ISH®VW INLINE CONNECTOR

Test Report

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

1. Purpose

Evaluation test is conducted to verify performance of ISHVW CONNECTOR 8P.
Test is in compliance with LV214.

2. Sample

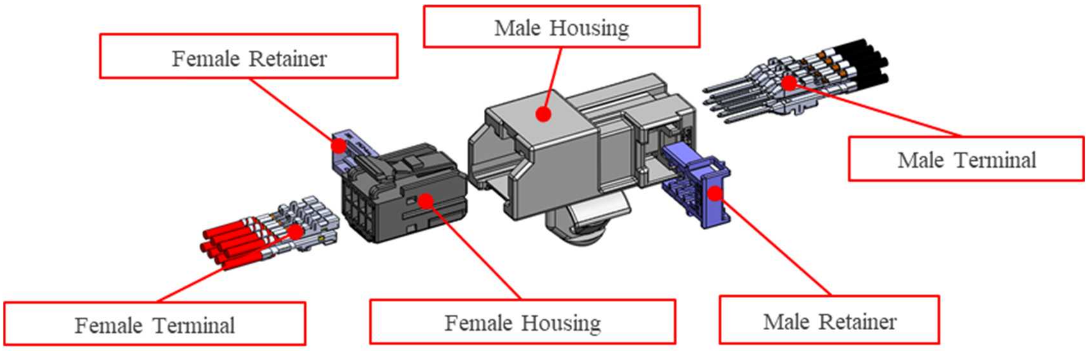
1) MALE

MALE CONNECTOR   Part No. : V0031-008B-201
MALE HOUSING : PBT
MALE RETAINER : GLASS FIELD PBT
MALE TERMINAL
MALE TERMINAL : Brass (Planting : Sn)   Part No. : VT010-01

2) FEMALE

FEMALE HOUSING : PBT   Part No. : V0116-91008-02
RETAINER : PBT   Part No. : V0116-92008-01
FEMALE TERMINAL   Part No. : VT009-01
BOX : Brass (Planting : Sn)
SPRING : Copper alloy (Planting : Sn)
*Contact force : 3.08N

Cable AESSX 0.3sq
AESSX 0.5sq



3. Test Result

See List of Results, Tables 1 to 6, and Graphs 1 to 18.

4. Observation

As a result of the evaluation, the required performance of all items was satisfied.

Table 1. List of Results

PG No.	Item			Requirements	Unit.	Set	n	Data: Ave.	Max.	Min.	s	Ave.±3s	Judge
PG0	E0.1	Visual Inspection		No abnormalities	—	10	10	No abnormalities					Pass
	E0.2	Contact resistance	0.3sq	10mΩ Max	mΩ	5	40	2.711	3.13	2.33	0.233	3.411	Pass
			0.5sq	10mΩ Max	mΩ	5	40	2.380	2.84	1.99	0.244	3.112	Pass
	E0.2.1	Contact resistance in contact area	0.3sq	10mΩ Max	mΩ	5	40	2.351	2.83	1.96	0.244	3.083	Pass
			0.5sq	10mΩ Max	mΩ	5	40	2.208	2.72	1.79	0.274	3.031	Pass
	E0.2.2	Contact resistance in line connection area	0.3sq	10mΩ Max	mΩ	5	40	0.180	0.23	0.14	0.032	0.277	Pass
			0.5sq	10mΩ Max	mΩ	5	40	0.204	0.30	0.11	0.068	0.408	Pass
	E0.3	Insulation resistance		100MΩ Min	MΩ	10	10	1,000MΩ Min					Pass
PG1	E0.1	Visual Inspection		No abnormalities	—	1	1	No abnormalities					Pass
	E1.1	Dimensions		No abnormalities	—	1	1	No abnormalities					Pass
	E1.2	Dimensions (of processed components)		No abnormalities	—	1	1	No abnormalities					Pass
PG2	E0.1	Visual Inspection		No abnormalities	—	1	1	No abnormalities					Pass
	E2.1	Material test of contact parts		—	—	1	1	See attachment 1					—
PG3	E0.1	Visual Inspection		No abnormalities	—	1	1	No abnormalities					Pass
	E3.1	Material test of housing		—	—	1	1	See attachment 2					—
	E3.2	Markings on the surface		No abnormalities	—	1	1	No abnormalities					Pass
PG4	E4.1	Contact engagement length		Contact engagement length >1.00mm	—	1	1	See attachment 3					Pass
				clearance >0mm	—	1	1	See attachment 3					Pass
PG5	E0.1	Visual Inspection		No abnormalities	—	12	96	No abnormalities					Pass
	E5.1	Contact opening dimension in the unused condition		—	mm	1	8	0.303	0.305	0.300	0.003	0.311	—
	E5.1	Contact opening dimension of the DUTs inserted 5 times.		—	mm	1	8	0.309	0.310	0.305	0.002	0.315	—
	E5.2	Normal contact force		—	N	-	8	3.079	3.21	3.00	0.107	2.760	—
		The DUTs inserted 5 times.		—	N	-	8	2.822	3.00	2.80	0.073	2.603	—
	B5.2	All DUTs of test are inserted		—	—	10	80	—					—
	B5.3	Aging in dry heat , inserted		Tmax:125℃	—	10	80	—					—
	E0.1	Visual Inspection		No abnormalities	—	10	80	No abnormalities					Pass
	E5.1	Contact opening dimension	1H	—	mm	1	8	0.311	0.315	0.310	0.002	0.318	—
			100H	—	mm	1	8	0.319	0.325	0.315	0.004	0.329	—
			200H	—	mm	1	8	0.321	0.325	0.315	0.004	0.332	—
			500H	—	mm	1	8	0.323	0.330	0.310	0.006	0.341	—
			1000H	—	mm	1	8	0.328	0.330	0.325	0.003	0.336	—
		Contact opening dimension (after insert/ remove)	1H	—	mm	1	8	0.314	0.315	0.310	0.002	0.321	—
			100H	—	mm	1	8	0.323	0.325	0.320	0.003	0.331	—
			200H	—	mm	1	8	0.323	0.330	0.315	0.005	0.336	—
			500H	—	mm	1	8	0.326	0.330	0.325	0.002	0.331	—
			1000H	—	mm	1	8	0.327	0.330	0.325	0.003	0.335	—

Table 2. List of Results

PG No.	Item				Requirements	Unit.	Set	n	Data Ave.	Max.	Min.	s	Ave.±3s	Judge
PG5	E5.2	Normal contact force		1H	—	N	1	8	2.744	2.80	2.59	0.096	2.457	—
				100H	—	N	1	8	2.538	2.59	2.18	0.146	2.099	—
				200H	—	N	1	8	2.331	2.59	2.18	0.146	1.892	—
				500H	—	N	1	8	2.254	2.80	1.97	0.245	1.518	—
				1000H	—	N	1	8	2.047	2.18	1.97	0.106	1.728	—
		Normal contact force (after insert/ remove)		1H	—	N	1	8	2.641	2.80	2.59	0.096	2.354	—
				100H	—	N	1	8	2.383	2.59	2.18	0.221	1.720	—
				200H	—	N	1	8	2.280	2.59	1.97	0.191	1.706	—
				500H	—	N	1	8	2.150	2.18	1.97	0.073	1.932	—
				1000H	—	N	1	8	2.099	2.18	1.97	0.106	1.779	—
PG6	E0.1	Visual Inspection			No abnormalities	—	5	5	No abnormalities					Pass
	E6.1	Deflection of contacts in the housing cavity			—	—	1	1	See attachment 4					—
	E6.4	Actuation forces of secondary lock	Male	open	10～50N	N	5	5	15.50	16.5	14.3	0.79	13.13	Pass
				close	50N Max.	N	5	5	37.23	37.8	36.5	0.53	38.83	Pass
			Female	open	10～50N	N	5	5	13.53	14.4	12.4	1.05	10.38	Pass
				close	50N Max.	N	5	5	7.068	8.00	5.73	0.978	10.00	Pass
	E0.1	Visual Inspection			No abnormalities	—	5	5	No abnormalities					Pass
PG7	E0.1	Visual Inspection			No abnormalities	—	10	10	No abnormalities					Pass
	E7.2	Retention force of housing latch / lock Connector without contact 1mm change			60N Min.	N	10	10	74.90	78.3	70.9	2.350	67.85	Pass
		Retention force of housing latch /lock Connector without contact Max force			60N Min.	N	10	10	98.61	101.0	96.0	1.570	93.90	Pass
	E0.1	Visual Inspection			No abnormalities	—	10	10	No abnormalities					Pass
PG8	E0.1	Visual Inspection			No abnormalities	—	3	3	No abnormalities					Pass
	E8.1	Determination of the contact insertion forces		Male	—	N	3	24	3.471	4.75	2.06	0.841	5.993	—
				Female	—	N	3	24	2.393	2.90	1.93	0.280	3.234	—
	E8.2.1	Contact removal force from the housing , primary lock only		Male	25N Min.	N	3	24	42.63	44.4	41.0	0.823	40.16	Pass
				Female	25N Min.	N	3	24	39.92	44.0	33.7	2.911	31.19	Pass
	E8.2.2	Contact removal force from the housing , secondary lock only		Male (Pos.1,5)	35N Min.	N	3	24	103.8	115.1	88.2	9.18	76.29	Pass (*1)
				Male (other than Pos.1,5)	35N Min.	N	3	24	48.82	51.8	45.0	2.06	42.64	Pass (*1)
				Female	35N Min.	N	3	24	98.10	113.6	88.3	6.629	78.21	Pass
	E0.1	Visual Inspection			No abnormalities	—	3	3	No abnormalities					Pass
PG9	E9.2	Max. possible insertion inclination Direction X			—	—	1	1	See attachment 5					—
		Max. possible insertion inclination Direction Y			—	—	1	1	See attachment 5					—
	E9.3	Examination of housing for scoop-proofing			—	—	1	1	See attachment 6					—

