

ISH[®] HYBRID CONNECTOR (NORMAL LOCK)

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 HYBRID CONNECTOR.

2. Specimen

Items shown in Table 1 were evaluated.

Table 1. List of samples

Pole	KEY CODING	Lock type	Cable	PARTS No.			Test result
				MALE ASSY	FEMALE SUB ASSY	FEMALE TERMINAL	
28P	-	NORMAL	0.5mm: AESSX-HT 0.3sq 1.5mm: BEAMEX-ER500 0.5sq	V0123-028E-01	V0124-028B-02	0.5mm: VT009-02 x 18pin 1.5mm: VT011-02 x 2pin	Initial: Sheet 3 Durability: Sheet 4~6

3. Test conditions

In compliance with Product Specification 【PSS-0035】.

4. Result

All test items were satisfied.

- For detail of the test results, see Table 2 ~ 5.
- For resistance monitoring during durability test, see Graphs 1 ~ 4.

Table 2. List of results: Initial properties (28P)

Measurement	Specification	Set	n	Unit	Data					Judge.		
					Avg.	Max.	Min.	s	Avg.±3s			
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	71.2N MAX.	5	5	N	58.67	60.0	56.9	1.59	63.44	✓		
Connector unmating force	66.2N MAX.	5	5	N	52.20	52.8	50.8	0.83	54.69	✓		
Connector retention force	Direction 1	100N MIN.	5	5	N	288.33	296.7	276.4	10.61	256.50	✓	
	Direction 2	100N MIN.	5	5	N	262.70	274.8	245.7	14.87	218.09	✓	
	Direction 3	100N MIN.	5	5	N	409.76	417.5	399.1	8.05	385.61	✓	
	Direction 4	100N MIN.	5	5	N	397.76	421.3	360.0	25.37	321.65	✓	
Unlocking force	50N MAX.	5	5	N	10.02	10.2	9.8	0.16	10.50	✓		
Insulation resistance	Between terminals	100MΩ MIN.	5	5	-	1,000MΩ以上					✓	
	Between terminal and housing	100MΩ MIN.	5	5	-	1,000MΩ以上					✓	
Withstanding voltage	Between terminals	No insulation breakdown or erosion	5	5	-	No insulation breakdown					✓	
	Between terminal and housing	No insulation breakdown or erosion	5	5	-	No insulation breakdown					✓	
Temperature rise	Single pom	0.5mm	ΔT=50°C MAX.	5	5	°C	26.30	28.0	24.5	1.61	31.13	✓
		1.5mm	ΔT=50°C MAX.	5	5	°C	33.66	34.7	32.7	0.97	36.57	✓
	All pin	0.5mm	ΔT=50°C MAX.	5	5	°C	26.06	27.5	24.7	1.06	29.24	✓
		1.5mm	ΔT=50°C MAX.	5	5	°C	31.84	32.8	30.9	0.86	34.42	✓
Leak current	1mA MAX.	5	5	-	1μA以下					✓		
Coplanarity	0.1mm MAX.	5	5	mm	0.07 Max.					✓		
Peg strength	Position 1	70N MIN.	5	5	N	200.43	222.6	180.7	21.06	137.25	✓	
	Position 2	100N MIN.	5	5	N	262.60	274.3	253.5	10.64	230.68	✓	
	Position 3	100N MIN.	5	5	N	786.80	794.2	781.5	6.61	766.97	✓	
Audible click	60dB MIN.	5	5	dB	66.76	68.0	65.6	1.01	63.73	✓		
Terminal crimp strength	0.5mm	70N MIN.	-	26	N	80.48	85.1	75.9	2.96	71.60	✓	
	1.5mm	90N MIN.	-	10	N	120.36	124.6	117.7	2.34	113.34	✓	
Terminal insertion force	0.5mm	0.5N~3.0N	-	10	N	1.488	1.78	1.22	0.173	2.007	✓	
	1.5mm	3.5N~4.5N	-	10	N	3.732	4.14	3.50	0.242	4.458	✓	
Terminal removal force	0.5mm	0.5N~3.0N	-	10	N	1.531	1.85	1.26	0.206	2.149	✓	
	1.5mm	3.5N~4.5N	-	10	N	3.623	3.94	3.33	0.233	4.322	✓	
Terminal contact force	0.5mm	3N MIN.	-	10	N	3.734	3.95	3.53	0.150	3.284	✓	
	1.5mm	4N MIN.	-	10	N	8.353	8.97	8.09	0.354	7.291	✓	
Terminal bend strength	a	0.5mm	Must not bend 1mm or over	-	10	-	Does not bend 1mm or over					✓
		1.5mm	Must not bend 1mm or over	-	20	-	Does not bend 1mm or over					✓
	b	0.5mm	Terminal bending 30° MAX.	-	10	N	2.598	4.43	1.10	1.250	6.348	✓
		1.5mm	Terminal bending 30° MAX.	-	20	N	1.801	2.66	0.82	0.734	4.003	✓
Voltage drop	0.5mm	10mV/A MAX.	5	130	mV/A	2.817	3.15	2.23	0.359	3.894	✓	
	1.5mm	10mV/A MAX.	5	10	mV/A	1.007	1.44	0.47	0.428	2.291	✓	
Dry circuit resistance	0.5mm	10mΩ MAX.	5	130	mΩ	2.696	2.87	2.46	0.179	3.233	✓	
	1.5mm	10mΩ MAX.	5	10	mΩ	0.952	1.19	0.60	0.271	1.765	✓	
Microcut	1μsMIN.7.0MAX.	-	-	-	Confirm by each durability test					-		
Terminal retention force	With secondary lock	0.5mm	49N MIN.	1	26	N	92.03	93.5	89.7	1.39	87.86	✓
		1.5mm	100N MIN.	3	6	N	122.40	125.7	118.0	2.39	115.23	✓
	Without secondary lock	0.5mm	20N MIN.	1	26	N	43.74	51.2	36.4	4.93	28.95	✓
		1.5mm	50N MIN.	3	6	N	71.22	72.9	68.2	1.66	66.24	✓
Terminal to housing insertion force	0.5mm	10N MAX.	1	26	N	4.892	5.30	4.39	0.337	5.903	✓	
	1.5mm	15N MAX.	5	10	N	6.629	7.27	6.15	0.423	7.898	✓	
Retainer insertion/removal force	Insertion force	29.4N MAX.	5	5	N	21.91	24.4	19.6	2.08	28.15	✓	
	Removal force	14.7N MIN.	5	5	N	39.68	40.8	38.2	1.18	36.14	✓	
Housing lock strength without terminals	49N MIN.	5	5	N	275.96	277.9	273.6	2.14	269.54	✓		
Sn whisker	125μm MAX.	5	5	-	No whisker					✓		

