ISH® CONNECTOR

(NORMAL LOCK/Low insertion force)

Test Report

0	RS0942	June 14, 2023	Y. Nishimura	J. Mukunoki	J. Tateishi
Rev.	ECN	Date	Prepared by	Checked by	Approved by

1. Purpose

To evaluate performance of ISH Connector.

2. Specimen

Items shown in Table 1 were evaluated.

Table 1. Test samples

Pole	LOCK	KEY CODING	PARTS No.				Test result
			MALE ASS'Y	FEMALE HOUSING	RETAINER	FEMALE TERMINAL	
32P	NORMAL	-	V0114-032E-01	V0116-91032-01 V0116-91032-02	V0116-92032-01	VT009-02	Initial properties : Sheet 3 Durability test : Sheet 4～5

3. Test condition

In compliance with Product Specification 【PSS-0034】

4. Result

All test items were satisfied.

- For detail of the test results see of Table1.
- For resistance monitoring during durability test, see Graphs 2 and 3, in which the largest pole count (20P) is shown as a representative results.

Table 2. List of results: Initial properties (32P)

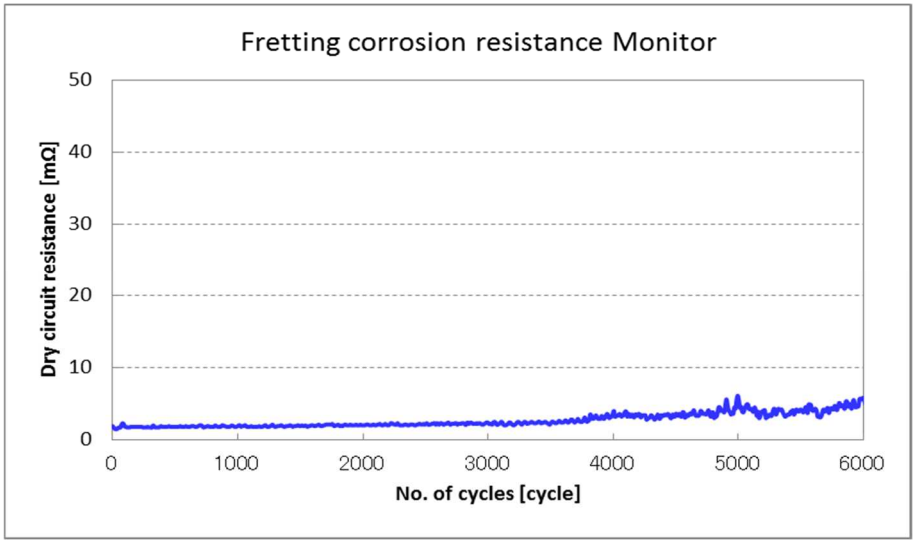
	Measurement		Requirements		Set	n	Unit	Data					Judgement
								Ave	Max	Min	σ	Ave±3s	
Initial Characteristics	Terminal appearance		No detrimental deformation		5	5	-	No detrimental deformation					✔
	Terminal outer dimension		Satisfy drawing dimension		5	5	-	Satisfies drawing dimension					✔
	Housing appearance		No detrimental deformation		5	5	-	No detrimental deformation					✔
	Housing outer dimension		Satisfy drawing dimension		5	5	-	Satisfies drawing dimension					✔
	Feeling (insertion/removal)		No discomfort		5	5	-	No discomfort					✔
	Connector mating force		75.4N MAX.		5	5	N	64.04	65.5	61.8	1.50	68.54	✔
	Connector unmating force		70.4N MAX.		5	5	N	61.73	63.9	59.6	1.72	66.89	✔
	Connector retention force	Direction 1	90N MIN.		5	5	N	187.23	192.2	182.9	3.68	176.19	✔
		Direction 2	90N MIN.		5	5	N	184.75	185.8	182.9	1.63	179.86	✔
		Direction 3	90N MIN.		5	5	N	265.33	269.2	261.3	3.94	253.51	✔
		Direction 4	90N MIN.		5	5	N	239.16	247.6	232.7	7.67	216.15	✔
	Unlocking force		50N MAX.		5	5	N	16.81	18.7	15.3	1.70	21.91	✔
	Insulation resistance		100MΩ MIN.	(a) Between terminals	5	5	-	1,000MΩ MIN.					✔
				(b) Between terminal and earth	5	5	-	1,000MΩ MIN.					✔
	Withstanding voltage		No insulation breakdown or errosion	(a) Between terminals	5	5	-	No insulation breakdown					✔
				(b) Between terminal and earth	5	5	-	No insulation breakdown					✔
	Temperature rise	Single pin	⊿T=50℃ MIN.		5	5	℃	25.69	26.3	25.0	0.58	27.43	✔
		All pin	⊿T=50℃ MIN.		5	5	℃	13.48	14.0	12.8	0.61	15.31	✔
	Leak current		1mA MAX.		5	5	-	1μA MAX.					✔
	Coplanarity	Terminal	0.1mm MAX.		5	5	mm						✔
		Hold down	0.1mm MAX.		5	5	mm						✔
	Peg strength	Position 1	70N MIN.		5	5	N	122.03	135.8	104.4	13.96	80.15	✔
		Position 2	100N MIN.		5	5	N	255.35	268.8	242.8	13.06	216.17	✔
		Position 3	100N MIN.		5	5	N	587.81	620.5	554.6	32.96	488.93	✔
	Lead strength		30N MIN.		1	32	N	31.47	32.0	31.1	0.28	30.63	✔
	Audible click		60dB MIN.		5	5	db	61.57	62.3	61.1	0.43	60.27	✔
	Terminal crimp strength		70N MIN.		5	5	N	80.64	83.1	77.3	1.96	74.76	✔
	Terminal insertion force		0.5N～3.0N		5	5	N	1.439	1.67	1.28	0.111	1.106	✔
	Terminal removal force		0.5N～3.0N		5	5	N	1.634	1.88	1.31	0.100	1.334	✔
	Terminal contact force		3N MIN.		5	5	N	3.65	3.84	3.25	0.20	3.04	✔
	Terminal bend strength	a	Must not bend 1mm or over		5	5	-	0mm (Not bend in the initial position.)					✔
		b	Terminal bending 30°MAX		5	5	-	Terminal bending 10°MAX					✔
	Voltage drop		10mV/A MAX.		5	160	mV/A	2.380	3.30	1.51	0.375	3.505	✔
	Dry circuit resistance		10mΩ MAX.		5	160	mΩ	2.509	3.09	1.81	0.301	3.412	✔
	Terminal retention force	With secondary lock	49N MIN.		2	64	N	88.63	89.9	84.9	2.16	82.15	✔
		Without secondary lock	20N MIN.		2	64	N	55.32	57.4	52.9	2.90	46.62	✔
	Terminal to housing insertion force		10N MAX.		2	64	N	3.082	3.67	2.41	0.268	3.886	✔
	Retainer insertion/removal force	Insertion force	29.4N MAX.		5	5	N	3.294	3.33	3.26	0.033	3.393	✔
		Removal force	5.5N MIN.		5	5	N	6.737	6.95	6.35	0.336	5.729	✔
	Housing lock strength without terminals		49N MIN.		5	5	N	136.33	136.8	135.7	0.57	134.63	✔
	Sn whisker		125μm MAX.		5	5	-	No whisker					✔