(*1)Since Pos.1 and 5 have the different shapes of the secondary lock, contact removal force is difference.

Table 3. List of Results

PG No.	Item			Requirements	Unit.	Set	n	Data: Ave.	Max.	Min.	s	Ave.±3s	Judge
PG10	E0.1	Visual Inspection		No abnormalities	—	-	20	No abnormalities					Pass
	E10.1	Conductor pull-out strength	0.3sq Male	50N Min	N	-	10	95.96	100.1	91.2	2.92	87.18	Pass
			0.3sq Female	50N Min	N	-	10	97.15	102.7	90.4	4.81	82.71	Pass
			0.5sq Male	50N Min	N	-	10	117.7	131.3	106	6.70	97.62	Pass
			0.5sq Female	50N Min	N	-	10	117.0	122.2	110	3.66	106.1	Pass
	E0.1	Visual Inspection		No abnormalities	—	-	20	No abnormalities					Pass
PG11	E0.1	Visual Inspection		No abnormalities	—	10	80	No abnormalities					Pass
	E5.1	Contact opening dimensions		–	mm	-	10	0.310	0.310	0.310	0	0.310	—
	E11.1	Insertion and removal forces ,mating cycle frequency		Insertion force must be 25% or less of the initial value	%	5	5	25% Max.					Pass
				Initial insertion force	N	5	5	21.68	22.0	21.3	0.32	20.71	—
				After 20 cycles	N	5	5	17.54	18.1	17.0	0.39	16.37	—
				Initial removal force	N	5	5	19.17	19.9	18.7	0.56	17.48	—
				After 20 cycles	N	5	5	16.73	18.1	16.0	0.83	14.24	—
	E5.1	Contact opening dimensions		–	mm	-	10	0.313	0.315	0.310	0.0026	0.320	—
	E0.1	Visual Inspection		No abnormalities	—	10	80	No abnormalities					Pass
PG12	E0.1	Visual Inspection		No abnormalities	—	-	6	No abnormalities					Pass
	E12.1	Current excess temperature without housing	0.3sq	—	—	-	3	See Graph 1.					—
			0.5sq	—	—	-	3						
	E12.2	Derating without housing	0.3sq	—	—	-	3	See Graph 2.					—
			0.5sq	—	—	-	3						
	E0.1	Visual Inspection		No abnormalities	—	-	6	No abnormalities					Pass
PG13	E0.1	Visual Inspection		No abnormalities	—	6	6	No abnormalities					Pass
	E13.1	Current excess temperature with housing	0.3sq	—	—	3	3	See Graph 3.					—
			0.5sq	—	—	3	3						
	E13.2	Derating with housing	0.3sq	—	—	3	3	See Graph 4.					—
			0.5sq	—	—	3	3						
	E0.1	Visual Inspection		No abnormalities	—	6	6	No abnormalities					Pass
PG14	E0.1	Visual Inspection		No abnormalities	—	-	6	No abnormalities					Pass
	E14.1	Thermal time constant	0.3sq	—	—	-	3	When 125°C is attained at 2 times rated current See Graph5.					—
			0.5sq	—	—	-	3						
	E0.1	Visual Inspection		No abnormalities	—	-	6	No abnormalities					Pass
PG15	E0.1	Visual Inspection		No abnormalities	—	8	8	No abnormalities					Pass
	B15.1	The DUTs are inserted and disconnected 2 times		—	—	8	8	—					—
	E5.1	Contact opening dimension	0.3sq	—	mm	-	10	0.310	0.310	0.310	0	0.310	—
			0.5sq	—	mm	-	10	0.310	0.310	0.310	0	0.310	—
	E0.2	Contact resistance	0.3sq	10mΩ Max	mΩ	4	32	2.416	2.74	2.12	0.160	2.898	Pass
			0.5sq	10mΩ Max	mΩ	4	32	2.887	3.23	2.48	0.179	3.423	Pass
	E12.2	Derating	0.3sq	—	—	4	4	See Graph 6.					—
			0.5sq	—	—	4	4						
	E14.0	Continuous contact resistance during B15.2 with test current		—	—	8	8	See Graph 7.					—
	B15.2	Temperature cycle endurance test/ current cycle endurance test		—	—	8	8	—					—
	B15.3	Humid heat, cyclic		—	—	8	8	—					—
	E14.0	Contact resistance continuous during B15.2 with test current		—	—	8	8	See Graph 8.					—
	B15.2	Temperature cycle endurance test/ current cycle endurance test		—	—	8	8	—					—

