ELCON Mini cable-to-board power connector system, Two Position, with Pull-Tab

1. INTRODUCTION

1.1 Purpose

Testing was performed on the ELCON Mini two position cable-to-board connector system, using connectors with the optional coding contacts, and cable connectors with Pull-tab to determine its conformance to requirements of Design Objectives 108-19346, Revision H.

1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the cable connector plug (part number 2246068-1) and board connector (part number 1982295-1). Testing was performed at the Engineering Assurance Product Testing Laboratory between 03Jul2014 and 10Oct2014.

1.3. Conclusion

The cable connector plug (part number 2246068-1) and board connector (part number 1982295-1) conformed to the electrical, mechanical, and environmental performance requirements of Design Objectives 108-19346, Revision H.

1.4. Environmental Conditions

Unless otherwise stated. The following environmental conditions prevailed during testing

Temperature: 15 to 35°C
Relative Humidity: 25 to 75%

1.5. Product Qualification and Requalification Test Sequence

Test or Examination	Test Group						
	1	2	3	4	5	6	7
	Test Sequence (a)						
Examination of product	1,10,14	1,6	1,9	1,17	1,4	1,6	1,3(b)
Termination resistance(power contacts & coding contacts)	2,7,11	2,5	2,4,6,8	2,6,10,14			
Insulation resistance				3,7,11,15			
Voltage proof				4,8,12,16			
Electrical load and temperature		4					
Current temperature de-rating curve		3					
Short-circuit capacity power contacts							2(b)
Resistance at crimp					2		
Vibration Sinusoidal	5						
Physical shock	6						
Insertion/withdrawal forces	3						
Insertion forces during wrong polarization	4						

Latch activation force (no power contact)						2,5	
Mechanical operation(half of number)			3,7				
Contact retention force in cable connector.	12						
Cable pull in 5 directions	8						
Locking latch strength	9						
Crimp tensile.					3		
Coding contact activation	13						
Rapid change of temperature				5			
Climatic sequence				9			
Damp/heat steady state				13			
Corrosion mixed flowing gas			5(c)				
Thermal shock						3	
Temperature life						4	

(a) Numbers indicate sequence in which tests are performed

(b) Executed by the customer

(c) Connectors for this tests shall be preconditioned by mating and un-mating 10 cycles

1.6. Test Specimens

The specimens were representative of normal production lots.

Sample-quantities	Sum	TEST-GROUP						
		1	2	3	4	5	6	7
Board connectors	24	6	6	3	3		3	3
Cable connectors(Terminated to cable)	21	6(d)	6(d)	3	3			3
Cable with power contact	6					6(d)		
Cable connectors(No cable)	3						3	

(d) Half are 4mm² cables the other half are 6mm² cables.

2. SUMMARY OF TESTING

**** Notes:*** *Test group 3 refers to the data of Group 2 in original ELCON Mini Two Position (without pull-tab) test report: 501-19131.*

2.1. Initial Examination of Product – All Test Groups

All specimens submitted for testing were representative of normal production lots. A Certificate Conformance (C of C) was issued by Product Assurance. Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2. Termination resistance (power contacts & coding contacts) – Test Groups 1, 2 and 4.

**** Notes:*** *Termination resistance 1 values below are excl. bulk resistance of wire (approx.: 4mm² cable is 0.32mΩ, 6mm² cable is 0.20mΩ). The values of termination resistance 2 below are calculated by resistance 1 subtracting bulk resistance of both contact tab and timer contact.*

Test Group		Test Sequence	Termination resistance 1	Spec	Jud.	Termination resistance 2	Spec	Jud.	Termination resistance 3	Spec	Jud.
1	4mm² Wire	2	0.56mΩ Max.	0.8mΩ Max.	OK	0.10mΩ Max.	0.3mΩ Max.	OK	3.10mΩ Max.	15mΩ Max	OK
		7	0.54mΩ Max.		OK	0.08mΩ Max.		OK	2.96mΩ Max. ΔR 0.54mΩ Max	ΔR<5mΩ	OK
		11	0.56mΩ Max		OK	0.10mΩ Max.		OK	5.24mΩ Max. ΔR 2.69mΩ Max	ΔR<5mΩ	OK
	6mm² Wire	2	0.59mΩ Max.		OK	0.08mΩ Max.		OK	3.57mΩ Max.	15mΩ Max	OK
		7	0.58mΩ Max.		OK	0.07mΩ Max.		OK	3.76mΩ Max. ΔR 0.50mΩ Max.	ΔR<5mΩ	OK
		11	0.77mΩ Max.		OK	0.26mΩ Max.		OK	5.16mΩ Max. ΔR 2.17mΩ Max	ΔR<5mΩ	OK
2	4mm² Wire	2	0.56mΩ Max.		OK	0.10mΩ Max.		OK	3.07mΩ Max.	15mΩ Max	OK
		5	0.62mΩ Max.		OK	0.16mΩ Max		OK	3.27mΩ Max. ΔR 0.31mΩ Max.	ΔR<5mΩ	OK
	6mm² Wire	2	0.62mΩ Max.		OK	0.11mΩ Max		OK	3.43mΩ Max.	15mΩ Max	OK
		5	0.78mΩ Max.		OK	0.27mΩ Max		OK	3.54mΩ Max. ΔR 0.97mΩ Max.	ΔR<5mΩ	OK
4	4mm² Wire	2	0.57mΩ Max.		OK	0.11mΩ Max.		OK	3.28mΩ Max.	15mΩ Max	OK
		6	0.55mΩ Max.		OK	0.09mΩ Max.		OK	3.37mΩ Max. ΔR 1.06mΩ Max.	ΔR<5mΩ	OK
		10	0.56mΩ Max		OK	0.10mΩ Max.		OK	3.29mΩ Max. ΔR 0.27mΩ Max.	ΔR<5mΩ	OK
		14	0.60mΩ Max.		OK	0.14mΩ Max.		OK	3.49mΩ Max.ΔR 0.68mΩ Max.	ΔR<5mΩ	OK

