

# MINIFLEX® 3-BFN L

Part No. 20538-0\*\*E-01#

## Test Report

Product Specification no. PRS-1579

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5	T19142	October 9, 2019	S.Shigekoshi	M.Muro	H.Ikari
4	T14183	December 22, 2014	R.T		E.K
Rev.	ECN	Date	Prepared by	Checked by	Approved by

## 1. Purpose

To evaluate the performance of MINIFLEX 3-BFN L in accordance with PRS-1579.

## 2. Specimen

(1) Connector : MINIFLEX 3-BFN L . . . P/N 20538-0\*\*E-01#

(2) FPC : Made by TAIYO TECHNOLEX CO.,LTD.

FPC Thickness :  $t=0.20\pm 0.03$  (Actual measurement : 0.19~0.20mm)

## 3. Test Sequence

All the evaluations were performed in accordance with Table 1. Test Sequence.

## 4. Result

See Table 2-1 to 2-7, Graph 1 to 14. For the details of the testing conditions and requirements, see PRS-1579.

The "n" in the tables show the number of measurement points.

## 5. Conclusion

All the specimens met the requirements of PRS-1579.

Table1 Test Sequence

Test Items	Group															
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R
C/T Resistance	2,7			1,3, 5	1,3	1,3	1,3	1,5	1,5	1,3	1,3	1,3	1,3			
D.W.Voltage								2,6	2,6							
Insulation Resistance								3,7	3,7							
Temp. rising																1
Act Locking Force	1,5															
Act Un-locking Force	3,6															
FPC Retention Force		1,3														
Durability	4	2														
C/T Retention Force			1													
Vibration				2												
Shock				4												
Fretting corrosion					2											
Thermal Shock						2										
High Temp. Life							2									
High Temp & High Hum energizing								4								
High Temp & High Hum Life									4							
Cold Temp. Life										2						
Gas (H <sub>2</sub> S)											2					
Gas (SO <sub>2</sub> )												2				
Salt Water Spray													2			
Solderability														1		
Soldering Heat Resist.															1	

Table 2-1 Test Result

Test Item	Measurement		Spec.	Set	n	Data					Judge	
						AVE.(X)	MAX.	MIN.	s	X±3s		
A Group Durability	Contact Resistance (mΩ)	※U	Initial	60mΩ MAX.	5	195	23.909	29.99	19.02	3.619	34.766	○
		After 20th	ΔR=40mΩ MAX.	0.491			4.80	-3.60	1.608	5.315	○	
		※L	Initial	60mΩ MAX.	5	195	15.059	18.97	11.05	2.387	22.220	○
		After 20th	ΔR=40mΩ MAX.	1.127			4.57	-1.85	1.368	5.231	○	
	Act Locking Force (N)	33P	Initial	6.93N MAX. (0.21N/Pos.×33P)	5	5	2.800 (0.085)	2.95 (0.09)	2.47 (0.07)	0.188 (0.006)	3.364 (0.068)	○
			20th cycles				2.218 (0.067)	2.36 (0.07)	2.08 (0.06)	0.122 (0.004)	2.584 (0.078)	○
		35P	Initial	7.35N MAX. (0.21N/Pos.×35P)	5	5	2.970 (0.085)	3.12 (0.09)	2.64 (0.08)	0.188 (0.005)	3.534 (0.101)	○
			20th cycles				2.352 (0.067)	2.50 (0.07)	2.22 (0.06)	0.122 (0.003)	2.718 (0.078)	○
		39P	Initial	8.19N MAX. (0.21N/Pos.×39P)	5	5	3.346 (0.086)	3.50 (0.09)	3.02 (0.08)	0.188 (0.005)	3.910 (0.100)	○
			20th cycles				2.656 (0.068)	2.80 (0.07)	2.52 (0.06)	0.122 (0.003)	3.022 (0.077)	○
		41P	Initial	8.61N MAX. (0.21N/Pos.×41P)	5	5	3.514 (0.086)	3.68 (0.09)	3.35 (0.08)	0.140 (0.003)	3.934 (0.096)	○
			20th cycles				2.664 (0.065)	2.80 (0.07)	2.49 (0.06)	0.129 (0.003)	3.051 (0.074)	○
		45P	Initial	9.45N MAX. (0.21N/Pos.×45P)	5	5	3.846 (0.085)	4.02 (0.09)	3.63 (0.08)	0.159 (0.004)	4.323 (0.096)	○
			20th cycles				2.926 (0.065)	3.06 (0.07)	2.76 (0.06)	0.125 (0.003)	3.301 (0.073)	○
		49P	Initial	10.29N MAX. (0.21N/Pos.×49P)	5	5	4.190 (0.086)	4.37 (0.09)	3.98 (0.08)	0.159 (0.003)	4.667 (0.095)	○
			20th cycles				3.186 (0.065)	3.32 (0.07)	3.02 (0.06)	0.125 (0.003)	3.561 (0.073)	○
		51P	Initial	10.71N MAX. (0.21N/Pos.×51P)	5	5	4.362 (0.086)	4.54 (0.09)	4.15 (0.08)	0.159 (0.003)	4.839 (0.095)	○
			20th cycles				3.310 (0.065)	3.45 (0.07)	3.12 (0.06)	0.136 (0.003)	3.718 (0.073)	○
		55P	Initial	11.55N MAX. (0.21N/Pos.×55P)	5	5	4.706 (0.086)	4.88 (0.09)	4.49 (0.08)	0.159 (0.003)	5.183 (0.094)	○
			20th cycles				3.570 (0.065)	3.71 (0.07)	3.38 (0.06)	0.136 (0.002)	3.978 (0.072)	○
57P	Initial	11.97N MAX. (0.21N/Pos.×57P)	5	5	4.848 (0.085)	5.03 (0.09)	4.64 (0.08)	0.162 (0.003)	5.334 (0.094)	○		
	20th cycles				3.664 (0.064)	3.80 (0.07)	3.50 (0.06)	0.125 (0.002)	4.039 (0.071)	○		
61P	Initial	12.81N MAX. (0.21N/Pos.×61P)	5	5	5.134 (0.084)	5.32 (0.09)	4.82 (0.08)	0.215 (0.004)	5.779 (0.067)	○		
	20th cycles				4.090 (0.067)	4.19 (0.07)	3.94 (0.06)	0.108 (0.002)	4.414 (0.072)	○		