Initial characteristics

Table 3. List of results: Properties after endurance tests – I (28P)

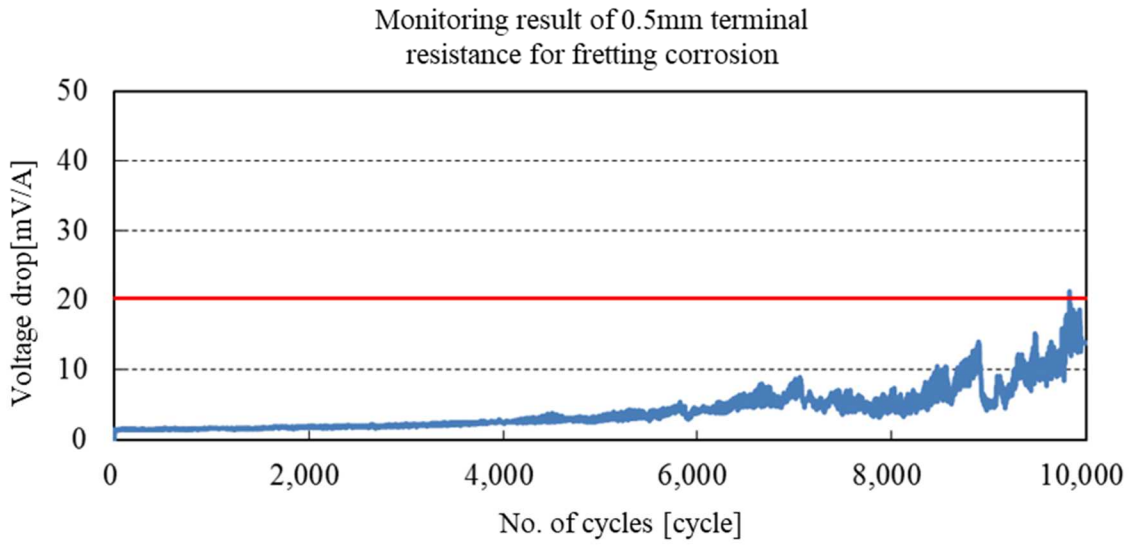
Item	Measurement		Requirements	Set	n	Unit	Data					Judge.	
							Avg.	Max.	Min.	s	Avg.±3s		
Repeated insertion/removal	Connector mating force	After 5 repeat	71.2N MAX.	5	5	N	61.25	62.6	60.0	1.08	64.49	✓	
		After test	71.2N MAX.	5	5	N	57.49	60.4	54.5	2.28	64.33	✓	
	Connector unmating force	After 5 repeat	66.2N MAX.	5	5	N	62.45	64.1	60.6	1.32	66.41	✓	
		After test	66.2N MAX.	5	5	N	60.83	62.1	59.1	1.34	64.85	✓	
	Voltage drop	Initial	0.5mm	10mV/A MAX.	5	130	mV/A	2.664	3.25	2.41	0.223	3.333	✓
			1.5mm	10mV/A MAX.	5	10	mV/A	0.818	1.17	0.68	0.164	1.310	✓
			0.5mm	20mV/A MAX.	5	130	mV/A	4.217	5.54	2.99	0.451	5.570	✓
Voltage drop	After test	0.5mm	20mV/A MAX.	5	10	mV/A	2.298	3.48	1.27	0.678	4.332	✓	
		1.5mm	20mV/A MAX.	5	10	mV/A	2.298	3.48	1.27	0.678	4.332	✓	
		1.5mm	20mV/A MAX.	5	10	mV/A	2.298	3.48	1.27	0.678	4.332	✓	
Resistance to forced mating	Connector mating force		67N MAX.	5	5	N	55.89	58.0	54.4	1.80	61.29	✓	
	Connector unmating force		67N MAX.	5	5	N	51.83	54.5	50.2	1.68	56.87	✓	
	Voltage drop	Initial	0.5mm	10mV/A MAX.	5	130	mV/A	2.780	3.28	2.30	0.329	3.767	✓
			1.5mm	10mV/A MAX.	5	10	V/A	1.089	1.01	0.98	0.036	1.197	✓
		After test	0.5mm	20mV/A MAX.	5	130	V/A	2.682	3.47	2.14	0.262	3.468	✓
1.5mm			20mV/A MAX.	5	10	V/A	0.967	1.03	0.90	0.093	1.246	✓	
Fretting corrosion	Dry circuit resistance	0.5mm	Grasp the ability value	-	5	-	See Graphs 1 and 2.					✓	
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	287.06	291.8	279.5	5.40	270.86	✓	
	Terminal crimp strength	0.5mm	70N MIN.	-	10	N	83.32	86.1	81.0	1.55	78.67	✓	
		1.5mm	90N MIN.	-	10	N	113.18	119.7	106.2	5.15	97.73	✓	
	Dry circuit resistance	Initial	0.5mm	10mΩ MAX.	5	130	mΩ	2.002	2.89	1.48	0.323	2.971	✓
			1.5mm	10mΩ MAX.	5	10	mΩ	0.810	0.99	0.64	0.119	1.167	✓
		After test	0.5mm	20mΩ MAX.	5	130	mΩ	2.697	3.48	2.09	0.368	3.801	✓