Table 4. List of Results

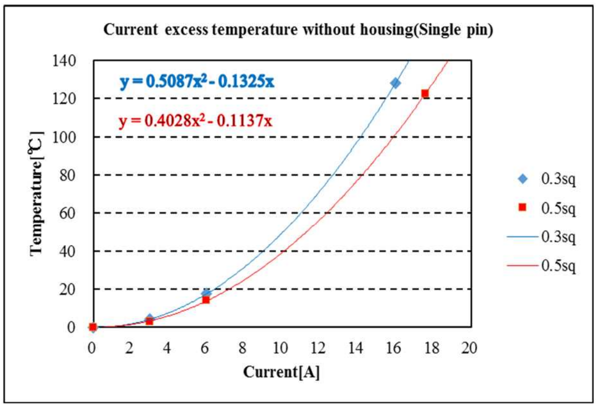
PG No.	Item			Requirements	Unit.	Set	n	Data: Ave.	Max.	Min.	s	Ave.±3s	Judge
PG15	E0.2	Contact resistance	0.3sq	30mΩ Max	mΩ	4	32	3.897	8.79	2.53	1.143	7.327	Pass
			0.5sq	30mΩ Max	mΩ	4	32	6.122	12.5	3.77	2.537	13.73	Pass
	E12.2	Derating	0.3sq	—	—	4	4	See Graph 6.					—
			0.5sq	—	—	4	4						—
	E5.1	Contact opening dimension	0.3sq	—	mm	-	10	0.320	0.320	0.320	0	0.320	—
			0.5sq	—	mm	-	10	0.322	0.325	0.320	0.0024	0.329	—
	E0.1	Visual Inspection		No abnormalities	—	8	8	No abnormalities					Pass
PG16	E0.1	Visual Inspection		No abnormalities	—	-	3	No abnormalities					Pass
	E16.0	Contact resistance, continuous monitoring during B16.1,recording, and storing		Verify no. of cycles to attain 300mΩ	—	-	3	See Graph 9.					—
	B16.1	Friction load		—	—	-	3	—					—
PG17	E0.1	Visual Inspection		No abnormalities	—	10	10	No abnormalities					Pass
	E0.2	Contact resistance	0.3sq	10mΩ Max	mΩ	5	40	2.484	3.11	2.16	0.192	3.059	Pass
			0.5sq	10mΩ Max	mΩ	5	40	3.066	3.41	2.81	0.125	3.442	Pass
	E14.0	Contact resistance continuous during B17.2 with test current		—	—	10	10	See Graph 10.					—
				No microcuts of 7Ω Min for 1,000ns Min	—	10	10	No abnormalities					Pass
	B17.2	Dynamic load, broad-band random vibration		Severity: Body unsealed	—	10	10	—					—
	E0.1	Visual Inspection		No abnormalities	—	10	10	No abnormalities					Pass
	E14.0	Contact resistance continuous during B17.3 with test current		—	—	10	10	See Graph 11.					—
				No microcuts of 7Ω Min for 1,000ns Min	—	10	10	No abnormalities					Pass
	B17.3	Endurance shock test		Severity: Body unsealed	—	10	10	—					—
	E0.1	Visual Inspection		No abnormalities	—	10	10	No abnormalities					Pass
	E0.2	Contact resistance	0.3sq	30mΩ Max	mΩ	5	40	3.629	4.46	2.84	0.404	4.841	Pass
			0.5sq	30mΩ Max	mΩ	5	40	5.737	7.34	4.35	0.663	7.728	Pass
	B17.4	Resonance frequency of the housing parts including contacts and lines under Sinusoidal vibration		—	—	—	—	See Graph 12.					—
PG18A	E0.1	Visual Inspection		No abnormalities	—	10	10	No abnormalities					Pass
	E0.2	Contact resistance	0.3sq	10mΩ Max	mΩ	5	40	2.692	3.13	2.15	0.229	3.378	Pass
			0.5sq	10mΩ Max	mΩ	5	40	3.202	3.69	2.71	0.284	4.055	Pass
	B18.2	Salt spray, cyclic		—	—	10	10	—					—
	E0.2	Contact resistance	0.3sq	30mΩ Max	mΩ	5	40	2.575	3.33	2.03	0.315	3.521	Pass
			0.5sq	30mΩ Max	mΩ	5	40	3.176	3.67	2.73	0.279	4.013	Pass
	E0.1	Visual Inspection		No abnormalities	—	10	10	No abnormalities					Pass
PG18C	E0.1	Visual Inspection		No abnormalities	—	10	10	No abnormalities					Pass
	E0.2	Contact resistance	0.3sq	10mΩ Max	mΩ	5	40	2.719	3.13	2.33	0.240	3.437	Pass
			0.5sq	10mΩ Max	mΩ	5	40	3.152	3.71	2.71	0.293	4.031	Pass
	B18.3	Salt spray, cyclic		—	—	10	10	—					—
	E0.2	Contact resistance	0.3sq	30mΩ Max	mΩ	5	40	2.635	3.25	2.15	0.270	3.446	Pass
			0.5sq	30mΩ Max	mΩ	5	40	3.196	3.70	2.73	0.304	4.108	Pass
	E0.1	Visual Inspection		No abnormalities	—	10	10	No abnormalities					Pass

Table 5. List of Results

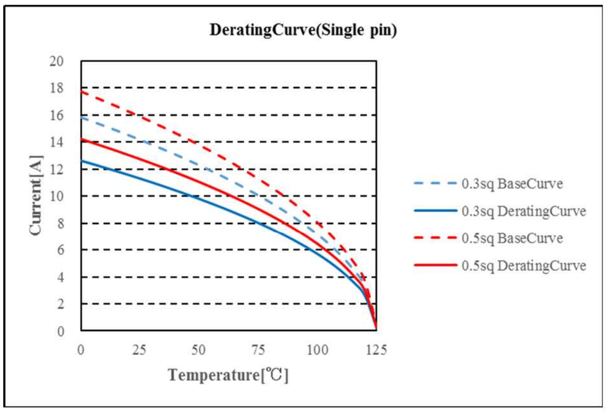
PG No.	Item			Requirements	Unit.	Set	n	Data					Judge
								Ave.	Max.	Min.	s	Ave.±3s	
PG19	E0.1	Visual Inspection		No abnormalities	—	24	24	No abnormalities					Pass
	E0.2	Contact resistance Group 1	0.3sq	10mΩ Max	mΩ	4	32	2.881	3.40	2.43	0.265	3.676	Pass
			0.5sq	10mΩ Max	mΩ	4	32	3.172	3.68	2.71	0.313	4.112	Pass
		Contact resistance Group 2	0.3sq	10mΩ Max	mΩ	4	32	2.896	3.36	2.45	0.293	3.775	Pass
			0.5sq	10mΩ Max	mΩ	4	32	3.131	3.71	2.67	0.313	4.070	Pass
		Contact resistance Group 3	0.3sq	10mΩ Max	mΩ	4	32	2.935	3.39	2.46	0.267	3.735	Pass
			0.5sq	10mΩ Max	mΩ	4	32	2.937	3.36	2.63	0.164	3.429	Pass
	B19.0	Inserting and removing groups according to standard		—	—	24	24	—					—
	E0.2	Contact resistance Group 1	0.3sq	30mΩ Max	mΩ	4	32	2.854	3.35	2.46	0.255	3.618	Pass
			0.5sq	30mΩ Max	mΩ	4	32	2.933	3.28	2.68	0.131	3.325	Pass
		Contact resistance Group 2	0.3sq	30mΩ Max	mΩ	4	32	2.807	3.39	2.42	0.305	3.724	Pass
			0.5sq	30mΩ Max	mΩ	4	32	2.911	3.17	2.62	0.115	3.257	Pass
		Contact resistance Group 3	0.3sq	30mΩ Max	mΩ	4	32	2.924	3.41	2.45	0.295	3.810	Pass
			0.5sq	30mΩ Max	mΩ	4	32	2.980	3.29	2.72	0.163	3.470	Pass
	E14.0	Contact resistance continuous during B19.1 with test current		—	—	16	16	See Graph 13.					—
	B19.1	Temperature shock		Tmax:125℃	—	24	24	—					—
	E14.0	Contact resistance continuous during B19.2 with test current		—	—	16	16	See Graph 14.					—
	B19.2	Temperature cycle		Tmax:125℃	—	24	24	—					—
	E14.0	Contact resistance continuous during B19.3 with test current		—	—	16	16	See Graph 15.					—
	B19.3	Aging in dry heat		Tmax:125℃	—	24	24	—					—
	E0.1	Visual Inspection		No abnormalities	—	24	24	No abnormalities					Pass
	B19.4	Industrial climate		—	—	24	24	—					—
	E14.0	Contact resistance continuous during B19.5 with test current		—	—	16	16	See Graph 16.					—
	B19.5	Humid heat, cyclic		—	—	24	24	—					—
	E0.1	Visual Inspection		No abnormalities	—	24	24	No abnormalities					Pass
	E14.0	Contact resistance continuous during B19.6 with test current		—	—	16	16	See Graph 17.					—
	B19.6	Dynamic load		—	—	16	16	—					—
	E14.0	Contact resistance continuous during B19.7 with test current		—	—	16	16	See Graph 18.					—
	B19.7	Mech. Shocks		—	—	24	24	—					—
	B19.8	One-time disconnection and insertion		—	—	24	24	—					—