※U : Upper Contact    L : Lower Contact

Table 2-2 Test Result

Test Item	Measurement		Spec.	Set	n	Data					Judge	
						AVE.(X)	MAX.	MIN.	s	X±3s		
A Group Durability	Act Un-locking Force (N)	33P	Initial	0.462N MIN. (0.014N/Pos.×33P)	5	5	1.899 (0.058)	1.99 (0.06)	1.81 (0.05)	0.084 (0.003)	1.647 (0.050)	○
			20th cycles				1.798 (0.054)	1.96 (0.06)	1.71 (0.05)	0.082 (0.002)	1.552 (0.047)	○
		35P	Initial	0.490N MIN. (0.014N/Pos.×35P)	5	5	2.015 (0.058)	2.11 (0.06)	1.93 (0.06)	0.084 (0.002)	1.763 (0.050)	○
			20th cycles				1.906 (0.054)	2.00 (0.06)	1.82 (0.05)	0.082 (0.002)	1.660 (0.047)	○
		39P	Initial	0.546N MIN. (0.014N/Pos.×39P)	5	5	2.310 (0.059)	2.39 (0.06)	2.21 (0.06)	0.079 (0.002)	2.073 (0.053)	○
			20th cycles				2.184 (0.056)	2.33 (0.06)	2.08 (0.05)	0.104 (0.003)	1.872 (0.048)	○
		41P	Initial	0.574N MIN. (0.014N/Pos.×41P)	5	5	2.324 (0.057)	2.42 (0.06)	2.22 (0.05)	0.074 (0.002)	2.102 (0.051)	○
			20th cycles				2.156 (0.053)	2.24 (0.05)	2.04 (0.05)	0.075 (0.002)	1.931 (0.047)	○
		45P	Initial	0.630N MIN. (0.014N/Pos.×45P)	5	5	2.559 (0.057)	2.67 (0.06)	2.45 (0.05)	0.095 (0.002)	2.274 (0.051)	○
			20th cycles				2.383 (0.053)	2.48 (0.06)	2.28 (0.05)	0.077 (0.002)	2.152 (0.048)	○
		49P	Initial	0.686N MIN. (0.014N/Pos.×49P)	5	5	2.673 (0.055)	2.79 (0.06)	2.56 (0.05)	0.095 (0.002)	2.388 (0.049)	○
			20th cycles				2.489 (0.051)	2.59 (0.05)	2.39 (0.05)	0.077 (0.002)	2.258 (0.046)	○
51P	Initial	0.714N MIN. (0.014N/Pos.×51P)	5	5	2.925 (0.057)	3.04 (0.06)	2.81 (0.06)	0.095 (0.002)	2.640 (0.052)	○		
	20th cycles				2.749 (0.054)	2.85 (0.06)	2.65 (0.05)	0.077 (0.002)	2.518 (0.049)	○		
55P	Initial	0.770N MIN. (0.014N/Pos.×55P)	5	5	3.053 (0.056)	3.17 (0.06)	2.95 (0.05)	0.092 (0.002)	2.777 (0.050)	○		
	20th cycles				2.872 (0.052)	2.98 (0.05)	2.77 (0.05)	0.079 (0.001)	2.635 (0.048)	○		
57P	Initial	0.798N MIN. (0.014N/Pos.×57P)	5	5	3.277 (0.057)	3.34 (0.06)	3.19 (0.06)	0.072 (0.001)	3.061 (0.054)	○		
	20th cycles				3.045 (0.053)	3.15 (0.06)	2.93 (0.06)	0.084 (0.001)	2.793 (0.049)	○		
61P	Initial	0.854N MIN. (0.014N/Pos.×61P)	5	5	3.420 (0.056)	3.67 (0.06)	3.23 (0.05)	0.185 (0.003)	2.865 (0.047)	○		
	20th cycles				3.306 (0.054)	3.53 (0.06)	3.20 (0.05)	0.146 (0.002)	2.868 (0.047)	○		