			1.5mm	20mΩ MAX.	5	10	mΩ	1.104	1.33	0.81	0.154	1.566	✓
	Terminal retention force	With secondary lock	0.5mm	49N MIN.	2	26	N	88.64	90.6	85.4	1.45	84.29	✓
			1.5mm	100N MIN.	3	6	N	127.09	131.2	122.9	2.95	118.24	✓
		Without secondary lock	0.5mm	20N MIN.	2	26	N	50.31	59.0	35.0	7.07	29.10	✓
1.5mm			60N MIN.	3	6	N	75.17	84.8	67.6	8.08	50.93	✓	
Housing lock strength without terminals		49N MIN.	5	5	N	292.87	298.3	285.4	4.94	278.05	✓		
Low temperature 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	0.5mm	10mΩ MAX.	5	130	mΩ	2.180	2.79	1.70	0.224	2.852	✓
			1.5mm	10mΩ MAX.	5	10	mΩ	0.936	1.23	0.77	0.168	1.440	✓
		After test	0.5mm	20mΩ MAX.	5	130	mΩ	2.349	2.99	1.87	0.212	2.985	✓
			1.5mm	20mΩ MAX.	5	10	mΩ	0.870	1.10	0.80	0.130	1.260	✓
	Terminal retention force	With secondary lock	0.5mm	49N MIN.	2	26	N	89.44	89.9	87.8	0.71	87.31	✓
			1.5mm	100N MIN.	3	6	N	129.55	131.3	126.7	2.05	123.40	✓
		Without secondary lock	0.5mm	20N MIN.	2	26	N	44.92	56.9	32.6	7.08	23.68	✓
			1.5mm	60N MIN.	3	6	N	67.04	70.1	64.1	2.04	60.92	✓
	Housing lock strength without terminals		49N MIN.	5	5	N	264.06	274.4	256.7	7.14	242.64	✓	
	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	290.60	295.50	287.70	2.90	281.90	✓	
Terminal crimp strength		0.5mm	70N MIN.	-	10	N	87.18	90.00	83.40	2.12	80.82	✓	
		1.5mm	90N MIN.	-	10	N	118.73	123.90	113.10	3.86	107.15	✓	
Dry circuit resistance		Initial	0.5mm	10mΩ MAX.	5	130	mΩ	2.236	2.94	1.36	0.369	3.343	✓
			1.5mm	10mΩ MAX.	5	10	mΩ	1.057	1.27	0.91	0.099	1.354	✓
		After test	0.5mm	20mΩ MAX.	5	130	mΩ	3.357	5.41	3.40	0.887	6.018	✓
			1.5mm	20mΩ MAX.	5	10	mΩ	1.599	1.76	1.36	0.133	1.998	✓
Terminal retention force		With secondary lock	0.5mm	49N MIN.	2	26	N	91.60	92.4	90.0	0.61	89.77	✓
			1.5mm	100N MIN.	3	6	N	128.14	130.0	122.0	3.00	119.14	✓
		Without secondary lock	0.5mm	20N MIN.	2	26	N	46.43	58.0	36.7	7.00	25.43	✓
	1.5mm		60N MIN.	3	6	N	76.36	80.4	71.6	4.01	64.33	✓	

Table 4. List of results: Properties after endurance tests – II (28P)