Table 6. List of Results

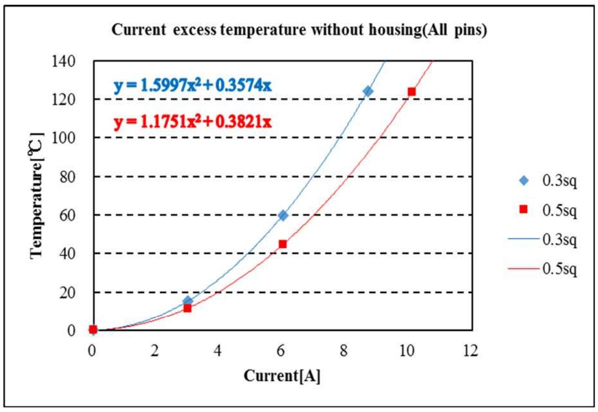
PG No.	Item			Requirements	Unit.	Set	n	Data Ave.	Max.	Min.	s	Ave.±3s	Judge
PG19	E0.2	Contact resistance Group 1	0.3sq	30mΩ Max	mΩ	4	32	4.065	5.03	3.15	0.633	5.963	Pass
			0.5sq	30mΩ Max	mΩ	4	32	3.568	4.79	2.97	0.400	4.766	Pass
		Contact resistance Group 2	0.3sq	30mΩ Max	mΩ	4	32	5.933	10.09	4.17	1.698	11.03	Pass
			0.5sq	30mΩ Max	mΩ	4	32	9.549	15.84	4.89	3.529	20.13	Pass
		Contact resistance Group 3	0.3sq	30mΩ Max	mΩ	4	32	6.543	10.11	4.47	1.521	11.11	Pass
			0.5sq	30mΩ Max	mΩ	4	32	8.865	14.90	5.55	2.725	17.04	Pass
	E0.1	Visual Inspection		No abnormalities	—	15	15	No abnormalities					Pass
PG20	E0.1	Visual Inspection		No abnormalities	—	5	5	No abnormalities					Pass
	E0.3	Insulation resistance		100MΩ Min	MΩ	5	5	1,000MΩ Min					Pass
	B20.1	Aging in dry heat		Tmax:125°C	—	5	5	—					—
	B20.2	Humid heat, constant		—	—	5	5	—					—
	E0.3	Insulation resistance		100MΩ Min	MΩ	5	5	1,000MΩ Min					Pass
	E0.1	Visual Inspection		No abnormalities	—	5	5	No abnormalities					Pass
	B20.3	Low-temperature aging		—	—	5	5	—					—
	B20.4	Removal and insertion at -20℃		Must be able to insert/remove	—	5	5	Able to insert/remove					—
	E0.1	Visual Inspection		No abnormalities	—	5	5	No abnormalities					Pass
	B20.5	Aging in dry heat		—	—	5	5	—					—
	B6.1	Drop test		—	—	5	5	—					—
	E0.1	Visual Inspection		No abnormalities	—	5	5	No abnormalities					Pass
PG21	E0.1	Visual Inspection		No abnormalities	—	20	20	No abnormalities					Pass
	E0.2	Contact resistance	0.3sq	10mΩ Max	mΩ	5	40	2.453	2.77	2.22	0.134	2.855	Pass
			0.5sq	10mΩ Max	mΩ	5	40	2.934	3.16	2.75	0.120	3.293	Pass
	B21.1	Long-term aging in dry heat (all parts)		Tmax:125°C	—	20	20	—					—
	E0.2	Contact resistance	0.3sq	30mΩ Max	mΩ	5	40	3.270	5.12	2.57	0.531	4.863	Pass
			0.5sq	30mΩ Max	mΩ	5	40	3.500	4.01	3.13	0.212	4.134	Pass
	E21.1	Functional test with both groups		—	—	20	20	—					—
	B6.1	Drop test		No abnormalities	—	10	10	No abnormalities					Pass
	E8.2	Contact pull-out forces of all contacts of group 2	Male (Pos.1,5)	35N Min.	N	3	24	111.1	116	105	3.960	99.19	Pass (*1)
			Male (other than Pos.1,5)	35N Min.	N	3	24	58.67	63.2	51.2	3.400	48.47	Pass (*1)
			Female	35N Min.	N	3	24	98.28	112.5	81.8	8.890	71.61	Pass
	E0.1	Visual Inspection		No abnormalities	—	10	10	No abnormalities					Pass
PG22A	E0.1	Visual Inspection		No abnormalities	—	25	25	No abnormalities					Pass
	E0.3	Insulation resistance		100MΩ Min	MΩ	5	5	1,000MΩ Min					Pass
	B22.1	Resistance to agents		—	—	25	25	—					Pass
	E0.3	Insulation resistance	Cold-cleaning agent	100MΩ Min	MΩ	5	5	100MΩ Min.					Pass
			Penetrating oil	100MΩ Min	MΩ	5	5	1000MΩ Min.					Pass
			Washer fluid	100MΩ Min	MΩ	5	5	100MΩ Min.					Pass
			Isopropanol	100MΩ Min	MΩ	5	5	1000MΩ Min.					Pass
			Grease	100MΩ Min	MΩ	5	5	1000MΩ Min.					Pass
	E0.1	Visual Inspection		No abnormalities	—	25	25	No abnormalities					Pass
	E1.1	Dimensions		No abnormalities	—	5	5	No abnormalities					Pass
PG28	E0.1	Visual Inspection		No abnormalities	—	5	5	No abnormalities					Pass
	B28.1	Aging		—	—	5	5	—					—
	E28.1	Locking noise		70dB Min	dB	5	5	71.02	71.3	70.8	0.23	70.34	Pass
	E0.1	Visual Inspection		No abnormalities	—	5	5	No abnormalities					Pass



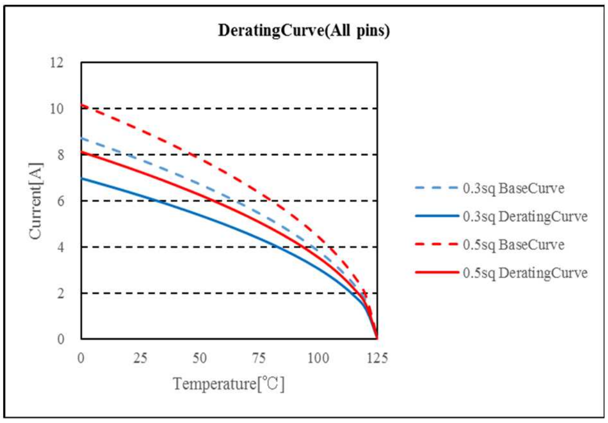
Graph 1. PG12 E12.1 Current excess temperature (Single pin)



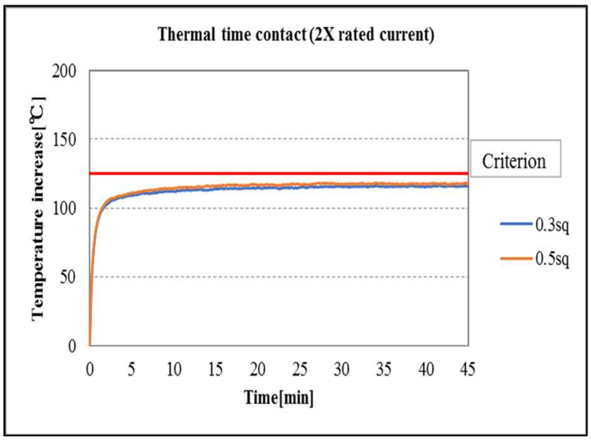
Graph 2. PG12 E12.2 Derating Curve (Single pin)



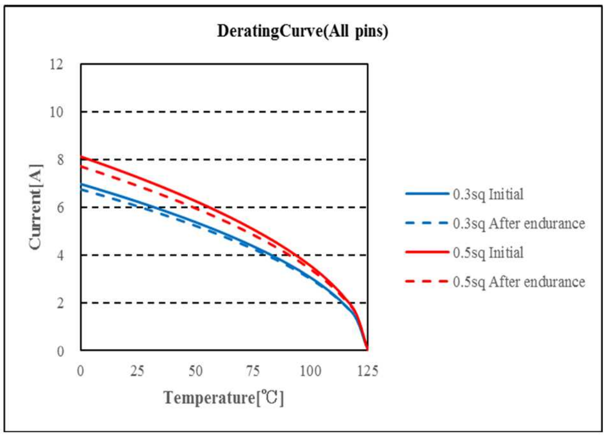
Graph 3. PG13 E13.1 Current excess temperature(All pins)



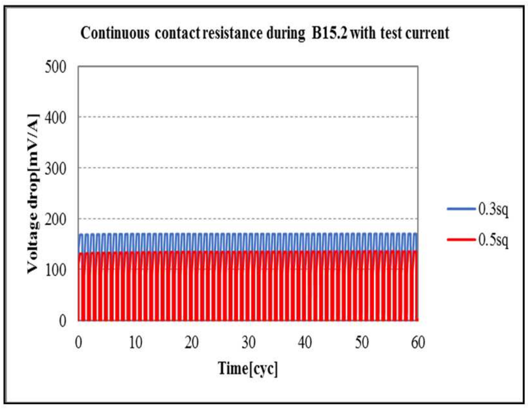
Graph 4. PG13 E13.2 Derating Curve(All pins)



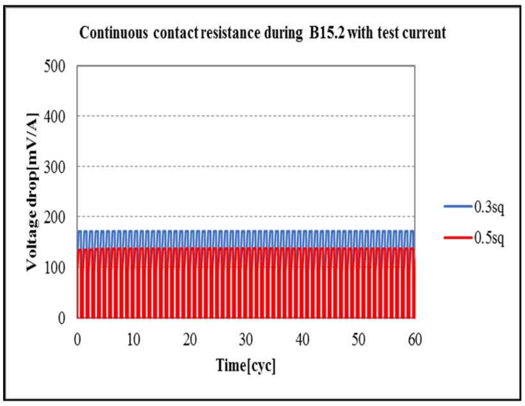
Graph 5. PG14 E14.1 Thermal time Constant(Single pin)



