P CAP ASSY)
- 2188340: Customer Drawing (U-TURN COVER FOR 60P CAP ASS'Y)
- 2219512: Customer Drawing (U-TURN COVER FOR 60P CAP ASS'Y)

3. REQUIREMENTS

3.1. Design and Construction

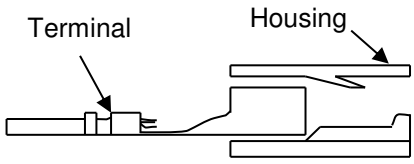
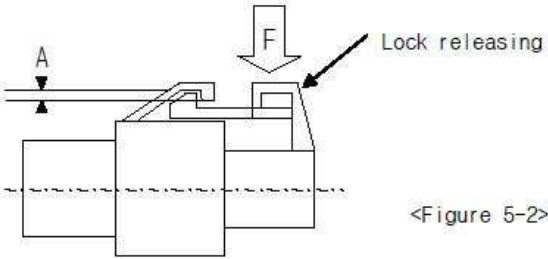
Product shall be of the design, construction, materials and physical dimensions specified on the applicable product drawing.

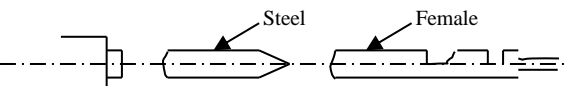
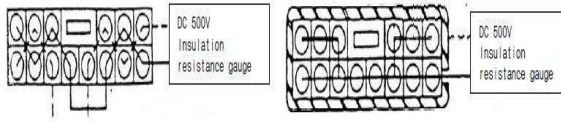
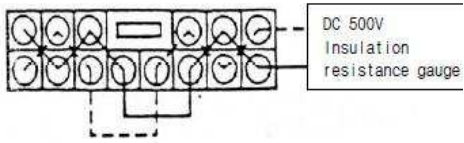
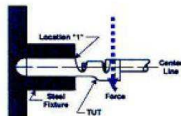
3.2. Ratings

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

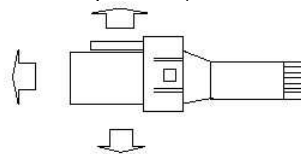
3.3. Test Requirements and Procedures Summary