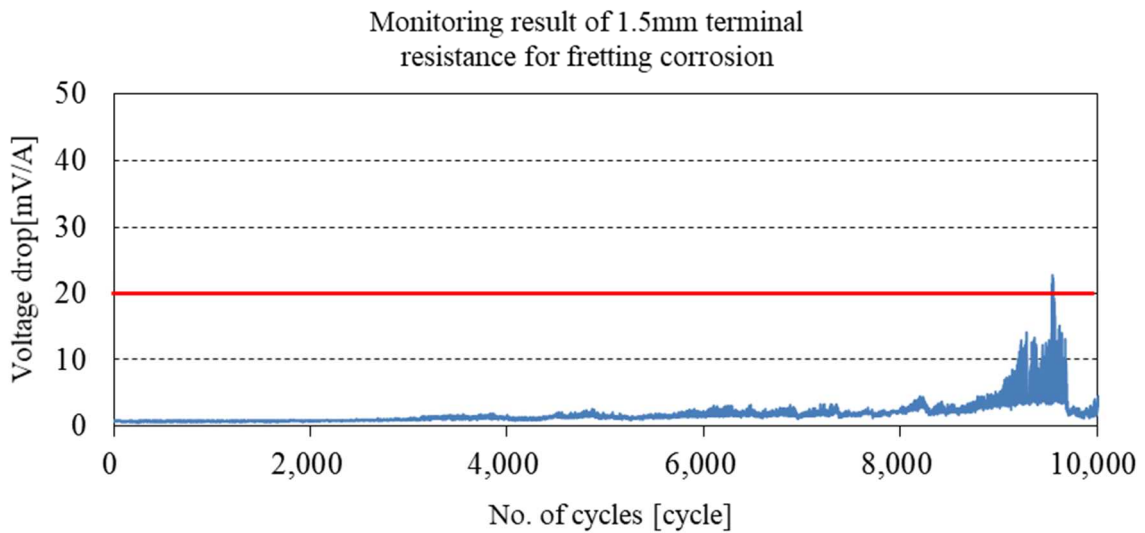
Item	Measurement		Requirements	Set	n	Unit	Data					Judge.	
							Avg.	Max.	Min.	s	Avg.±3s		
Temperature /humidity cycle	Housing appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓	
	Feeling (insertion/removal)		No discomfort	5	5	-	No discomfort					✓	
	Insulation resistance	Between terminals	100MΩ MIN.	5	5	-	10,000MΩ MIN.					✓	
		Between terminal and housing	100MΩ MIN.	5	5	-	10,000MΩ MIN.					✓	
	Withstanding voltage	Between terminals	No insulation breakdown or erosion	5	5	-	No insulation breakdown					✓	
		Between terminal and housing	No insulation breakdown or erosion	5	5	-	No insulation breakdown					✓	
	Leak current		1mA MAX.	5	5	-	0.1mA MAX.					✓	
	Dry circuit resistance	Initial	0.5mm	10mΩ MAX.	5	130	mΩ	2.837	3.42	2.31	0.302	3.743	✓
			1.5mm	10mΩ MAX.	5	10	mΩ	1.155	1.36	1.04	0.085	1.410	✓
		After test	0.5mm	20mΩ MAX.	5	130	mΩ	3.152	4.05	2.50	0.354	4.214	✓
			1.5mm	20mΩ MAX.	5	10	mΩ	1.235	1.62	0.95	0.191	1.808	✓
	Terminal retention force	secondary lock	0.5mm	49N MIN.	2	26	N	91.29	91.7	90.4	0.36	90.21	✓
			1.5mm	100N MIN.	3	6	N	129.53	133.1	125.9	3.06	120.35	✓
		secondary lock	0.5mm	20N MIN.	2	26	N	46.10	53.5	37.7	5.06	30.92	✓
1.5mm			60N MIN.	3	6	N	69.78	71.7	67.8	1.94	63.96	✓	
Resistance to humidity	Housing appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓	
	Connector retention force	Direction 1	100N MIN.	5	5	N	298.00	305.9	292.0	5.14	282.58	✓	
		Between terminals	100MΩ MIN.	5	5	-	10,000MΩ MIN.					✓	
	Insulation resistance	Between terminal and housing	100MΩ MIN.	5	5	-	10,000MΩ MIN.					✓	
		Between terminals	No insulation breakdown or erosion	5	5	-	No insulation breakdown					✓	
	Withstanding voltage	Between terminal and housing	No insulation breakdown or erosion	5	5	-	No insulation breakdown					✓	
		Leak current		1mA MAX.	5	5	-	0.1mA MAX.					✓
	Dry circuit resistance	Initial	0.5mm	10mΩ MAX.	5	130	mΩ	2.560	3.34	1.67	0.470	3.970	✓
			1.5mm	10mΩ MAX.	5	10	mΩ	1.091	1.18	0.98	0.060	1.271	✓
		After test	0.5mm	20mΩ MAX.	5	130	mΩ	2.634	3.12	2.34	0.164	3.126	✓
			1.5mm	20mΩ MAX.	5	10	mΩ	1.144	1.38	1.07	0.086	1.402	✓
	Terminal retention force	secondary lock	0.5mm	49N MIN.	2	26	N	88.87	89.3	87.7	0.56	87.19	✓
			1.5mm	100N MIN.	3	6	N	116.14	122.4	111.8	4.45	102.79	✓
		secondary lock	0.5mm	20N MIN.	2	26	N	46.67	52.2	36.8	4.35	33.62	✓
1.5mm			60N MIN.	3	6	N	67.39	70.2	64.8	2.20	60.79	✓	
Resistance to abrasion	Terminal appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓	
	Housing appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓	
	Voltage drop	Initial	0.5mm	10mV/A MAX.	5	130	V/A	3.145	3.61	3.02	0.147	3.586	✓
			1.5mm	10mV/A MAX.	5	10	V/A	1.352	1.43	1.13	0.102	1.658	✓
		After test	0.5mm	20mV/A MAX.	5	130	V/A	2.836	3.21	2.72	0.130	3.226	✓
			1.5mm	20mV/A MAX.	5	10	V/A	1.145	1.32	0.96	0.088	1.409	✓
Corrosion gas	Terminal appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓	
	Housing appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓	
	Terminal crimp strength	0.5mm	70N MIN.	-	10	N	87.17	89.9	83.6	1.76	81.89	✓	
		1.5mm	90N MIN.	-	10	N	124.40	126.5	122.5	1.52	119.84	✓	
	Voltage drop	Initial	0.5mm	10mV/A MAX.	5	130	V/A	3.005	3.19	2.79	0.081	3.248	✓
			1.5mm	10mV/A MAX.	5	10	V/A	1.067	1.12	1.03	0.031	1.160	✓
		After test	0.5mm	20mV/A MAX.	5	130	V/A	3.217	3.97	2.40	0.297	4.108	✓
			1.5mm	20mV/A MAX.	5	10	V/A	1.255	1.75	0.66	0.362	2.341	✓
Resistance to stress corrosion	Terminal appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓	
	Terminal crimp strength	0.5mm	70N MIN.	-	10	N	79.41	82.40	77.60	2.61	71.58	✓	
		1.5mm	90N MIN.	-	10	N	119.81	120.10	119.30	0.43	118.52	✓	
Condensation	Terminal appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓	
	Housing appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓	
	Insulation resistance	Between terminals	100MΩ MIN.	5	5	-	10,000MΩ MIN.					✓	
		Between terminal and housing	100MΩ MIN.	5	5	-	10,000MΩ MIN.					✓	
	Withstanding voltage	Between terminals	No insulation breakdown or erosion	5	5	-	No insulation breakdown					✓	
		Between terminal and housing	No insulation breakdown or erosion	5	5	-	No insulation breakdown					✓	
	Leak current		1mA MAX.	5	5	-	1μA MAX.					✓	
	Dry circuit resistance	Initial	0.5mm	10mΩ MAX.	5	130	mΩ	2.860	3.44	2.34	0.329	3.847	✓
1.5mm			10mΩ MAX.	5	10	mΩ	1.233	1.48	1.05	0.130	1.623	✓	
After test		0.5mm	20mΩ MAX.	5	130	mΩ	2.875	3.25	2.55	0.146	3.313	✓	
		1.5mm	20mΩ MAX.	5	10	mΩ	1.132	1.40	0.94	0.138	1.546	✓	