Table 3. List of results: Properties after endurance tests – Ⅰ (32P)

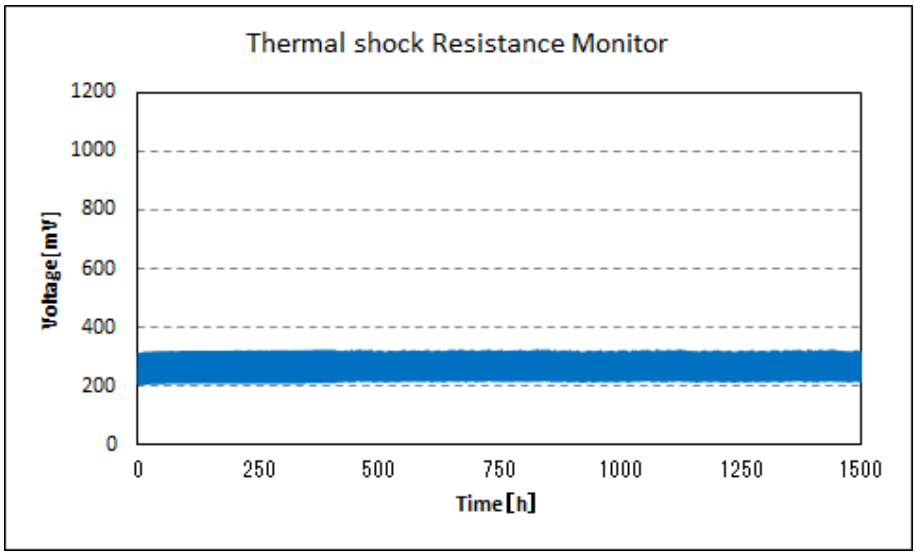
Item	Measurement		Requirements		Set	n	Unit	Data					Judgement
								Ave	Max	Min	σ	Ave±3s	
Repeated insertion/removal	Connector mating force	After 5 repeat	75.4N MAX.		5	5	N	64.58	65.6	63.1	1.32	68.54	✔
		After test	75.4N MAX.		5	5	N	65.28	66.3	63.6	1.50	69.78	✔
	Connector unmating force	After 5 repeat	70.4N MAX.		5	5	N	61.98	63.8	60.7	1.62	66.84	✔
		After test	70.4N MAX.		5	5	N	65.40	66.3	64.1	1.11	68.73	✔
	Voltage drop	Initial	10mV/A MAX.		5	160	mV/A	1.810	2.46	1.11	0.274	2.632	✔
		After test	20mV/A MAX.		5	160	mV/A	3.590	5.18	2.39	0.625	5.465	✔
Resistance to forcedmating	Connector mating force		70N MAX.		5	5	N	60.79	63.2	57.1	2.36	67.87	✔
	Connector unmating force		70N MAX.		5	5	N	62.54	65.3	60.9	1.75	67.79	✔
	Voltage drop	Initial	10mV/A MAX.		5	160	mV/A	2.557	2.69	2.36	0.137	2.968	✔
		After test	20mV/A MAX.		5	160	mV/A	2.594	2.64	2.52	0.048	2.738	✔
Fretting corrosion	Dry circuit resistance	Monitor dry circuit resistance during test.	20mΩMAX.		5	5	mΩ	See Graph 1 on Sheet 25					✔
Thermal a going	Housing appearance		No detrimental deformation		5	5	-	No detrimental deformation					✔
	Feeling (insertion/removal)		No discomfort		5	5	-	No discomfort					✔
	Connector retention force	Direction 1	100N MIN.		5	5	N	180.56	181.9	177.9	1.63	175.67	✔
	Terminal crimp strength		70N MIN.		5	5	N	83.32	86.1	81.0	1.55	78.67	✔
	Dry circuit resistance	Initial	10mΩ MAX.		5	160	mΩ	2.107	3.69	1.26	0.559	3.784	✔
		After test	20mΩ MAX.		5	160	mΩ	2.025	3.87	1.39	0.670	4.035	✔
	Terminal retention force	With secondary lock	49N MIN.		2	64	N	82.59	85.2	80.2	1.44	78.27	✔
		Without secondary lock	20N MIN.		2	64	N	49.88	56.4	46.3	3.02	40.82	✔
	Housing lock strength without terminals		49N MIN.		5	5	N	141.85	144.1	140.6	1.35	137.80	✔
Low temprature a going	Housing appearance		No detrimental deformation		5	5	-	No detrimental deformation					✔
	Feeling (insertion/removal)		No discomfort		5	5	-	No discomfort					✔
	Dry circuit resistance	Initial	10mΩ MAX.		5	160	mΩ	2.238	3.76	1.23	0.532	3.834	✔
		After test	20mΩ MAX.		5	160	mΩ	2.313	3.08	1.45	0.623	4.182	✔
	Terminal retention force	With secondary lock	49N MIN.		2	64	N	89.51	90.6	89.0	0.39	88.34	✔