Table 2-3 Test Result

Test Item	Measurement		Spec.	Set	n	Data					Judge
						AVE.(X)	MAX.	MIN.	s	X±3s	
B Group FPC Retention Force(N)	33P	Initial	4.29N MIN. (0.13N/Pos.×33P)	5	5	11.310 (0.343)	11.58 (0.35)	10.71 (0.32)	0.365 (0.011)	10.215 (0.310)	○
		20th cycles	3.30N MIN. (0.10N/Pos.×33P)			10.041 (0.304)	10.40 (0.32)	9.69 (0.29)	0.312 (0.009)	9.105 (0.276)	○
	35P	Initial	4.55N MIN. (0.13N/Pos.×35P)	5	5	11.996 (0.343)	12.26 (0.35)	11.39 (0.33)	0.365 (0.010)	10.901 (0.311)	○
		20th cycles	3.50N MIN. (0.10N/Pos.×35P)			10.649 (0.304)	11.01 (0.31)	10.30 (0.29)	0.312 (0.009)	9.713 (0.278)	○
	39P	Initial	5.07N MIN. (0.13N /Pos.×39P)	5	5	13.482 (0.346)	13.75 (0.35)	12.88 (0.33)	0.365 (0.009)	12.387 (0.318)	○
		20th cycles	3.90N MIN. (0.10N /Pos.×39P)			11.914 (0.305)	12.34 (0.32)	11.47 (0.29)	0.394 (0.010)	10.732 (0.275)	○
	41P	Initial	5.33N MIN. (0.13N /Pos.×41P)	5	5	14.362 (0.350)	15.18 (0.37)	13.68 (0.33)	0.707 (0.017)	12.241 (0.299)	○
		20th cycles	4.10N MIN. (0.10N /Pos.×41P)			13.080 (0.319)	13.71 (0.33)	12.56 (0.31)	0.423 (0.010)	11.811 (0.288)	○
	45P	Initial	5.85N MIN. (0.13N /Pos.×45P)	5	5	15.535 (0.345)	16.15 (0.36)	14.98 (0.33)	0.543 (0.012)	13.906 (0.309)	○
		20th cycles	4.50N MIN. (0.10N /Pos.×45P)			14.270 (0.317)	14.90 (0.33)	13.75 (0.31)	0.423 (0.009)	13.001 (0.289)	○
	49P	Initial	6.37N MIN. (0.13N /Pos.×49P)	5	5	16.935 (0.346)	17.55 (0.36)	16.38 (0.33)	0.543 (0.011)	15.306 (0.312)	○
		20th cycles	4.90N MIN. (0.10N /Pos.×49P)			15.550 (0.317)	16.18 (0.33)	15.03 (0.31)	0.423 (0.009)	14.281 (0.291)	○
	51P	Initial	6.63N MIN. (0.13N /Pos.×51P)	5	5	17.948 (0.352)	18.83 (0.37)	17.25 (0.34)	0.730 (0.014)	15.758 (0.309)	○
		20th cycles	5.10N MIN. (0.10N /Pos.×51P)			16.430 (0.322)	17.06 (0.33)	15.91 (0.31)	0.423 (0.008)	15.161 (0.297)	○
	55P	Initial	7.15N MIN. (0.13N /Pos.×55P)	5	5	19.068 (0.347)	19.53 (0.36)	18.15 (0.33)	0.538 (0.010)	17.454 (0.317)	○
		20th cycles	5.50N MIN. (0.10N /Pos.×55P)			17.670 (0.321)	18.14 (0.33)	17.19 (0.31)	0.352 (0.006)	16.614 (0.302)	○
	57P	Initial	7.41N MIN. (0.13N/Pos.×57P)	5	5	19.744 (0.346)	20.11 (0.35)	19.33 (0.34)	0.362 (0.006)	18.658 (0.327)	○
		20th cycles	5.70N MIN. (0.10N /Pos.×57P)			18.164 (0.319)	18.45 (0.32)	17.82 (0.31)	0.240 (0.004)	17.444 (0.306)	○
61P	Initial	7.93N MIN. (0.13N /Pos.×61P)	5	5	21.164 (0.347)	22.21 (0.36)	20.54 (0.34)	0.631 (0.010)	19.271 (0.316)	○	
	20th cycles	6.10N MIN. (0.10N /Pos.×61P)			19.318 (0.317)	19.82 (0.32)	18.82 (0.31)	0.460 (0.008)	17.938 (0.294)	○	