Table 5. List of results: Properties after endurance tests –III (28P)

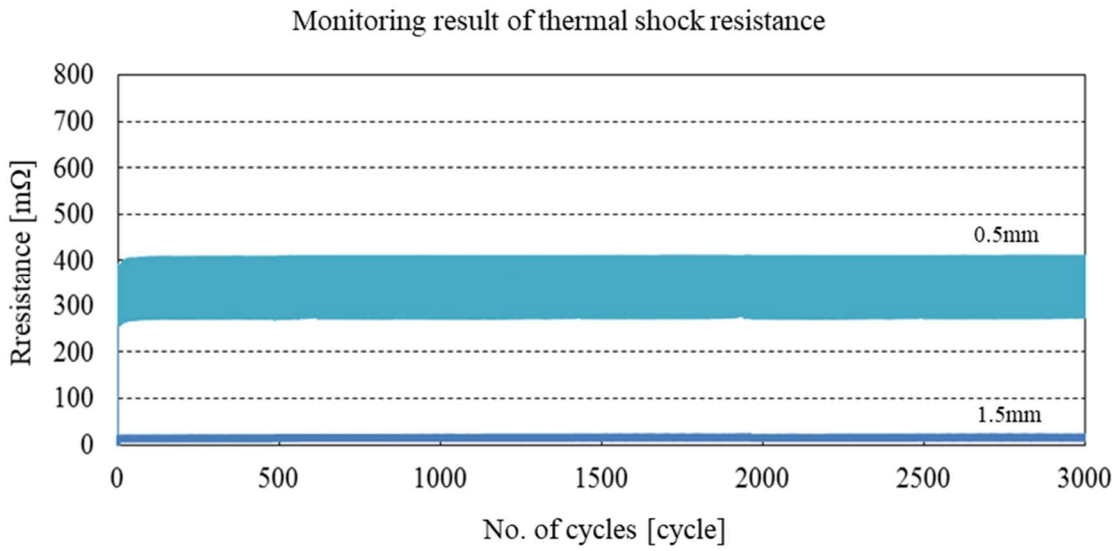
Item	Measurement		Requirements	Set	n	Unit	Data					Judge.			
							Avg.	Max.	Min.	s	Avg±3s				
Dump heat cycle	Housing appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓			
	Leak current		1mA MAX.	5	5	-	1μA MAX.					✓			
	Insulation resistance	250h	0.5mm	100MΩ MIN.	5	5	-	10,000MΩ MIN.					✓		
			1.5mm	100MΩ MIN.	5	5	-	10,000MΩ MIN.					✓		
		500h	0.5mm	100MΩ MIN.	5	5	-	10,000MΩ MIN.					✓		
			1.5mm	100MΩ MIN.	5	5	-	10,000MΩ MIN.					✓		
		750h	0.5mm	100MΩ MIN.	5	5	-	10,000MΩ MIN.					✓		
			1.5mm	100MΩ MIN.	5	5	-	10,000MΩ MIN.					✓		
	1000h	0.5mm	100MΩ MIN.	5	5	-	10,000MΩ MIN.					✓			
		1.5mm	100MΩ MIN.	5	5	-	10,000MΩ MIN.					✓			
Migration		No migration	5	5	-	No migration					✓				
Current cycle	Temperature rise	Initial	Single pole	0.5mm	ΔT=50°C MAX.	5	5	°C	26.74	27.7	25.6	0.73	28.93	✓	
				1.5mm	ΔT=50°C MAX.	5	5	°C	33.30	34.1	32.9	0.53	34.89	✓	
			All poles	0.5mm	ΔT=50°C MAX.	5	5	°C	27.85	29.3	26.2	1.14	31.27	✓	
		After test	Single pole	0.5mm	ΔT=50°C MAX.	5	5	°C	31.06	31.5	29.9	0.67	33.07	✓	
				1.5mm	ΔT=50°C MAX.	5	5	°C	30.13	31.7	28.5	1.47	34.54	✓	
			All poles	0.5mm	ΔT=50°C MAX.	5	5	°C	36.57	37.0	36.1	0.34	37.59	✓	
	Voltage drop	Initial	0.5mm	10mV/A MAX.	5	130	V/A	2.706	3.25	2.23	0.205	3.321	✓		
			1.5mm	10mV/A MAX.	5	10	V/A	0.889	1.32	0.70	0.185	1.444	✓		
		After test	0.5mm	20mV/A MAX.	5	130	V/A	2.835	3.31	2.52	0.167	3.336	✓		
	Shock	Voltage drop	Initial	Single pole	0.5mm	10mV/A MAX.	5	130	V/A	2.650	3.15	2.20	0.171	3.163	✓
					1.5mm	10mV/A MAX.	5	10	V/A	0.959	1.18	0.86	0.110	1.289	✓
			After test	Single pole	0.5mm	20mV/A MAX.	5	130	V/A	2.644	3.05	2.07	0.182	3.190	✓
					1.5mm	20mV/A MAX.	5	10	V/A	1.099	1.27	0.86	0.146	1.537	✓
			Microcut		1μsMIN.7ΩMAX.	5	5	-	No microcut					✓	