		Without secondary lock	20N MIN.		2	64	N	49.95	55.7	45.7	2.95	41.10	✔
	Housing lock strength without terminals		49N MIN.		5	5	N	144.16	148.7	141.0	3.40	133.96	✔
Thermal shock	Housing appearance		No detrimental deformation		5	5	-	No detrimental deformation					✔
	Feeling (insertion/removal)		No discomfort		5	5	-	No discomfort					✔
	Connector retention force	Direction 1	100N MIN.		5	5	N	188.67	190.5	186.0	2.40	181.47	✔
	Terminal crimp strength		70N MIN.		5	5	N	86.88	89.0	83.4	1.75	81.63	✔
	Dry circuit resistance	Initial	10mΩ MAX.		5	160	mΩ	2.555	3.23	1.81	0.320	3.515	✔
		After test	20mΩ MAX.		5	160	mΩ	3.637	5.75	2.76	0.799	6.034	✔
	Terminal retention force	With secondary lock	49N MIN.		2	64	N	83.40	88.3	79.5	2.37	76.29	✔
		Without secondary lock	20N MIN.		2	64	N	51.82	59.2	47.5	2.69	43.75	✔
Temperature /humidity cycle	Housing appearance		No detrimental deformation		5	5	-	No detrimental deformation					✔
	Feeling (insertion/removal)		No discomfort		5	5	-	No discomfort					✔
	Insulation resistance		100MΩ MIN.	(a) Between terminals	5	5	-	1,000MΩ MIN.					✓
				(b) Between terminal and earth	5	5	-	1,000MΩ MIN.					✓
	Withstanding voltage		No insulation breakdown or errosion	(a) Between terminals	5	5	-	No insulation breakdown					✓
				(b) Between terminal and earth	5	5	-	No insulation breakdown					✓
	Leak current		1mA MAX.		5	5	-	1μA MAX.					✔
	Dry circuit resistance	Initial	10mΩ MAX.		5	160	mΩ	2.487	3.09	1.91	0.508	4.011	✔
		After test	20mΩ MAX.		5	160	mΩ	3.160	5.37	2.55	0.925	5.935	✔
	Terminal retention force	With secondary lock	49N MIN.		2	64	N	89.67	90.4	87.3	1.00	86.67	✔
		Without secondary lock	20N MIN.		2	64	N	50.69	55.3	47.7	2.14	44.27	✔
Resistance to humidity	Housing appearance		No detrimental deformation		5	5	-	No detrimental deformation					✓
	Connector retention force	Direction 1	100N MIN.		5	5	N	202.01	210.3	194.8	6.74	181.79	✓
	Insulation resistance		100MΩ MIN.	(a) Between terminals	5	5	-	1,000MΩ MIN.					✓
				(b) Between terminal and earth	5	5	-	1,000MΩ MIN.					✓
	Withstanding voltage		No insulation breakdown or errosion	(a) Between terminals	5	5	-	No insulation breakdown					✓
				(b) Between terminal and earth	5	5	-	No insulation breakdown					✓
	Leak current		1mA MAX.		5	5	-	1μA MAX.					✓