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

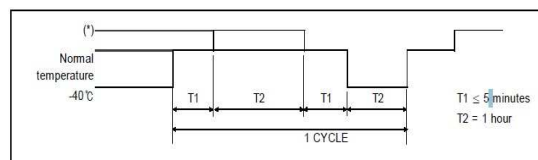
TEST DESCRIPTION	REQUIREMENT	PROCEDURE
Appearance	No crack, damage, distortion are permitted	Using sense of sight and touch.
CONN engage and disengage force	Max 7.6 kgf and less	Measure force by inserting and disengaging the connector with terminal assembled at constant 50 mm/min speed. However, remove lock part when measuring disengage force.
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 housings	025 series : Min 3kgf 030~250 series : Min 5kgf	Applicated the maximum size wire onto the terminal and insert it by applying a 5 kgf force or hand reversely to the housing.
Engage force between terminal and housing	Max 1.5 kgf	As shown in the following figure 4-1, measure the weight while inserting terminal into fixed housing at 100mm/min speed.  <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	025~040 series : Min 8kgf 050~375 series : 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 50mm/min. Then measure weight when lock structure is disengaged or destroyed.
HSG lock releasing force	Max 6 kgf	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	025 series : Min 6kgf 030~060 series : Min 8kgf 070~312 series : 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)	<p>Engage</p> <p>Disengage</p>	<p>025 series : 0.1~0.5kgf 110~187 series : 0.3~1.5kgf 250 series : 0.5~2.0kgf</p> <p>025 series : 0.1~0.5kgf 110~187 series : 0.15~1.5kgf 250 series : 0.5~2.1kgf</p>	<p>As shown in figure 4-3, engage and disengage male terminal or steel gauge into or from female terminal at 100 mm/min speed.</p> 												
Crimp strength (kgf)	<p>0.3 SQ : Min 6kgf 0.5 SQ : Min 9kgf 1.25 SQ : Min 17kgf 3.0 SQ : Min 35kgf</p>		<p>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</p>												
Voltage Drop	<p>025 series : Max 10mV/A 030~070 series: Max 5 mV/A 090~370 series: Max 3 mV/A</p>		<p>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).</p> <p>1)HARNESS versus UNIT:VD =V(L3+L4)</p> <table border="1" data-bbox="831 751 1406 877"> <thead> <tr> <th>Application</th> <th>Open voltage</th> <th>Short circuit current</th> <th>Division</th> </tr> </thead> <tbody> <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> </tbody> </table> <p><Table5-1></p>	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
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												
Insulation resistance	<p>Unsealed Conn' : Min 100 MΩ</p>		<p>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.</p>  <p><Figure 5-6: Between neighboring terminals> <Figure 5-7: Between neighboring terminal and housing surface></p>												
Leakage current	<p>Unsealed Conn' : Max 10 μA</p>		<p>Measure it by applying DC 14V between neighboring terminals (figure 5-6).</p>  <p><Figure 5-6: Between neighboring terminals></p>												
High voltage test	<p>No allowed Insulation breakdown</p>		<p>Measured by applying test potential of 1000 V AC between the adjacent contact between the contact and housing.</p>												
Terminal bending strength	<p>No torn or No crack</p>		<p>Terminal is ready to sample. As Shown in the figure, makes fixed. After applying force on 15sec, expand at least 10bent portion and scans. The new sample was fixed to rotate 90,180 degrees and then is measured in the same way. According to the thickness of raw material, apply power to the table below.</p>  <table border="1" data-bbox="1036 1801 1312 1921"> <thead> <tr> <th>Terminal Material Thickness(mm)</th> <th>Applied Force</th> </tr> </thead> <tbody> <tr> <td>≤ 0.20</td> <td>0.4kgf</td> </tr> <tr> <td>≤ 0.30</td> <td>1kgf</td> </tr> <tr> <td>≤ 0.40</td> <td>1.5kgf</td> </tr> <tr> <td>≥ 0.40</td> <td>2kgf</td> </tr> </tbody> </table>	Terminal Material Thickness(mm)	Applied Force	≤ 0.20	0.4kgf	≤ 0.30	1kgf	≤ 0.40	1.5kgf	≥ 0.40	2kgf		
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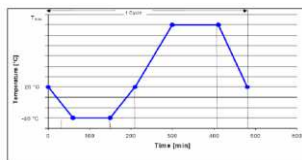
Twisting Test	Appearance	No crack, damage, distortion are permitted		Apply 8kgf force on the end part of combined connector 10 times each in the (front, rear, left, right) directions perpendicular to axial direction.
	Voltage Drop	025 series : Max 10mV/A 090~375series: Max 3 mV/A		
Connector Engage and Disengage Endurance Test	Appearance	No crack, damage, distortion are permitted		Make combine connectors engage and disengage at 100mm/min. Perform it 50 times. (Do not use locking device)
	Voltage Drop	025 series : Max 20mV/A 030~375series: Max 10 mV/A		
Over Current Cycle Test	Appearance	No crack, damage, distortion are permitted		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 °C of ambient temperature.
	Voltage Drop	025 series : Max 20mV/A 030~375series: Max 10 mV/A		
	Temperature Rise	Max 40°C		
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°C 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) :
	Voltage Drop	025 series : Max 20mV/A 030~375series: Max 10 mV/A		
	Insulation Resistance	Min 100 MΩ	Between terminals housing surface	
	Current Leakage	Max 1 μA		
	Temperature Rise	Max 40°C		
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. (ENG ROOM : 120°C, ENG ROOM except : 80°C)
	Voltage Drop	025 series : Max 20mV/A 030~375series: Max 10 mV/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.
	Voltage Drop	025 series : Max 20mV/A 030~375series: Max 10 mV/A		
		High Temperature	Connector Using Part	
		80°C	Unsealed Connector	
		120°C	Sealed Connector	



<Figure 6-1>



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°C 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	025 series : Max 20mV/A 030~375series: Max 10 mV/A			
	Insulation Resistance	Min 100 MΩ	Between terminals		
			housing surface		
Current Leakage	Max 1 μA				
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 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.	
	Voltage Drop	025 series : Max 20mV/A 030~375series: Max 10 mV/A			
Waterproof Test	Appearance	No crack, damage, distortion are permitted		Make combined connectors engaged and disengaged 10 time hands, and leave it in combined state at 120 °C ambient temperature for 40 minutes and then spray water of normal temperature for 20 minutes according to S2 of JIS D0203. Rep 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.	
	Insulation Resistance	Min 100 MΩ	Between terminals		
			housing surface		
Current Leakage	Max 1 μA				
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. Immerse connector in combined state for 2 hours in mixed oil of 50± 2°C ENG oil (SAE10W) or equivalent oil and B. Immerse connector in combined state for 1 hour in car gasoline (JIS K2202) at normal temperature, and then pick it out. C. Immerse connector in combined state for 1 hour in brake liquid (pure product) at normal temperature, and then pick it out. D. Immerse connector in combined state for 1 hour in 100% washer liquid (pure product) at normal temperature, and then pick it out. E. Immerse connector in combined state for 1 hour in 50% LLC (Long life coolant) at normal temperature, and then pick it out.	
	Voltage Drop	025 series : Max 20mV/A 030~375series: Max 10 mV/A			
Ozone Test	Appearance	No crack, damage, distortion are permitted		Engage and disengage Connector with terminal assembled 10 times with hands, and samples keep at 40°C and 50±5pphm Ozone for 100hour. Then pick connector out of chamber and dry it for 2 hours or more.	
	Voltage Drop	025 series : Max 20mV/A 030~375series: Max 10 mV/A			