Table 2-4 Test Result

Test Item	Measurement		Spec.	Set	N	Data					Judge	
						AVE.(X)	MAX.	MIN.	s	X±3s		
C Group Retention Force	C/T		0.3N MIN.	5	30	1.156	1.30	1.01	0.089	0.889	○	
D Group Vibration Shock	Contact Resistance (mΩ)	※U	Initial	60mΩ MAX.	5	195	23.764	29.97	19.00	3.357	33.835	○
			After Vibration	ΔR=40mΩ MAX.			0.653	4.55	-3.20	1.728	5.837	○
			After Shock				0.587	4.69	-3.32	1.822	6.053	○
	Contact Resistance (mΩ)	※L	Initial	60mΩ MAX.	5	195	14.986	18.99	11.06	2.259	21.763	○
			After Vibration	ΔR=40mΩ MAX.			1.143	4.14	-1.96	1.331	5.136	○
			After Shock				1.290	4.77	-1.82	1.429	5.577	○
	Discontinuity	In Vibration	1μsec. MAX.	10	10	No Discontinuity					○	
		In Shock				No Discontinuity					○	
Appearance	After Vibration	No abnormality adversely affecting the performance shall occur.	10	10	No Abnormality					○		
	After Shock				No Abnormality					○		
E Group Fretting corrosion	Contact Resistance (mΩ)	U	Initial	60mΩ MAX.	5	195	23.857	29.96	19.01	3.474	34.279	○
			After Test	ΔR=40mΩ MAX.			0.508	4.68	-3.79	1.750	5.758	○
	Contact Resistance (mΩ)	L	Initial	60mΩ MAX.	5	195	14.925	18.95	11.10	2.184	21.477	○
			After Test	ΔR=40mΩ MAX.			1.276	4.85	-1.61	1.377	5.407	○
	Discontinuity	In Test	1μsec. MAX.	10	10	No Discontinuity					○	
Appearance	After Test	No abnormality adversely affecting the performance shall occur.	10	10	No Abnormality					○		
F Group Thermal Shock	Contact Resistance (mΩ)	U	Initial	60mΩ MAX.	5	195	23.885	29.86	19.08	3.422	34.151	○
			After Test	ΔR=40mΩ MAX.			0.566	4.44	-3.45	1.657	5.537	○
	Contact Resistance (mΩ)	L	Initial	60mΩ MAX.	5	195	14.930	18.98	11.07	2.335	21.935	○
			After Test	ΔR=40mΩ MAX.			1.235	4.65	-1.73	1.403	5.444	○
	Appearance	After Test	No abnormality adversely affecting the performance shall occur.	10	10	No Abnormality					○	

※U : Upper Contact L : Lower Contact

Table 2-5 Test Result

Test Item	Measurement		Spec.	Set	N	Data					Data		
						AVE.(X)	MAX.	MIN.	s	X±3s			
G Group High Temp. Life	Contact Resistance (mΩ)	※U	Initial	60mΩ MAX.	5	195	23.811	30.00	19.00	3.470	34.221	○	
			After Test	Δ R=40mΩ MAX.			0.473	4.76	-3.35	1.740	5.693	○	
		※L	Initial	60mΩ MAX.	5	195	14.904	18.99	11.02	2.345	21.939	○	
		After Test	Δ R=40mΩ MAX.	1.335			4.77	-1.53	1.417	5.586	○		
	Appearance	After Test	No abnormality adversely affecting the performance shall occur.			10	10	No Abnormality					○
H Group High Temp. & High Hum. energizing	Contact Resistance (mΩ)	U	Initial	60mΩ MAX.	5	195	23.801	29.99	19.03	3.637	34.712	○	
			After Test	Δ R=40mΩ MAX.			0.484	4.53	-3.56	1.631	5.377	○	
			L	Initial	60mΩ MAX.	5	195	14.844	18.97	11.01	2.428	22.128	○
		After Test		Δ R=40mΩ MAX.	1.363			4.66	-1.64	1.462	5.749	○	
	D.W.Voltage	U	Initial	No abnormalities such as creeping discharge, flashover, insulator breakdown occur	5	190	No Abnormality					○	
			After Test				No Abnormality					○	
		L	Initial		5	190	No Abnormality					○	
			After Test				No Abnormality					○	
	Insulation Resistance (MΩ)	U	Initial	100MΩ MIN	5	190	MIN. 5.0×10 <sup>5</sup> MΩ					○	
			After Test				MIN. 1.0×10 <sup>5</sup> MΩ					○	
L		Initial	5		190	MIN. 4.0×10 <sup>5</sup> MΩ					○		
		After Test				MIN. 2.5×10 <sup>5</sup> MΩ					○		
Appearance	After Test	No abnormality adversely affecting the performance shall occur.			10	10	No Abnormality					○	