Table 4. List of results: Properties after endurance tests – Ⅱ (32P)

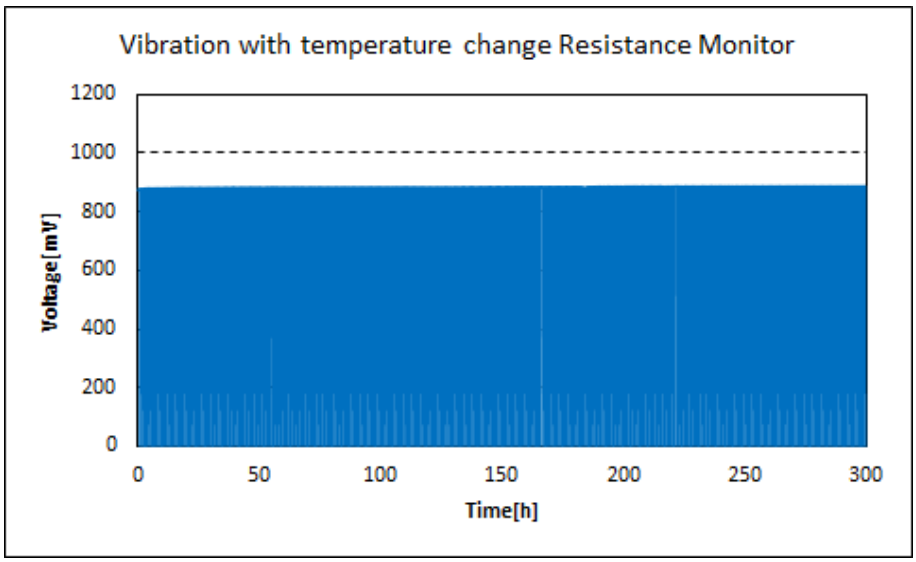
Item	Measurement		Requirements		Set	n	Unit	Data					Judgement
								Avg.	Max.	Min.	s	Avg.±3s	
Resistance to humidity	Dry circuit resistance	Initial	10mΩ MAX.		5	160	mΩ	2.493	3.08	1.93	0.315	3.438	✔
		After test	20mΩ MAX.		5	160	mΩ	2.644	3.39	2.26	0.408	3.868	✔
	Terminal retention force	With secondary lock	49N MIN.		2	64	N	90.34	91.3	88.3	0.72	88.18	✔
		Without secondary lock	20N MIN.		2	64	N	49.58	52.2	47.4	1.64	44.66	✔
Resistance to abrasion	Housing appearance		No detrimental deformation		5	5	-	No detrimental deformation					✔
	Feeling (insertion/removal)		No discomfort		5	5	-	No discomfort					✔
	Voltage drop	Initial	10mV/A MAX.		5	160	mV/A	3.054	3.45	2.36	0.762	5.340	✔
		After test	20mV/A MAX.		5	160	mV/A	3.526	4.11	2.76	0.951	6.379	✔
Corrosion gas	Housing appearance		No detrimental deformation		5	5	-	No detrimental deformation					✔
	Feeling (insertion/removal)		No discomfort		5	5	-	No discomfort					✔
	Terminal crimp strength		70N MIN.		5	5	N	87.17	89.9	83.6	1.76	81.89	✔
	Voltage drop	Initial	10mV/A MAX.		5	160	mV/A	2.302	3.26	1.22	0.412	3.538	✔
		After test	20mV/A MAX.		5	160	mV/A	2.794	3.86	1.88	0.386	3.952	✔
Resistance to stress corrosion	Terminal appearance		No detrimental deformation		5	5	-	No detrimental deformation					✔
	Terminal crimp strength		70N MIN.		5	5	N	82.35	85.5	79.3	2.57	74.64	✔
Conden sation	Terminal appearance		No detrimental deformation		5	5	-	No detrimental deformation					✔
	Housing appearance		No detrimental deformation		5	5	-	No detrimental deformation					✔
	Insulation resistance		100MΩ MIN.	(a) Between terminals	5	5	-	1,000MΩ MIN.					✔
				(b) Between terminal and earth	5	5	-	1,000MΩ MIN.					✔
	Withstanding voltage		No insulation breakdown or errosion	(a) Between terminals	5	5	-	No insulation breakdown					✔
				(b) Between terminal and earth	5	5	-	No insulation breakdown					✔
	Leak current		1mA MAX.		5	5	-	1μA MAX.					✔
	Dry circuit resistance	Initial	10mΩ MAX.		5	160	mΩ	2.402	3.04	1.75	0.324	3.374	✔