Temperature rise			Initial	Single pole	0.5mm	ΔT=50°C MAX.	5	5	°C	24.87	26.7	23.7	1.34	28.89	✓
		1.5mm			ΔT=50°C MAX.	5	5	°C	33.25	33.5	32.9	0.28	34.09	✓	
		All poles		0.5mm	ΔT=50°C MAX.	5	5	°C	22.61	23.6	21.9	0.71	24.74	✓	
		After test	Single pole	0.5mm	ΔT=50°C MAX.	5	5	°C	30.26	30.5	30.0	0.20	30.86	✓	
				1.5mm	ΔT=50°C MAX.	5	5	°C	26.41	28.1	25.5	1.12	29.77	✓	
			All poles	0.5mm	ΔT=50°C MAX.	5	5	°C	36.57	37.3	36.1	0.46	37.95	✓	
Voltage drop		Initial	Single pole	0.5mm	10mV/A MAX.	5	130	V/A	2.089	2.80	1.46	0.277	2.920	✓	
				1.5mm	10mV/A MAX.	5	10	V/A	1.048	1.38	0.73	0.187	1.609	✓	
		After test	Single pole	0.5mm	20mV/A MAX.	5	130	V/A	2.518	3.39	1.83	0.311	3.451	✓	
	1.5mm			20mV/A MAX.	5	10	V/A	1.009	1.20	0.81	0.143	1.438	✓		
	Dry circuit resistance	Initial	0.5mm	10mΩ MAX.	5	130	mΩ	2.180	2.79	1.70	0.224	2.852	✓		
			1.5mm	10mΩ MAX.	5	10	mΩ	1.046	1.27	0.82	0.161	1.529	✓		
After test	Single pole	0.5mm	20mΩ MAX.	5	130	mΩ	2.436	3.30	1.88	0.304	3.348	✓			
		1.5mm	20mΩ MAX.	5	10	mΩ	0.982	1.07	0.87	0.071	1.195	✓			
Microcut		1μsMIN.7ΩMAX.	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		0.5mm	3N MIN.	-	10	N	3.544	3.67	3.46	0.068	3.340	✓		
			1.5mm	4N MIN.	-	10	N	7.830	8.00	7.74	0.085	7.575	✓		
	Voltage drop	Initial	Single pole	0.5mm	10mV/A MAX.	5	130	V/A	2.476	3.91	0.64	0.761	4.759	✓	
				1.5mm	10mV/A MAX.	5	10	V/A	1.212	1.57	0.71	0.235	1.917	✓	
		After test	Single pole	0.5mm	20mV/A MAX.	5	130	V/A	4.384	7.35	2.62	1.109	7.711	✓	
				1.5mm	20mV/A MAX.	5	10	V/A	4.166	16.09	1.03	4.506	17.684	✓	
	Dry circuit resistance	Initial	Single pole	0.5mm	10mΩ MAX.	5	130	mΩ	2.362	3.62	0.71	0.740	4.582	✓	
				1.5mm	10mΩ MAX.	5	10	mΩ	1.148	1.52	0.45	0.323	2.117	✓	
		After test	Single pole	0.5mm	20mΩ MAX.	5	130	mΩ	4.034	7.03	2.30	1.114	7.376	✓	
				1.5mm	20mΩ MAX.	5	10	mΩ	1.536	13.00	0.68	4.549	15.183	✓	
	Microcut		1μsMIN.7ΩMAX.	5	5	-	No microcut					✓			