※U : Upper Contact L : Lower Contact



Table 2-6 Test Result

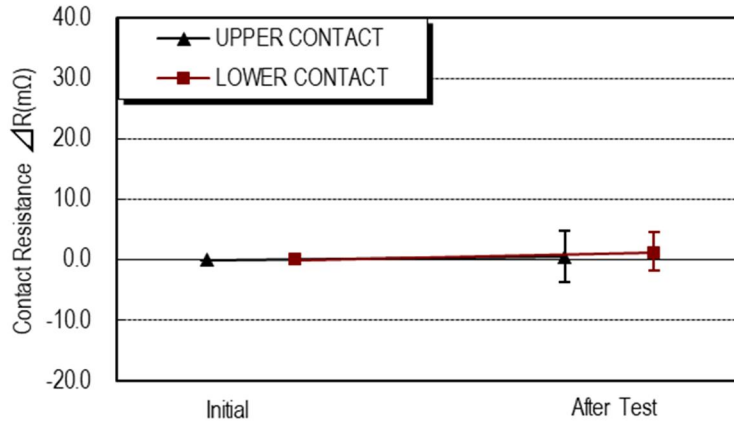
Test Item	Measurement		Spec.	Set	N	Data					Judge	
						AVE.(X)	MAX.	MIN.	s	X±3s		
J Group High Temp. & High Hum. Life	Contact Resistance (mΩ)	※U	Initial	60mΩ MAX.	5	195	23.761	29.94	19.00	3.372	33.877	○
			After Test	ΔR=40mΩ MAX.			0.636	4.31	-3.37	1.674	5.658	○
		※L	Initial	60mΩ MAX.	5	195	15.145	19.00	11.08	2.326	22.123	○
			After Test	ΔR=40mΩ MAX.			1.079	4.60	-1.82	1.348	5.123	○
	D.W.Voltage	U	Initial	No abnormalities such as creeping discharge, flashover, insulator breakdown occur	5	190	No Abnormality					○
			After Test				No Abnormality					○
		L	Initial		No Abnormality					○		
			After Test		No Abnormality					○		
	Insulation Resistance (MΩ)	U	Initial	100MΩ MIN	5	190	MIN. 5.0×10 <sup>4</sup> MΩ					○
			After Test				MIN. 1.5×10 <sup>4</sup> MΩ					○
		L	Initial		MIN. 5.0×10 <sup>4</sup> MΩ					○		
			After Test		MIN. 1.0×10 <sup>4</sup> MΩ					○		
	Appearance	After Test	No abnormality adversely affecting the performance shall occur.	10	10	No Abnormality					○	
	K Group Cold Temp. Life	Contact Resistance (mΩ)	U	Initial	60mΩ MAX.	5	195	23.741	29.94	19.00	3.614	34.583
After Test				ΔR=40mΩ MAX.	0.626			4.08	-3.23	1.627	5.507	○
L			Initial	60mΩ MAX.	5	195	15.008	18.99	11.00	2.228	21.692	○
			After Test	ΔR=40mΩ MAX.			1.191	4.71	-1.72	1.383	5.340	○
Appearance		After Test	No abnormality adversely affecting the performance shall occur.	5	5	No Abnormality					○	
L Group Gas(H <sub>2</sub> S)	Contact Resistance (mΩ)	U	Initial	60mΩ MAX.	5	195	23.852	29.96	19.01	3.553	34.511	○
			After Test	ΔR=40mΩ MAX.			0.487	4.22	-3.28	1.661	5.470	○
		L	Initial	60mΩ MAX.	5	195	14.997	18.98	11.02	2.399	22.194	○
			After Test	ΔR=40mΩ MAX.			1.101	4.64	-1.97	1.393	5.280	○
	Appearance	After Test	No abnormality adversely affecting the performance shall occur.	10	10	No Abnormality					○	