		After test	20mΩ MAX.		5	160	mΩ	2.748	3.36	2.45	0.459	4.125	✔
Dump heat cycle	Housing appearance		No detrimental deformation		5	5	-	No detrimental deformation					✔
	Leak current		1mA MAX.		5	5	-	1μA MAX.					✔
	Insulation resistance	250h	100MΩ MIN.	(a) Between terminals	5	5	-	1,000MΩ MIN.					✔
				(b) Between terminal and earth	5	5	-	1,000MΩ MIN.					✔
		500h	100MΩ MIN.	(a) Between terminals	5	5	-	1,000MΩ MIN.					✔
				(b) Between terminal and earth	5	5	-	1,000MΩ MIN.					✔
		750h	100MΩ MIN.	(a) Between terminals	5	5	-	1,000MΩ MIN.					✔
				(b) Between terminal and earth	5	5	-	1,000MΩ MIN.					✔
		1000h	100MΩ MIN.	(a) Between terminals	5	5	-	1,000MΩ MIN.					✔
				(b) Between terminal and earth	5	5	-	1,000MΩ MIN.					✔
	Migration		No migration		5	5	-	No migration					✔
Current cycle	Temperature rise		△T=50℃ MAX.		5	5	℃	15.02	15.3	14.8	0.21	15.65	✔
	Voltage drop	Initial	10mV/A MAX.		5	160	mV/A	1.957	2.82	1.28	0.342	2.983	✔
		After test	20mV/A MAX.		5	160	mV/A	1.996	2.62	1.63	0.349	3.043	✔
Shock	Voltage drop	Initial	10mV/A MAX.		5	160	mV/A	2.014	2.93	1.21	0.378	3.148	✔
		After test	20mV/A MAX.		5	160	mV/A	2.060	3.03	1.28	0.382	3.206	✔
	Microcut		1μsMIN.7ΩMAX.		5	5	-	No microcut					✔
Vibration	Temperature rise		△T=50℃ MAX.		5	5	℃	13.81	15.7	12.5	1.17	17.32	✔
	Voltage drop	Initial	10mV/A MAX.		5	160	mV/A	2.167	3.10	1.25	0.384	3.319	✔
		After test	20mV/A MAX.		5	160	mV/A	2.305	3.19	1.43	0.392	3.481	✔
	Dry circuit resistance	Initial	10mΩ MAX.		5	160	mΩ	2.300	3.33	1.26	0.385	3.455	✔
		After test	20mΩ MAX.		5	160	mΩ	2.402	3.14	1.80	0.422	3.668	✔
	Microcut		No exceed 1μs and 7Ω		5	5	-	No microcut					✔
Vibration with temperature change	Terminal appearance		No detrimental deformation		5	5	-	No detrimental deformation					✔
	Housing appearance		No detrimental deformation		5	5	-	No detrimental deformation					✔
	Terminal contact force		3N MIN.		5	5	N	3.415	3.59	3.24	0.111	3.082	✔
	Dry circuit resistance	Initial	10mΩ MAX.		5	160	mΩ	2.116	3.51	1.18	0.492	3.592	✔
		After test	20mΩ MAX.		5	160	mΩ	6.162	11.93	1.53	2.018	12.22	✔
	Microcut		No exceed 1μs and 7Ω		5	5	-	No microcut					✔