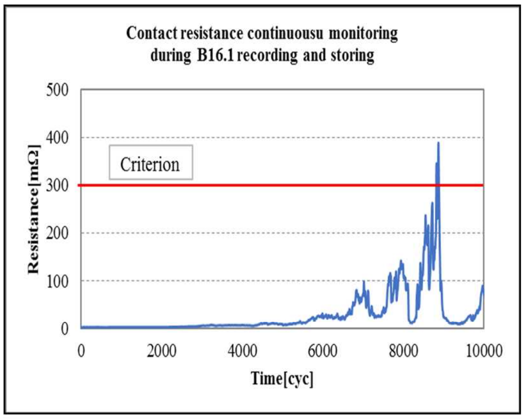
Graph 6. PG15 E13.2 Derating Curve(All pins)



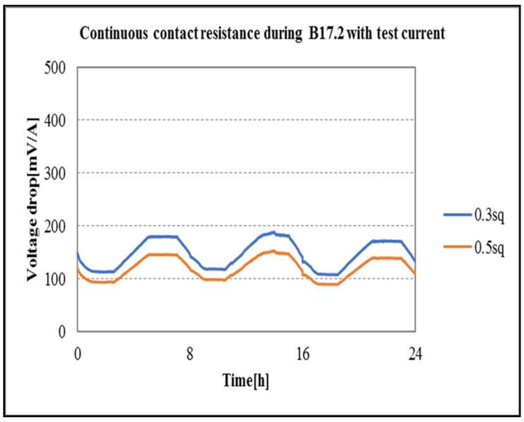
Graph 7. PG15 E14.0 Resistance Monitor



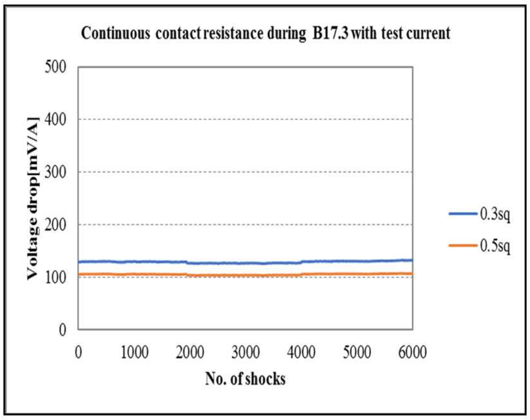
Graph 8. PG15 E14.0 Resistance Monitor



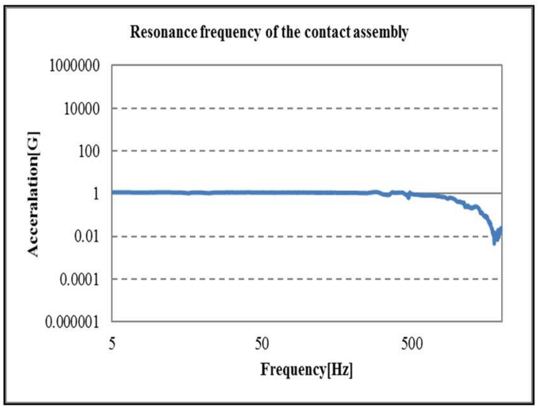
Graph 9.PG16 E16.0 Resistance Monitor



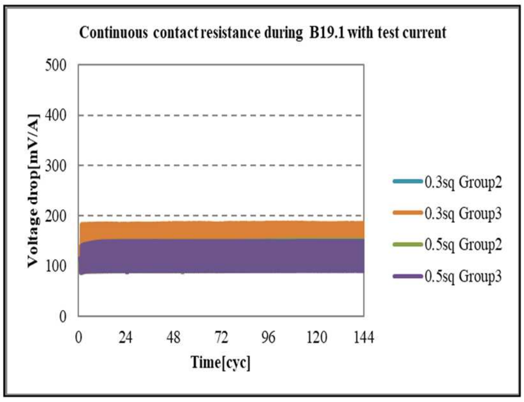
Graph 10.PG17 E14.0(B17.1) Resistance Monitor



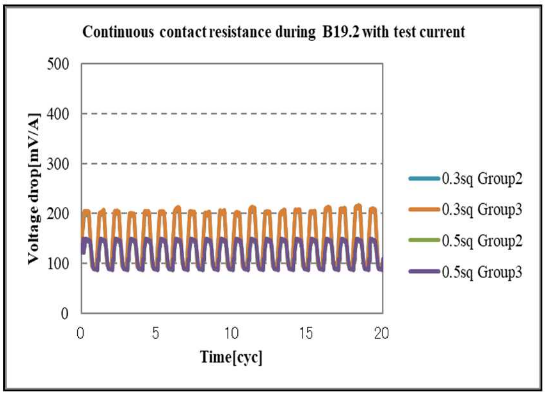
Graph 11. PG17 E14.0(B17.1) Resistance Monitor



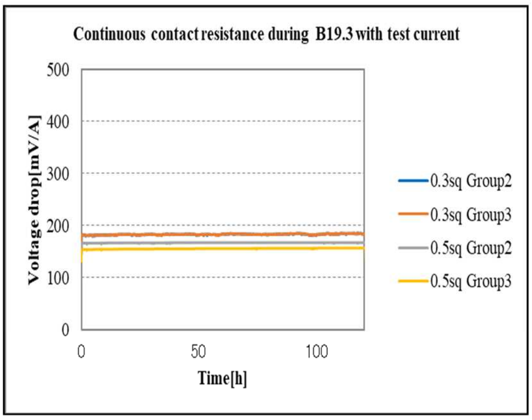
Graph 12. PG17 B17.4 Resistance frequency
of the contact assembly