※U : Upper Contact    L : Lower Contact

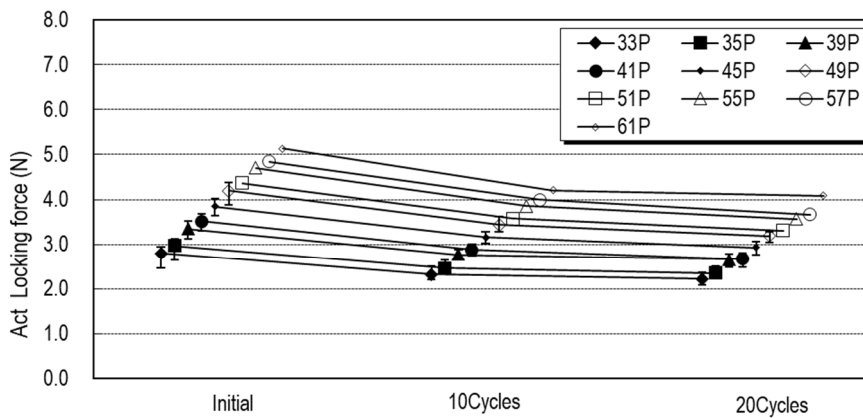
Table 2-7 Test Result

Test Item	Measurement		Spec.	Set	N	Data					Judge	
						AVE.(X)	MAX.	MIN.	s	X±3s		
M Group Gas(SO <sub>2</sub> )	Contact Resistance (mΩ)	※U	Initial	60mΩ MAX.	5	195	23.723	29.87	19.03	3.539	34.340	○
			After Test	ΔR=40mΩ MAX.			0.589	4.66	-3.37	1.728	5.773	○
		※L	Initial	60mΩ MAX.	5	195	15.045	19.00	11.00	2.375	22.170	○
			After Test	ΔR=40mΩ MAX.			1.117	4.23	-1.85	1.349	5.164	○
	Appearance	After Test	No abnormality adversely affecting the performance shall occur.	10	10	No Abnormality					○	
N Group Salt Water Spray	Contact Resistance (mΩ)	U	Initial	60mΩ MAX.	5	195	23.675	29.99	19.01	3.545	34.310	○
			After Test	ΔR=40mΩ MAX.			0.638	4.28	-3.86	1.687	5.699	○
		L	Initial	60mΩ MAX.	5	195	15.014	18.98	11.02	2.393	22.193	○
			After Test	ΔR=40mΩ MAX.			1.281	4.26	-1.74	1.448	5.625	○
	Appearance	After Test	No abnormality adversely affecting the performance shall occur.	10	10	No Abnormality					○	
P Group Solderability	Zero x Time (sec.)	C/T	3sec. MAX	5	5	MAX. 0.1sec.					○	
	Appearance	C/T	Wetness: 95% MIN.	5	5	95%MIN.was wet.					○	
Q Group Soldering Heat Resistance	Reflow twice		No Abnormality	5	5	No Abnormality					○	
	Soldering iron											
R Group Temp. rising	0.3A/Contact		ΔT=30K MAX.	5	5	No Problem. MAX.ΔT=10.6K					○	

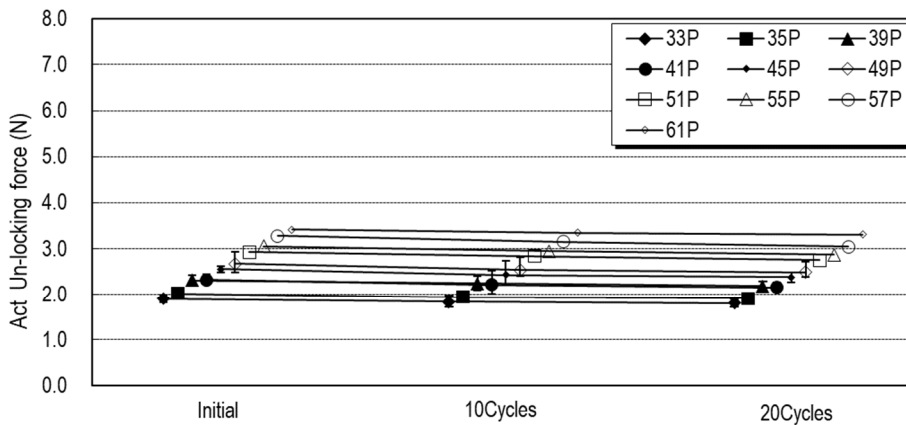
※U : Upper Contact L : Lower Contact



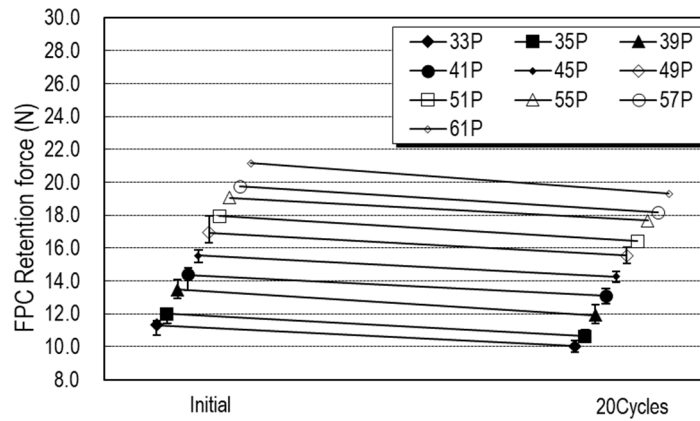
Graph.1 A change of contact resistance  
A group : Durability



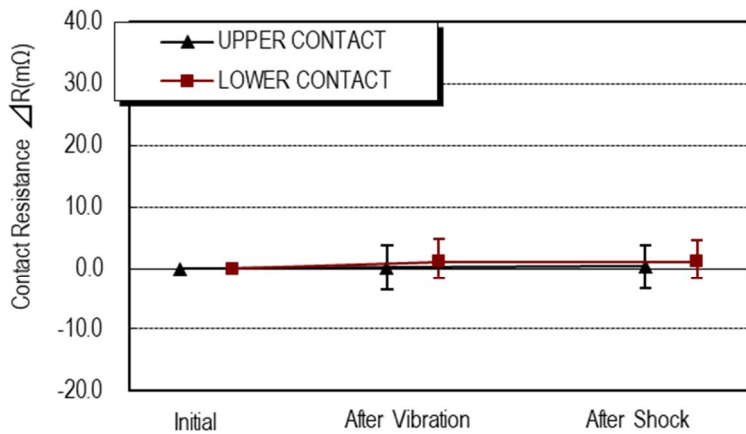
Graph.2 A change of Locking force  
A group : Durability