Grapf1. Fretting corrosion Resistance Monitor

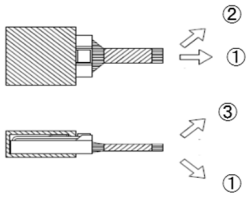


Grapf2. Thermal shock Resistance Monitor



Graph3. Vibration with temperature change Resistance Monitor

Table 5. Initial performances test method - I

Test Item	Procedure
Initial characteristics Test Method	Visual(e.g. magnifier) and tactile verification.
Terminal outer dimension	Measure dimensions using caliper, micrometer, projector.
Housing appearance	Visual(e.g. magnifier) and tactile verification.
Housing outer dimension	Measure dimensions using caliper, micrometer, projector.
Feelinng (insertion/removal)	Verification of feeling by insertion/removal of connector and single terminal.
Connector mating force	Measure the force required to mate female and male connectors together at a uniform rate of 100 mm/min. (terminals must be fully populated)
Connector unmating Force	Measure the force required to pull the connectors apart at a rate of 100 mm/min. with the locking feature disengaged.
Connector Retention Force	Measure the maximum force to pull out female connector from mated state(Figure below). Pull in four directions at a speed of 50mm/min. (terminals must be fully populated) 
Unlocking force	Measure the force required to disengage the lock.
Insulation resistance	Supply DC500V insulation resistance between (a) terminals (b) terminal and earth on mated connectors.
Insulation resistance	Supply AC1000V between (a) terminals (b) terminal and ground on mated connectors for 1minute. Same connection as for insulation resistance test
Temperature rise	Supply current to mated connectors, measure the temperature rise at crimp area, when temperature is saturated. Female connector wire length: 300mm ・Single pole：7A to 1 terminal ・All poles：Connect all poles and apply the current that is calculated by 7A multiplied bythe coefficient in Table below.
Leak current	Supply 16±0.1V to mated connector terminals. Measure maximum leak current.

Pole	Coefficient
1	1
2～3	0.75
4～5	0.6
6～8	0.55
9～12	0.5
13～20	0.4
21～30	0.3
＞30	0.2

Table 6. Initial performances test method - Ⅱ

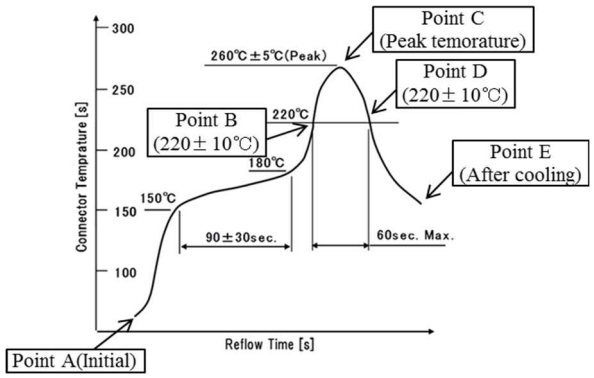
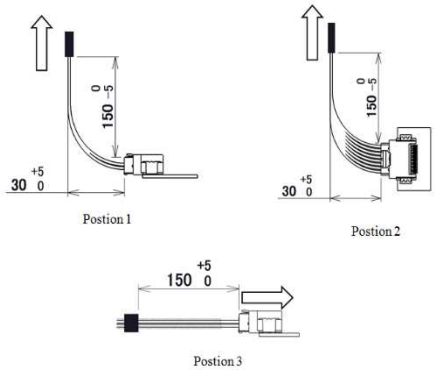
Test Item	Procedure
Coplanarity	Measure coplanarity of male connector lead and peg at initial and 5 points specified in Figure below during the reflow. 
Peg strength	Mate a wired female connector to the soldered male connector, and pull the wire at a rate of 100mm/min. Measure the force when the peg comes out from the PCB. If mating portion has some breakage, it is needed to reinforce them. Fix the connector in the following 3 positions, and pull towards the arrowed direction. 
Lead strength	Using a hook, pull a lead which is soldered onto the male connector, at the rate of 10mm/min at 45°, measure the force when lead comes off the PCB