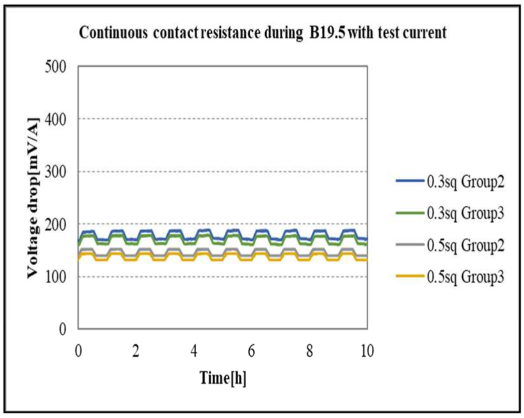
Graph 13. PG19 B19.1 Resistance Monitor



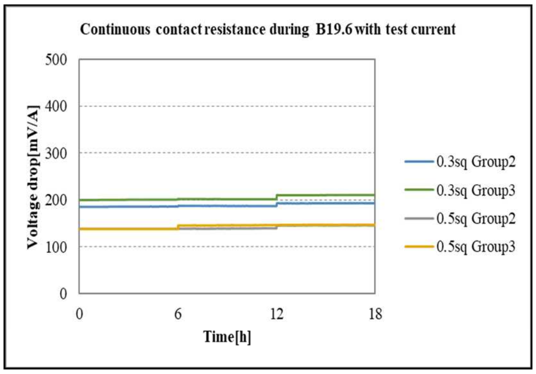
Graph 14. PG19 B19.2 Resistance Monitor



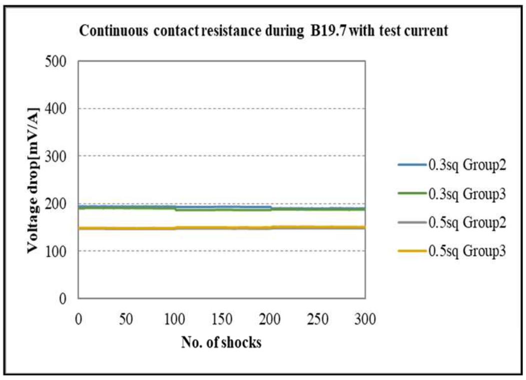
Graph 15.PG19 B19.3 Resistance Monitor



Graph 16.PG19 B19.5 Resistance Monitor



Graph 17.PG19 B19.6 Resistance Monitor



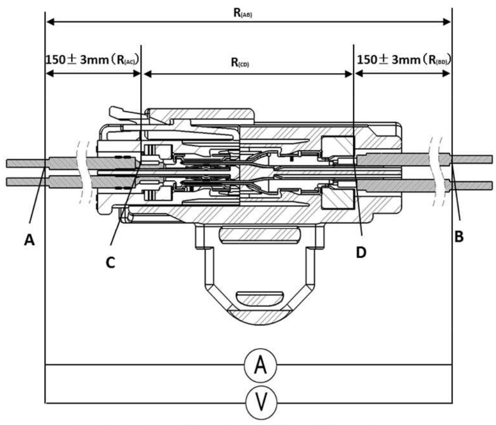
Graph 18.PG19 B19.7 Resistance Monitor

5. Test Methods and Performances

Table 7. Mechanical Performances

	Test item
PG0	Inspection of as- received condition
PG1	Dimensions
PG2	Material and surface analysis, contacts
PG3	Material and surface analysis, housing
PG4	Contact engagement length
PG5	Mechanical and thermal relaxation behavior
PG6	Interaction between contact and housing
PG7	Handling and functional reliability of the housing
PG8	Insertion and retention forces of the contact parts in the housing
PG9	Insertion inclination/misuse safe(scoop-proofing)
PG10	Contacts : conductor pull-out strength
PG11	Contacts : Insertion and removal forces, mating cycle frequency
PG12	Current heating, derating
PG13	Housing influence on the derating
PG14	Thermal time constant (current excess temperature at n times rated current)
PG15	Electrical stress test
PG16	Friction corrosion
PG17	Dynamic load
PG18A	Coastal climate load
PG18C	Deicing salt load
PG19	Environmental simulation
PG20	Climate load of the housing
PG21	Long-term temperature aging
PG22A	Chemical resistance
PG28	Locking noise

5-1 Properties tests

E0.1	Visual inspection
	A. Test method・・・Visual (e.g. magnifier) and tactile verification. B. requirement・・・No detrimental deformation.
E0.2	Contact resistance
	A. Test method Apply current at 20mV (open circuit), 10mA (short circuit). Measure and record the resistance across A to B and A to C and B to D as illustrated in Figure 1, In-Line Circuit Test Lead Location. Calculate the resistance with the following formula. R= R(CD) = R(AB) - R(AC) - R(BD) ※R(AC) , R(BD)：Cable conductor resistance ①Contact resistance in contact area. (E0.2.1) ②Contact resistance in line area. (E0.2.2) B. requirement Initial：10mΩ Max.　After test：30mΩ Max.  Fig.1 In-line Circuit Test Lead Location

<table>
<tr><td rowspan="2">E0.3</td><td>Insulation resistance</td></tr>
<tr><td>A. Test method・・・Measure insulation resistance between all adjacent contacts.
Test Voltage=500+50V, test time=60±5s
B. requirement・・・100MΩ Min.

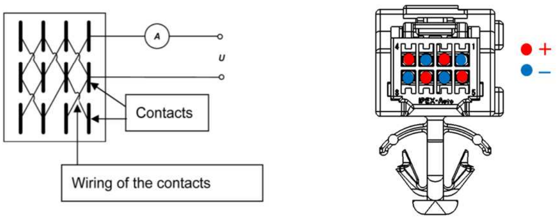


Fig.2 Insulation resistance measurement setup</td></tr>
<tr><td rowspan="2">E1.1</td><td>Dimensions</td></tr>
<tr><td>A. Test method・・・Measure dimensions using caliper, micrometer, projector.
B. requirement・・・Satisfy drawing dimension.</td></tr>
<tr><td rowspan="2">E1.2</td><td>Dimensions (of processed components)</td></tr>
<tr><td>A. Test method・・・Measure dimensions of the crimping part using caliper,
micrometer, projector.
B. requirement・・・Satisfy drawing dimension.</td></tr>
<tr><td rowspan="2">E2.1</td><td>Material test, contact parts</td></tr>
<tr><td>A. Test method・・・Material properties indication for male terminal, female terminal and peg.
Material: material certificate, conductivity, tensile strength,
modulus of elasticity.
B. requirement・・・Record must be maintained. RoHS, ELV directives must be observed.</td></tr>
<tr><td rowspan="2">E3.1</td><td>Material test, housing</td></tr>
<tr><td>A. Test method・・・Material properties indication for male housing, female housing.
①Material: Material certificate
②Measurement of burrs in functional areas
B. requirement・・・Record must be maintained. No burrs detrimental to function.</td></tr>
<tr><td rowspan="2">E3.2</td><td>Markings on the surface</td></tr>
<tr><td>A. Test method・・・Check for any dirt or markings on assembled parts, male housing, female housing.
B. requirement・・・Must satisfy appearance inspection of the inspection standard.
No burrs on functional area.</td></tr>
<tr><td rowspan="2">E4.1</td><td>Contact engagement length</td></tr>
<tr><td>A. Test method・・・Contact engagement length and required clearance must be calculated based on worst case
dimensions.
B. requirement・・・Contact engagement length:>1.00mm (for all contact points)

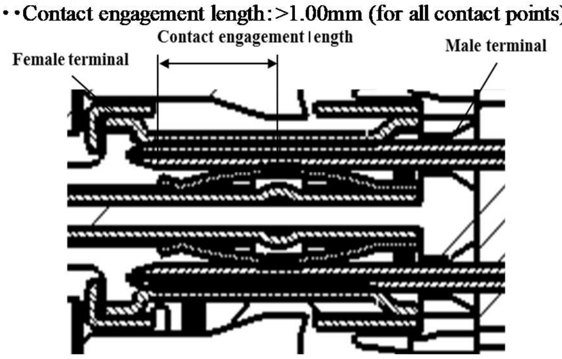
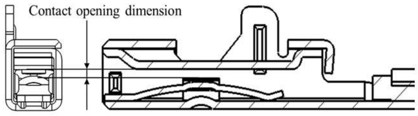
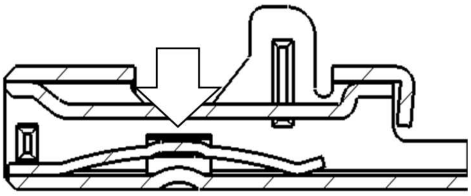
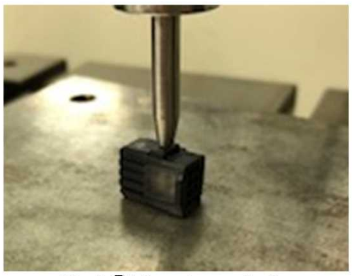
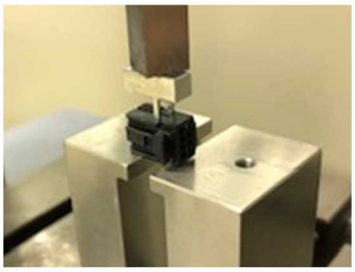
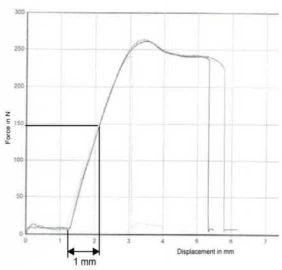
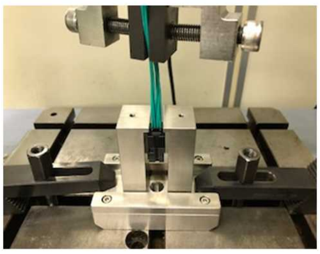
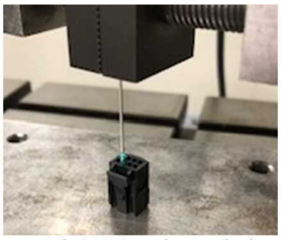
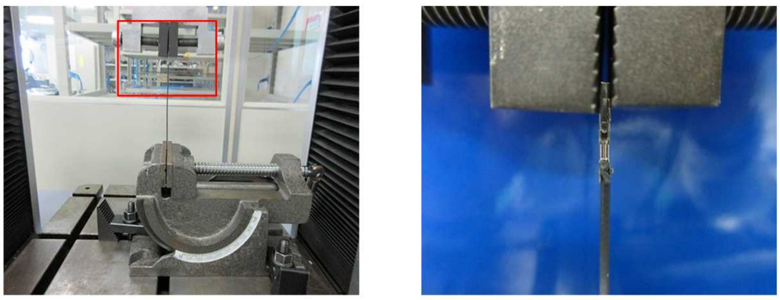
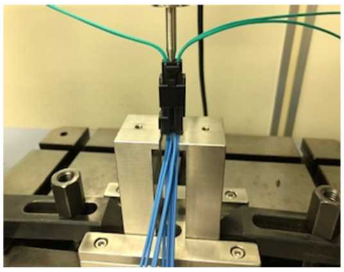
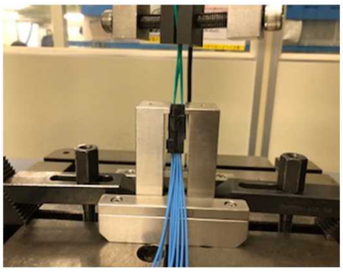
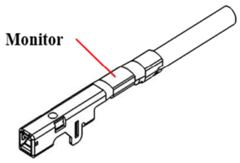
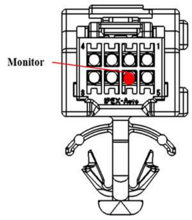
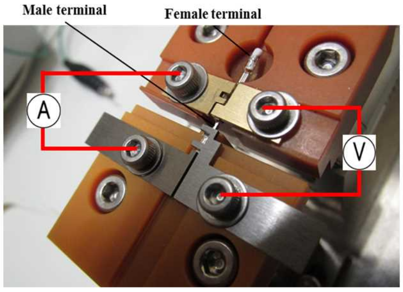
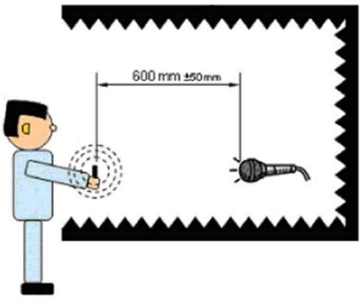