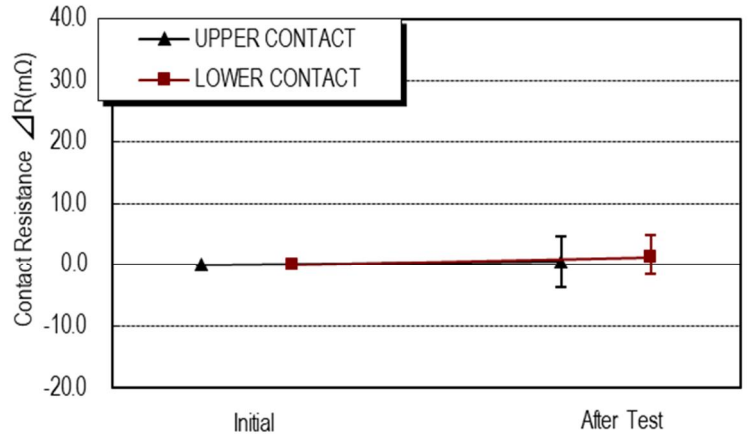
Graph.3 A change of Un-locking force  
A group : Durability



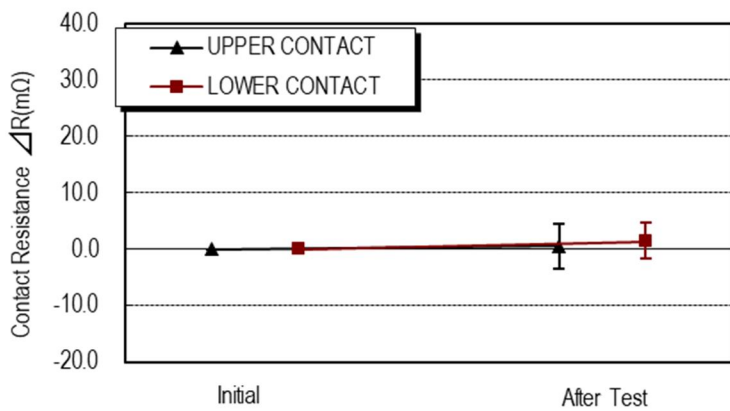
Graph.4 A change of FPC Retention Force  
B group : FPC Retention Force



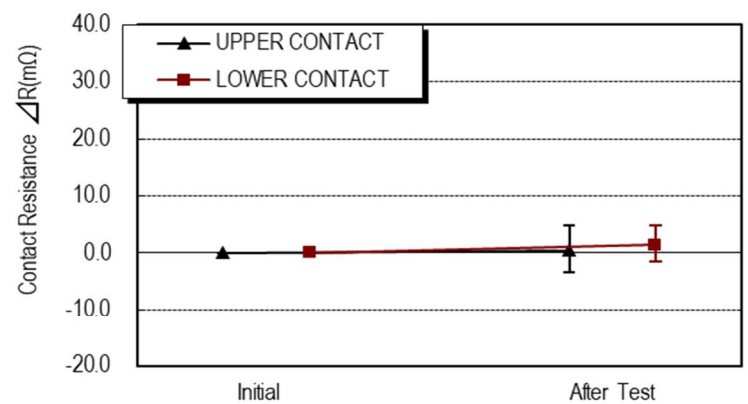
Graph.5 A change of contact resistance  
D group : Vibration / Shock



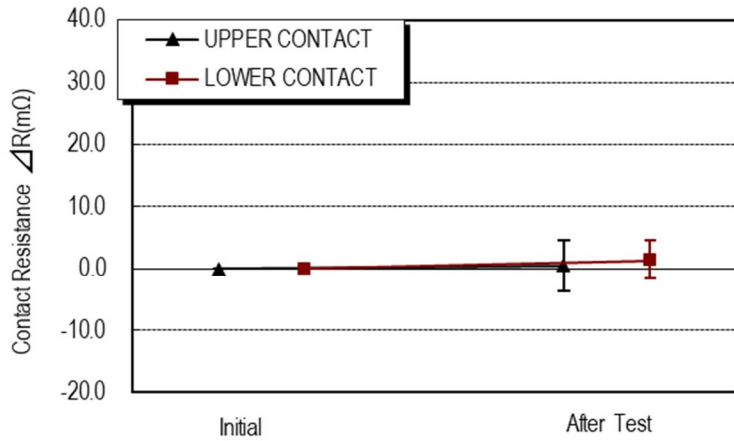
Graph.6 A change of contact resistance  
E group : Fretting Corrosion



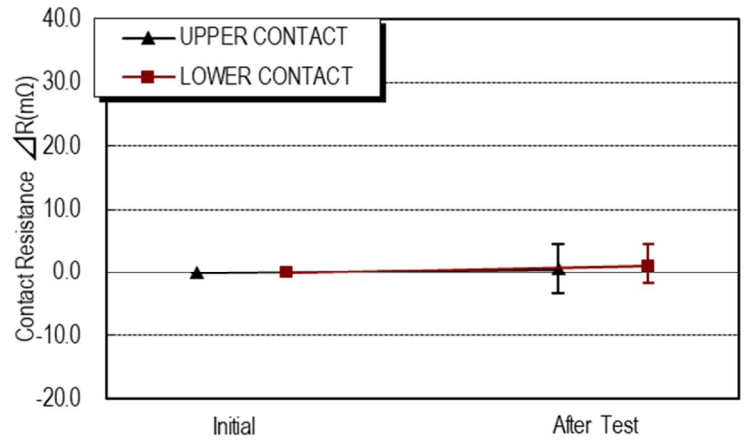
Graph.7 A change of contact resistance  
F group : Thermal Shock