Table 7. Initial performances test method -Ⅲ

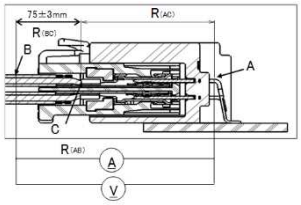
Test Item	Procedure
Audible click	Horizontally insert fully populated female connector to male connector which is soldered onto PCB. Measure by the sound with sound level meter, and analyze the frequency analyzer (FFT). Measurement range:10kHz～20kHz Background noise: 5kHz MIN, Peak: 50dB MAX Measurement must be done in a room. Keep the position of the connector lock 600mm away from sound level meter. Fix PCB and measure the lock sound without any touches.
Terminal crimp strength	Crimp wire of 100mm approx. to female terminal and pull at the speed of 50-100mm/min. Measure the force required to break the wire or pull out of the crimp portion. Do not used insulation barrel
Terminal insertion force	Measure the force to insert female terminal into fixed male connector at a speed of 100 mm/min.
Terminal removal force	Measure the force to pull out female terminal from male connector at a speed of 100 mm/min.
Terminal contact force	Calculate female and male terminal contact force. Measure female terminal spring displacement-force characteristics, and calculate contact force from displacement upon male terminal insertion. (accuracy 0.01mm MAX)
Terminal bend strength	(a) Push male terminals in mating direction from housing entrance at speed of 50mm/min with the load (maximum of connector insertion force). (b) Remove housing walls around male terminals. Push terminals at speed of 50mm/min in the direction perpendicular to mating axes (4 directions: up, down, left, right)with force of 3N.
Voltage drop	Open: 12V, Short circuit: 1A Measure the difference between male connector lead and temp. measurement point when temperature reached saturation at 75mm from female terminal crimp. Then, subtract voltage drop of wires and male connector lead Wire resistance: 3.77mΩ/75mm (20℃) or actual measurement. 
Dry circuit resistance	Open: 20±5mV, Short circuit: 10±0.5mA Subtract resistance of point 75mm from female terminal crimp and male connector lead. Then, subtract resistance of wires and male connector lead Wire resistance: 3.77mΩ/75mm (20℃) or actual measurement.
Microcut monitoring	Measure dry circuit resistance.

Table 8. Initial performances test method -Ⅳ

Test Item	Procedure
Terminal retention force	Measure the force to pull out female terminal from female connector housing at a speed of 100mm/min. Test with and without retainer.
Terminal to housing insertion force	Measure the force to fully insert female terminal into female connector housing at a speed of 100mm/min.
Retainer/hinge insertion/removal force	Fully populate female connector housing. Measure the force required to insert and remove the retainer/hinge at speed of 100mm/min.
Housing lock strength without terminals	Measure the maximum force to pull out unpopulated female connector housing from mated status at a speed of 100mm/min.
Sn whisker	Check the surface of connector's metal portions(terminals, lead) with microscope, etc. to find Sn whisker. Use microscope with magnification of X100 MIN. Check closely not to lose sight of whisker with different magnifications.

Table 9. Environmental performances test method - I

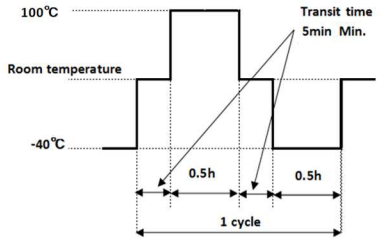
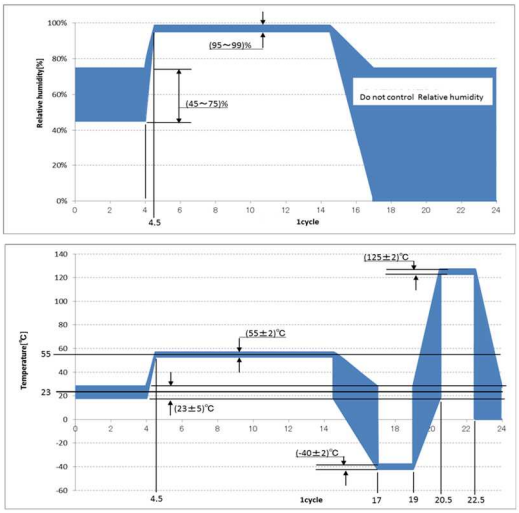
Test item	Procedure
Repeated insertion/removal	Measure the force required to insert/remove populated female connector into/from fixed male connector at speed of 100mm/min. Repeat 10 times. Lock must be disengaged.
Resistance to forced mating (with 98N in 4 directions)	Insert populated female connector into male connector. Apply force of 98N from 4 directions perpendicular to insertion axes. Apply force twice per direction. Repeat 10 times. Female connector insertion depths: 1)depth at which terminals start to touch and 2) depth of maximum insertion.
Fretting corrosion	Insert female terminals into male connector and subject them to micro motion. Frictional distance: 0.23mm, Cycle time: 1-2 Hz, No. of cycles: 5,000 Monitor dry circuit resistance during test.
Thermal aging	Place mated connectors in thermal chamber at 125±3℃ for 120h. Remove the connectors from the chamber and leave it to ambient temperature to recover.
Low temperature aging	Place mated connector in thermal chamber at −40±3℃ for 120h. Repeat insert/remove for 5 times immediately after removing from the chamber, then leave to recover to ambient temperature.
Thermal shock	Place mated connectors in thermal chamber and subject them to heat /cold cycle (100±3℃/-40±3℃). No of cycles: 3000 Duration (0.5h) may be shortened if sample's temperature reaches test temperature requirement early. Monitor resistance during test, open circuit 20±5mV, short circuit 10±0.5mA 
Temperature/humidity cycle	Place mated connectors in climatic chamber and subject them to the cycle pattern specified in Figure below. Duration 24h, No. of cycles: 10, Temperature: 85±3℃. 