Fig.3 Contact engagement length</td></tr>
</table>

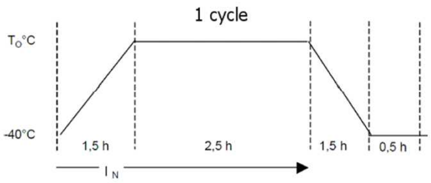
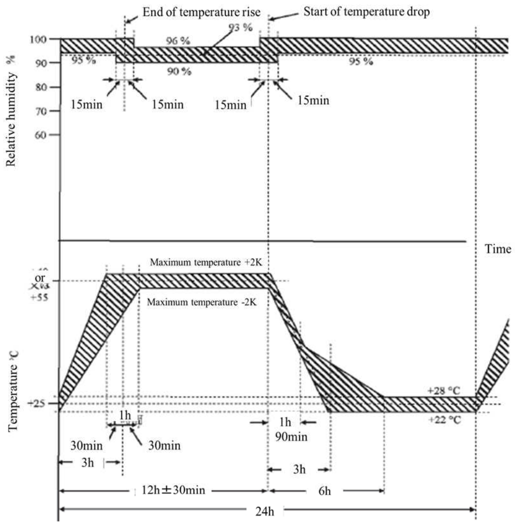
E5.1	Contact opening dimension A. Test method Measure contact opening dimension with a gauge. (All groups) B. requirement・・・Record the measured values.  Fig.4 Contact opening dimension
E5.2	Normal contact force A. Test method・・・Measure normal contact force. (Group 1) B. requirement・・・Record measurement method and measured values.  Fig.5 Measuring method
E6.1	Deflection of contacts in the housing cavity A. Test method・・・Check drawing dimensions for housing cavity and terminal. (Confirmed by the CAD) B. requirement・・・Can be joined even in the worst case.
E6.4	Actuation forces for secondary lock A. Test method・・・Fully populate the housing, insert the hinge then remove. B. requirement・・・①Force when secondary lock is locked: 50N max. ②Force when unlocked: 10N to 50N.  Fig.6 ①Measuring method  Fig.7 ②Measuring method
E7.2	Retention force of the housing latch/lock A. Test method Measure the force required to pull the female housing by a distance of 1mm, and the maximum force. Female housing is mated without any terminals and locked. B. requirement・・・60N Min.  Fig.8 Retention force load-displacement curve  Fig.9 Measuring method

E8.1	Determination of the contact insertion forces A. Test method・・・Determine the peak force required to insert terminal into housing.  Fig.10 Measuring method
E8.2	Contact removal force from the housing A. Test method・・・Measure the force required to remove the terminal from the housing, by pulling terminal into the opposite direction of insertion. B. requirement・・・primary lock：25N Min.(E8.2.1), secondary lock：35N Min.(E8.2.2)  Fig.11 Measuring method
E9.2	Max. possible insertion inclination A. Test method・・・Verify mated state under maximum possible insertion inclination. (X and Y directions. Z is the insertion direction, confirmed by the CAD) B. requirement・・・Must be designed so connector is guided into housing without female terminal settling or male terminal buckling under the worst-case dimensions.
E9.3	Examination of housing for scoop-proofing A. Test method・・・Verify scoop-proofing. (Confirmed by the CAD) B. requirement・・・Electrical connection is established only when correctly mated. No interference between male terminal and female housing.
E10.1	Conductor pull-out strength A. Test method・・・Measure the force required to pull out the conductor from the crimp. Insulation barrel is not in function. B. requirement・・・50N Min. (Conductor：0.3sq (AWG22) , 0.5sq(AWG20))  Fig.12 Measuring method (0.3sq(AWG22))

	Contacts：Insertion and removal forces, mating cycle frequency
E11.1	A. Test method・・・Depending on the plating type, repeat insertion/removal as follows. No addition of lubricant. Sn:20 times B. requirement・・・The insertion force change at the time of contact with the terminal must be up to 25% compared to the initial value.  Fig.13 Measuring method (Insertion force)  Fig.14 Measuring method (Removal force)
	Current excess temperature, Derating curve (without housing)
E12.1 E12.2	A. Test method Different current is applied and left for 1 h to stabilize the terminal temperature. (temperature change of terminal must be ±2°Cmin. when measured for 3 times at an interval of 5 minutes) Measure the ambient temperature at a distance of 50mm min. horizontally from the sample. Record the ambient temperature, surface temperature of the terminal, and current applied. Create base curve and 80% derating curve from the temperature increase curve. B. requirement・・・Create temperature increase curve. [E 12.1], Create derating curve. [E 12.2]  Fig.15 Temperature monitor location
	Current excess temperature, Derating curve (with housing)
E13.1 E13.2	A. Test method Different current is applied to DC circuit with all terminal and left for 1 h to stabilize the terminal temperature. (temperature change of terminal must be ±2°Cmin. when measured for 3 times at an interval of 5 minutes) Measure the ambient temperature at a distance of 50mm min. horizontally from the sample. Record the ambient temperature, surface temperature of the terminal, and current applied. Create base curve and 80% derating curve from the temperature increase curve. B. requirement・・・Create temperature increase curve. [E 13.1], Create derating curve. [E 13.2]  Fig.16 Temperature monitor position
	Continuous contact resistance during the test with test current
E14.0	A. Test method・・・Monitor voltage drop during the test. Continuous contact resistance during the test with test current （100 mA） Frequency of measurement: every 1 minute B. requirement・・・Record must be maintained.

E14.1	Thermal time constant
	A. Test method Apply current value of 1x, 2x, 3x, 4x, 5x the rated current to single terminal. (temperature change of terminal must be ±2℃min. when measured for 3 times at an interval of 5 minutes) Leave the terminal for 1 hour to stabilize temperature and measure the increase. Temperature increase tolerance: 125℃ B. requirement・・・Create temperature increase graph.
E16.0	Contact resistance, continuous monitoring during B16.1,recording, and storing
	A. Test method・・・Monitor voltage drop during the test. Continuous contact resistance during B16.1 with test current Frequency: 4Hz B. requirement・・・Record must be maintained.  Fig.17 Measuring method
E21.1	Functional test with both groups
	A. Test method・・・Insert and remove 5 times.
E28.1	Locking noise
	A. Test method Measure the locking noise [dB] when female connector is inserted into male connector. Distance to microphone: 600±50mm. Distance from the floor: 1m B. requirement・・・Must satisfy 70dB(A) min. Signal-to-noise ratio between the locking noise and ambient noise must be at least 7dB(A).  Fig.18 Schematic of the measurement setup "volume measurement"

5-2 Loads

B5.2	Insert test sample A. Test method・・・Insert male terminal into female terminal. (Group 2 to 5)
B5.3	Aging in dry heat, inserted A. Test method Age mated samples in chamber at 125°C. Remove the sample at each specified timing (1h, 100h, 200h, 500h, and 1000h). (Group 2 to 5)  Fig.19 Temperature chamber (PL-2KPH / ESPEC)
B15.1	Insertion and removal before the test (2 times) A. Test method・・・Insert and remove the connector 2 times.
B15.2	Temperature cycle endurance test/current cycle endurance test A. Test method Applied current "I_N" is read from the derating curve at 80 °C ambient temperature. The test current is constant. 1 cycle (6h) as shown in Fig. 20. Repeat 60 cycles.  Fig.20 Temperature cycle
B15.3	Humid heat, cycle A. Test method・・・Temperature: 25～55°C. Relative humidity: 95%RH. 1 cycle (24h) as shown in Fig. 21. Repeat 21 cycles.  Fig.21 Humid heat cycle

B16.1

Friction load

A. Test method
Insert male terminal into female terminal. Distance of fretting motion: 50µm,
Cycle time : 1Hz、No. of cycles: 10000 cycles min. Monitor dry circuit resistance
during fretting motion MAX.100mV、10mA
B. requirement
Create a graph of resistance vs no. of cycles.
Record cycles at dry circuit resistance 300mΩ.