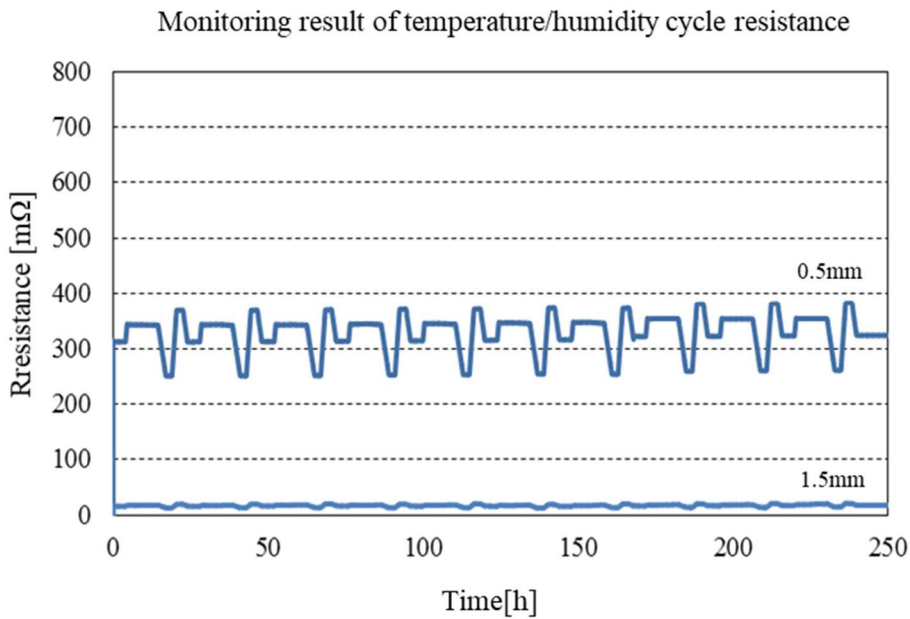
Graph 1. Monitoring result of 0.5mm terminal resistance for fretting corrosion



Graph 2. Monitoring result of 1.5mm terminal resistance for fretting corrosion



Graph 3. Monitoring result of thermal shock resistance



Graph 4. Monitoring result of temperature/humidity cycle resistance

Table 6. Initial performances test method - I

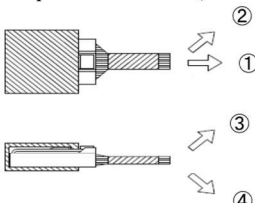
Test item	Procedure														
Terminal external appearance	Visual(e.g. magnifier) and tactile verification.														
Terminal outer dimension	Measure dimensions using caliper, micrometer, projector.														
Housing appearance	Visual(e.g. magnifier) and tactile verification.														
Housing outer dimension	Measure dimensions using caliper, micrometer, projector.														
Feeling (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	<p>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)</p>  <p>The diagram illustrates a cross-section of a female connector being pulled out of a mated state. Four arrows indicate the directions of pull: ① (right), ② (up), ③ (down), and ④ (left).</p>														
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.														
Withstanding voltage	Supply AC1000V between (a) terminals (b) terminal and ground on mated connectors for 1minute. Same connection as for insulation resistance test														
Temperature rise	<p>Supply current to mated connectors, measure the temperature rise at crimp area, when temperature is saturated. Female connector wire length: 300mm</p> <ul style="list-style-type: none"> • Single pin : Apply current to 1 terminal.(1.5mm terminal : 11A, 0.5mm terminal : 7A) • All poles : Connect 1.5 mm terminals and 0.5 mm terminals in series, and apply the current value that is calculated by the above current value (7A) multiplied by the coefficient in Table 4. <table border="1" data-bbox="606 1355 837 1545"> <thead> <tr> <th>Pole</th> <th>Coefficient</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>2~3</td> <td>0.75</td> </tr> <tr> <td>4~5</td> <td>0.6</td> </tr> <tr> <td>6~8</td> <td>0.55</td> </tr> <tr> <td>9~12</td> <td>0.5</td> </tr> <tr> <td>13~20</td> <td>0.4</td> </tr> </tbody> </table>	Pole	Coefficient	1	1	2~3	0.75	4~5	0.6	6~8	0.55	9~12	0.5	13~20	0.4
Pole	Coefficient														
1	1														
2~3	0.75														
4~5	0.6														
6~8	0.55														
9~12	0.5														
13~20	0.4														
Leak current	Supply 16±0.1V to mated connector terminals. Measure maximum leak current.														

Table 7. Initial performances test method - II

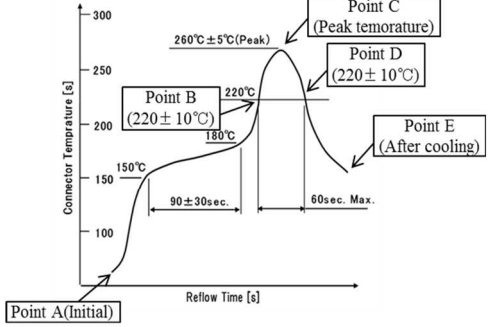
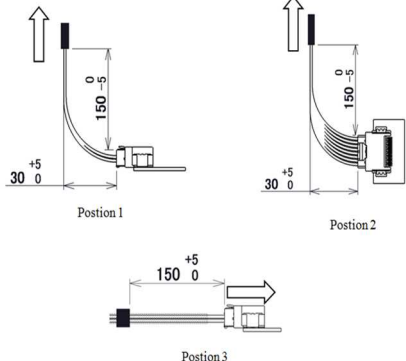
Test item	Procedure
Coplanarity	<p>Measure coplanarity of male connector lead and peg at initial and 5 points specified in Figure below during the reflow.</p> 
Peg strength	<p>Mate a wired female connector to the soldered male connector, and pull the wire at a rate of 100mm/min. Measure the force when 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.</p> 