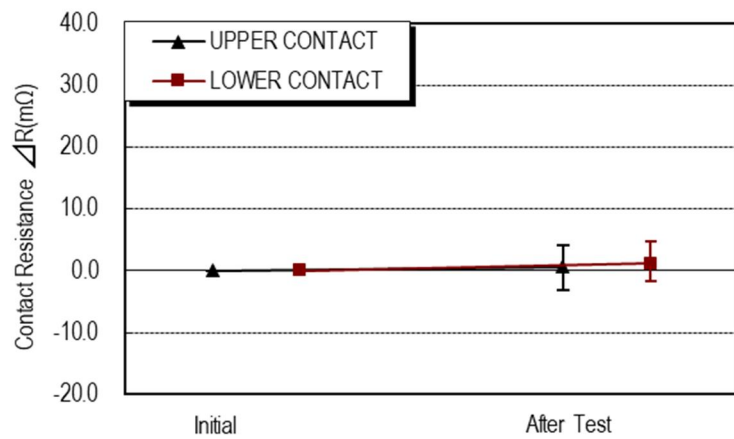
Graph.8 A change of contact resistance  
G group : High Temp. Life



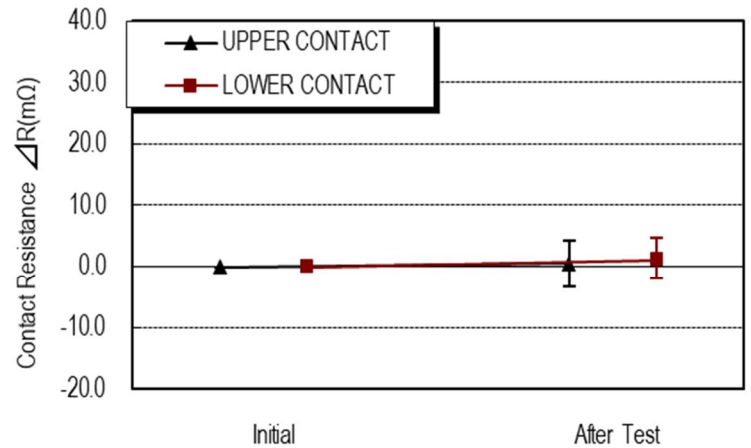
Graph.9 A change of contact resistance  
H group : High Temp. & High Hum. energizing



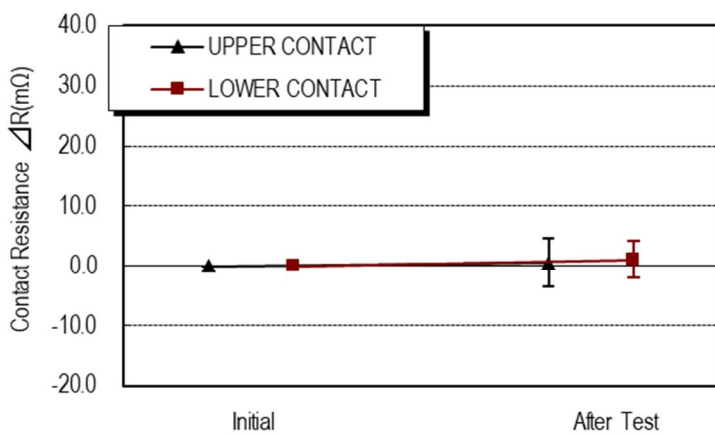
Graph.10 A change of contact resistance  
J group : High Temp. & High Hum. Life



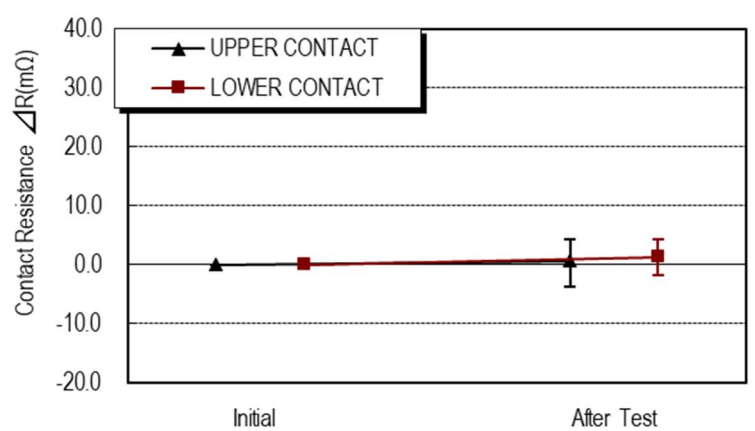
Graph.11 A change of contact resistance  
K group : Cold Temp. Life



Graph.12 A change of contact resistance  
L group : Gas (H<sub>2</sub>S)



Graph.13 A change of contact resistance  
M group : Gas (SO<sub>2</sub>)



Graph.14 A change of contact resistance  
N group : Salt Water Spray