B17.2 B17.3

Dynamic load, broad-band random vibration / Endurance shock test

A. Test method・・・Vibration: see Table 7, Sweep speed:1 oct./min

Table.7 Vibration and shock (Body, non-sealed)

TC (temp. cycle)	Random vibration with TC		Sine wave with TC	No. of shocks
0 min / 20 °C 60 min / - 40 °C 150 min / - 40 °C 300 min / 105 °C 420 min / 105 °C 480 min / 20 °C	8 h per axis RMS value of acceleration 19.7m/s^2		No sine wave	A=30 G T=6 ms Sinusoidal half-wave No. of shocks : 6000
	Hz	(m/s^2)^2/Hz		
	10	10		
	55	3.25		
	180	0.125		
	300	0.125		
	360	0.07		
	1000	0.07		

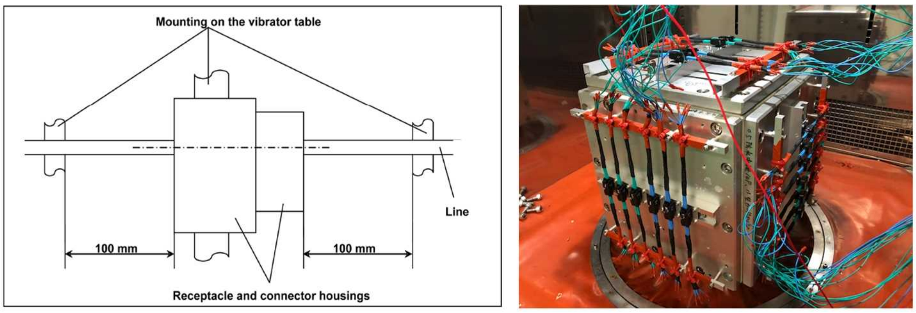


Fig.22 Mounting on vibrator table, coupling (F-26000BDH/LA26AW / EMIC)

B17.4

Resonance frequency of the contact assembly

A. Test method・・・Affix vibration transducer to the housing to determine resonance frequency, based on the conditions below:
Dynamic load, sinusoidal, Sweep speed: a = 10 m/s2, f = 5 Hz – 2 000 Hz – 5 Hz
B. requirement・・・Create a graph of vibration response of the housing.

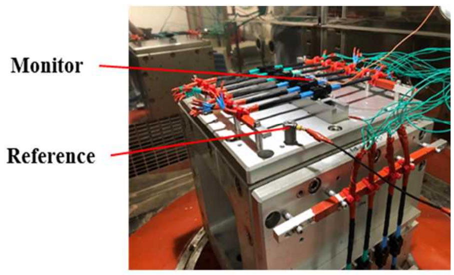


Fig.23 Resonant frequency measurement

B18.2

Coastal climate load

A. Test method・・・Salt spray, cyclic

Severity 3

B18.3

Coastal climate load

A. Test method・・・Salt spray, cyclic

Severity 3

Salt mixture (Nordic country salt): 3% salt solution, of which 95% is NaCl, 2,5% is $MgCl_2$, and 2,5% is $CaCl_2$

B19.0

Inserting and removing

A. Test method・・・Insert/remove connectors for each group according to Table 8.

Table.8 Description of the 3 groups

	Group 1	Group 2	Group 3
No. of contacts	10min.	10min.	10min.
No. of insertion	1	1	Sn : 10
Inserted/Not inserted	Not inserted	Inserted	Inserted

B19.1

Temperature shock

A. Test method

−40℃~125℃.1 cycle=15 min. Repeat 144 cycles.

Acclimatization period: 10 sec. max.(All groups)

Fig.24 Temperature shock chamber (TSE-11 / ESPEC)

B19.2

Temperature cycle

A.Test method・・・−40℃~125℃.1 cycle= 10 h (with 3 h. time for temperature cycle: 2 h max.)

Repeat 20 cycles. (All groups)

B19.3

Aging in dry heat

A. Test method・・・Age for 120 h in chamber at 125℃. (All groups)

B19.4

Industrial climate (multi-component climate)

A.Test method・・・Age for 21 days in the chamber. Temperature 25℃. Relative humidity: 75%.

Flow rate: 1m3/h. SO_2：0.2ppm, H_2S：0.01ppm、NO_2：0.2ppm、Cl_2：0.01ppm

Fig.25 Gas chamber (GH-180-VL/M / Yamasaki)

<table>
<tr><td rowspan="2">B19.5</td><td>Humid heat, cyclic</td></tr>
<tr><td>A. Test method・・・Temperature: 25～55℃. Relative humidity: 95%RH.
1 cycle (24h) as shown in Fig. 21. Repeat 10 cycles. (All groups)</td></tr>
<tr><td rowspan="2">B19.6</td><td>Dynamic load, Broad-band random vibration</td></tr>
<tr><td>A. Test method・・・RMS value of acceleration: 13.9m/s2. 6 h per axis according to Table 9. (Groups 2 and 3)

Table.9 Broad-band random vibration
<table>
<tr><th>Hz</th><th>(m/s²)²/Hz</th></tr>
<tr><td>0</td><td>5</td></tr>
<tr><td>55</td><td>1,625</td></tr>
<tr><td>180</td><td>0,0625</td></tr>
<tr><td>300</td><td>0,0625</td></tr>
<tr><td>360</td><td>0,035</td></tr>
<tr><td>1 000</td><td>0,035</td></tr>
</table></td></tr>
<tr><td rowspan="2">B19.7</td><td>Mech. Shocks (single shocks)</td></tr>
<tr><td>A. Test method
Acceleration: 30G. Individual shock duration: 6ms. Sinusoidal half-wave. 50 shocks. (All groups)</td></tr>
<tr><td rowspan="2">B19.8</td><td>One-time disconnection and insertion</td></tr>
<tr><td>A. Test method・・・Insert and remove once. (All groups)</td></tr>
<tr><td rowspan="2">B20.1</td><td>Aging in dry heat</td></tr>
<tr><td>A. Test method・・・Age for 120 h in the chamber at 125℃</td></tr>
<tr><td rowspan="2">B20.2</td><td>Humid heat, constant</td></tr>
<tr><td>A. Test method・・・Age for 10 days in the chamber at 40℃、RH 95%.</td></tr>
<tr><td rowspan="2">B20.3</td><td>Low-temperature aging</td></tr>
<tr><td>A. Test method・・・Age for 48 h in the chamber at -40℃.</td></tr>
<tr><td rowspan="2">B20.4</td><td>Removal and insertion at -20℃</td></tr>
<tr><td>A. Test method・・・Insert and remove once at -20℃.</td></tr>
<tr><td rowspan="2">B20.5</td><td>Aging in dry heat</td></tr>
<tr><td>A. Test method・・・Age for 48 h in the chamber at 125℃.</td></tr>
<tr><td rowspan="2">B21.1</td><td>Long-term aging in dry heat (all parts)</td></tr>
<tr><td>A. Test method・・・Age for 1000 h in the chamber at 125℃. (All groups)
Leave for 48 h at room temperature.</td></tr>
<tr><td rowspan="2">B22.1</td><td>Resistance to agents</td></tr>
<tr><td>A. Test method
Test samples must be exposed to the fluids (for chemicals and method, see Appendix E) and aged for 48h at the required aging temperature.
After the test is complete, the test samples must be rinsed thoroughly with water and dried.


Fig.26 Chemical agent</td></tr>
<tr><td rowspan="2">B28.1</td><td>Aging</td></tr>
<tr><td>A. Test method・・・Leave for 24 h at room temperature.</td></tr>
</table>