Table 8. Initial performances test method -III

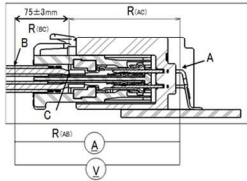
Test item	Procedure														
Audible click of connector mating	Horizontally insert fully populated female connector to male connector which is soldered onto PCB. Measure by the sound with sound level meter, and analyze the frequency analyzer (FFT). Measurement range:10kHz~20kHz Background noise: 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 a terminals at a speed of 50mm/min to the perpendicular direction to mating axis (4 directions: up, down, left, right)with the force. 1.5mm terminal : 12N (only up , down) , 0.5mm terminal : 3N (4 directions) applies a load.														
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: Table below or actual measurement.														
	<table border="1"> <thead> <tr> <th>Wire size(mm²)</th> <th>Resistance(mΩ)</th> </tr> </thead> <tbody> <tr> <td>0.3</td> <td>3.77</td> </tr> <tr> <td>0.5(JIS)</td> <td>2.45</td> </tr> <tr> <td>0.5(ISO)</td> <td>2.8</td> </tr> <tr> <td>0.75</td> <td>1.77</td> </tr> <tr> <td>1.0</td> <td>1.4</td> </tr> <tr> <td>1.25</td> <td>1.07</td> </tr> </tbody> </table> 	Wire size(mm ²)	Resistance(mΩ)	0.3	3.77	0.5(JIS)	2.45	0.5(ISO)	2.8	0.75	1.77	1.0	1.4	1.25	1.07
Wire size(mm ²)	Resistance(mΩ)														
0.3	3.77														
0.5(JIS)	2.45														
0.5(ISO)	2.8														
0.75	1.77														
1.0	1.4														
1.25	1.07														
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: Table above or actual measurement.														
Microcut monitoring	Measure dry circuit resistance.														

Table 9. 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 insertion force to housing	Measure the force to fully insert female terminal into female connector housing at a speed of 100mm/min.
Retainer insertion/removal force	Fully populate female connector housing with the female terminals. Measure the force to insert and remove the retainer at a speed of 100mm/min. Measure the forces for each of the two locking positions.
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 $\times 100$ MIN. Check closely not to lose sight of whisker with different magnifications.

Table 10. Environmental performances test method - I

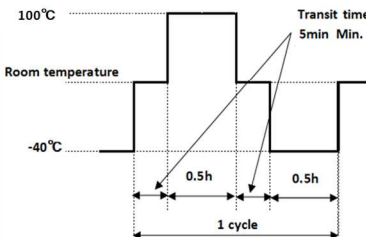
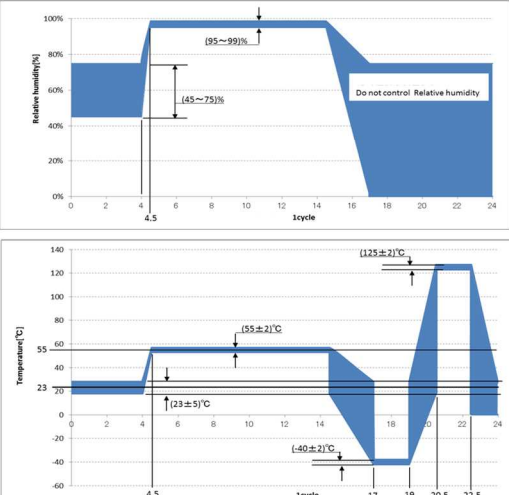
Test item	Procedure
Repeated insertion/removal	Measure the force required to insert/remove populated female connector into/from fixed male connector at speed of 100mm/min. Repeat 10 times. Lock must be disengaged.
Resistance to forced mating (with 98N in 4 directions)	Insert populated female connector 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°C 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°C for 120h. Repeat insert/remove for 5 times immediately after removing from the chamber, then leave to recover to ambient temperature.
Thermal shock	<p>Place mated connectors in thermal chamber and subject them to heat /cold cycle (100±3°C/-40±3°C). 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</p> 
Temperature/humidity cycle	<p>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°C.</p> 

Table 11. Environmental performances test method - II

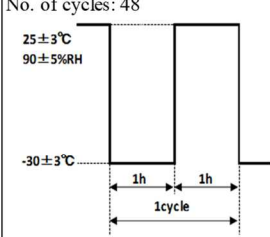
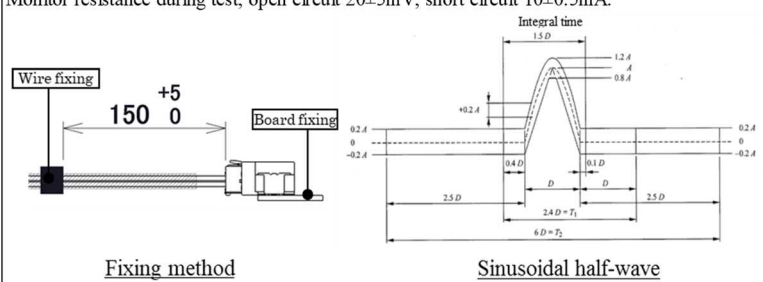
Test item	Procedure
Resistance to humidity	Place mated connectors in climatic chamber and subject them to 60°C±5°C, 90~95%RH for 96h. Hang connectors to prevent any dews developing on the connectors.
Resistance to abrasion	Suspend mated connectors in the chamber and spray dust for 10s every 15 min. Insert/remove 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°C, 90-95%RH, SO ₂ gas for 96h.
Resistance to stress corrosion	Degrease female terminals, cleanse with 10%H ₂ SO ₄ , 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°C, then 1h at 25±3°C 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°C, 85±5%RH. Measure the leak current during the test.
Current cycle	Place the mated connectors in thermal chamber at 70°C±3°C. 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/s ² 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. 

Table 12. 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/s ² , •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°C. ◎Vibration condition •Acceleration: 59.8m/s ² •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.