Salt Water Test	Appearance	No crack, damage, distortion are permitted		Engage and disengage connector with terminal assembled 10 times with hands, and put it in 35°C temperature regulation chamber, spray 5% salty water for 24 hours according to JIS Z2371, and, maintain room temperature without spray for 1 hour, Then repeat this four times. Then pick connector out of chamber and dry it at room temperature for 2 hours or more.																
	Voltage Drop	025 series : Max 20mV/A 030~375series: Max 10 mV/A																		
	Insulation Resistance	Min 100MΩ	Between terminals housing surface																	
	Current Leakage	Max 1 μA																		
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°C, density 10ppm, humidity 90~95%, for 24 hours. Then pick connector out of chamber and dry it for 2 hours or more.																
	Voltage Drop	025 series : Max 20mV/A 030~375series: Max 10 mV/A																		
Crash Impact test	Instant short circuit	Max 10 μs		Engage and disengage connector with terminal assembled 10 times with hands, and apply the impact of 1960, 3920, 5880, 9822 m/s ² in each direction.																
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 120°C or 80°C (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.																
	Crimp Tensile Strength	0.3SQ	Min 6kgf	1) Sn Wave Test A <table border="1"> <thead> <tr> <th>Division</th> <th>Condition</th> </tr> </thead> <tbody> <tr> <td>Ambient temperature/humidity</td> <td>Refer to figure 5-8, 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>4.4</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> </tbody> </table>	Division	Condition	Ambient temperature/humidity	Refer to figure 5-8, 90~95%	Applied current	Basic current (Connector electrodes in series.)	Current application cycle	120 CYCLE (45 minutes-ON, 15 minutes-OFF)	Vibration acceleration	4.4	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
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0.5SQ	Min 9kgf																			
1.25SQ	Min 17kgf																			
3.0SQ	Min 35kgf																			
Voltage Drop	025 series : Max 20mV/A 030~375series: Max 10 mV/A		 <table border="1"> <thead> <tr> <th>Duration</th> <th>Temperature °C</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>20</td> </tr> <tr> <td>60</td> <td>-40</td> </tr> <tr> <td>150</td> <td>-40</td> </tr> <tr> <td>210</td> <td>20</td> </tr> <tr> <td>300</td> <td>T_{max}*</td> </tr> <tr> <td>410</td> <td>T_{max}*</td> </tr> <tr> <td>480</td> <td>20</td> </tr> </tbody> </table>	Duration	Temperature °C	0	20	60	-40	150	-40	210	20	300	T _{max} *	410	T _{max} *	480	20	
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<Figure 5-8>

	Temperature Rise	Max 40°C	2) Random Wave Test <table border="1"> <tr> <th>Division</th> <th>Condition</th> </tr> <tr> <td>Ambient temperature</td> <td>Figure 5-8</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>Follow figure 6-9</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>	Division	Condition	Ambient temperature	Figure 5-8	Applied current	Basic current (Connector electrodes in series.)	Current application cycle	120 CYCLE (45 minutes-ON, 15 minutes-OFF)	Vibration acceleration	Follow figure 6-9	Vibration time	8 hours for X, Y, Z each	Connector attaching method	Test mode D, E, F
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Instant short circuit	Max 10 μ s	<table border="1"> <thead> <tr> <th>Strespoint (Hz)</th> <th>Magnitude (G²/Hz)</th> </tr> </thead> <tbody> <tr> <td>60.0</td> <td>0.00100</td> </tr> <tr> <td>200.0</td> <td>1.50000</td> </tr> <tr> <td>210.0</td> <td>0.10000</td> </tr> <tr> <td>1000.0</td> <td>0.10000</td> </tr> </tbody> </table> <p><Figure 6-9></p>	Strespoint (Hz)	Magnitude (G ² /Hz)	60.0	0.00100	200.0	1.50000	210.0	0.10000	1000.0	0.10000					
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60.0	0.00100																
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3.4. Applied Part No List

TE Part no	Description
2188208-2	025/060/110 HYBRID 60P PLUG ASSY
2188204-2	025/060/110 HYBRID 60P CAP ASSY
2219512-2	U-TURN COVER FOR 60P CAP ASSY
2188340-2	U-TURN COVER FOR 60P CAP ASSY
2188340-3	U-TURN COVER FOR 60P CAP ASSY