Table 10. Environmental performances test method - Ⅱ

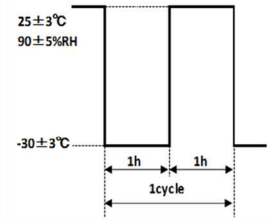
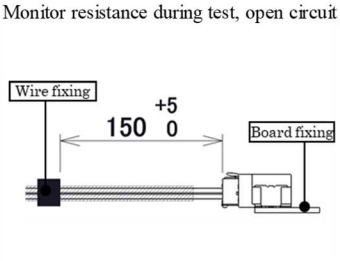
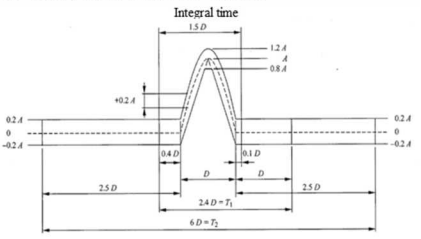
Test item	Procedure
Resistance to humidity	Place mated connectors in climatic chamber and subject them to 60℃±5℃, 90～95%RH for 96h. Hang connectors to prevent any dews developing on the connectors.
Resistance to abrasion	Suspend mated connectors in the chamber and spray dust for 10s every 15 min. Insert/remove connectors every other cycle. No. of cycles: 8 Chamber length must be 900-1200mm. Use approx. 1.5kg of dust particles of Kanto Loam layer or Portland cement (JIS R5210).
Corrosion gas	Place male and female connectors (not mated) in 25±5ppm, 40±2℃, 90-95%RH, SO2 gas for 96h.
Resistance to stress corrosion	Degrease female terminals, cleanse with 10%H2SO4, rinse under water and dry. Submerge in solution of free ammonia 6N, copper 10.2g/L for 3h, then remove. Making test solution: Mix, ammonia (28%～30%): Purified water = 1:1.6, to make 6N ammonia water. Mix copper powder (10.2g) with 6N ammonia solution (1L).
Condensation	Place mated connectors in climatic chamber and subject them to the following cycle. 1 cycle: 1h at -30±3℃, then 1h at 25±3℃ and 90±5%RH No. of cycles: 48 
Dump heat cycle	Place mated connectors in the chamber and apply current for 1000h at 85±3℃、85±5%RH. Measure the leak current during the test.
Current cycle	Place the mated connectors in thermal chamber at 70℃±3℃. Energize 1.5mm terminals and 0.5mm terminals in series, and apply the current value (1.5mm terminal : 7A , 0.5mm terminal : 3A) for 45min, then break for 15min. No. of cycles: 300.
Shock	Fix mated connectors and subject to impact. Use impact according to Figure below sinusoidal half-wave. Duration D=6ms, Peak acceleration A=981m/s2 Directions: 6 directions (top, down, left, right, front back), 3 shocks each direction Connect all terminals in direct circuit. Monitor resistance during test, open circuit 20±5mV, short circuit 10±0.5mA.  Fixing method  Sinusoidal half-wave

Table 11. Environmental performances test method -Ⅲ

Test item	Procedure
Vibration	Fix mated connectors in same way as the shock test on fixture and subject them to vibration. ◎Vibration condition ・Direction: 3 (front-back, left-right, top-bottom) ・Acceleration: 66.6m/s2, ・Duration: 2h(front-back, left-right), 4h(top-bottom) ・Frequency: 10-50Hz ・Sweep time: 8min (per sweep) Energize all terminals in series with, open 13+1/0V, short circuit 10±0.5mA, continuously during test.
Vibration with temperature change	Fix mated connectors in same way as the shock test on fixture and subject them to vibration at 100±3℃. ◎Vibration condition ・Acceleration: 59.8m/s2 ・Frequency: 20-200Hz ・Sweep time: 3min (per sweep) Apply the current value(1.5mm terminal : 4.5A , 0.5mm terminal : 2A) for 45min, break for 15min. No. of cycles: 300 Repeat in other directions. Monitor resistance during current supply. After test, carry out vibration test on 3 axes, each for 1h. Check for any microcuts.