2.3. Insulation resistance – Test Group 4.

Test Group	Test Sequence	Insulation Resistance	Spec.	Jud.
4	3	$6.65x10^{10}$Ω Min.	$5x10^3$ MΩ	OK
	7	$4.44x10^{11}$Ω Min.	$1x10^3$ MΩ	OK
	11	$5.55x10^{10}$Ω Min.		OK
	15	$4.20x10^{11}$Ω Min.		OK

2.4. Voltage proof – Test Group 4.

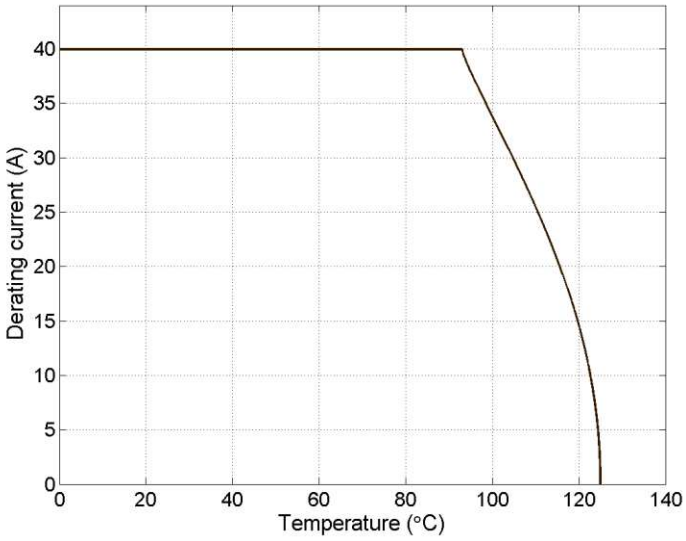
Test Group	Test Sequence	Insulation Resistance	Spec.	Jud.
4	4	No break-down or flash-over was observed.	No breakdown or flashover.	OK
	8	No break-down or flash-over was observed.		OK
	12	No break-down or flash-over was observed.		OK
	16	No break-down or flash-over was observed.		OK

2.5. Electrical load and temperature– Test Group 2.

The data was taken from specimens mounted on 2 ounce copper 4 layers printed circuit boards. The maximum temperature rise for connectors with 4mm² cable is 6.15℃, and connectors with 6mm² cables is 14.90℃. Both result meet the requirement of 30℃ max. T-rise.

2.6. Current temperature de-rating curve – Test Group 2.

The data was taken from specimens mounted on 2 ounce copper 4 layers printed circuit boards.



6mm²Wire

2.7. Resistance at crimp – Test Group 5.

Test Group		Test Sequence	Resistance at Crimp	Spec.	Jug.
5	4mm²Wire	2	0.03mΩ Max.	0.103mΩ Max.	OK
	6mm²Wire	2	0.06mΩ Max.	0.073mΩ Max.	OK

2.8. Vibration Sinusoidal – Test Group 1.

No discontinuity greater than 1microsecond were detected; No physical damage.

2.9. Physical shock – Test Group 1.

No discontinuity greater than 1microsecond were detected; No physical damage.

2.10. Insertion/withdrawal forces – Test Group 1.

Test Group		Test Sequence	Insertion force	Spec.	Jug.	Withdrawal force	Spec.	Jug.
1	4mm²Wire	3	23.85~24.70 N	50N Max.	OK	11.9~12.5N	10~30N	OK
	6mm²Wire	3	23.94~24.46 N	50N Max.	OK	11.72~12.63 N	10~30N	OK

2.11. Insertion forces during wrong polarization – Test Group 1.

The cable connector was not mated during the applied force of 250N. No physical damage occurred.

2.12. Latch activation force (no power contact) – Test Group 6.

Test Group	Test Sequence	Latch activation force	Spec	Jug.
6	2	9.53N ~ 11.59 N	20N Max.	OK
	5	7.86N ~ 9.41 N		OK

2.13. Contact retention force in cable connector – Test Group 1.

Apply 50N straight force at a contact of the cable connector, in un-mating direction during 10 sec, all maximum displacement smaller than 0.20mm.

2.14. Cable pull in 5 directions – Test Group 1.

No functional damage was observed and the latch stayed in place.

2.15. Locking latch strength – Test Group 1.

No functional damage was observed and the latch stayed in place.

2.16. Crimp tensile – Test Group 5.

Test Group		Test Sequence	Crimp tensile	Spec.	Jug.
5	4mm²Wire	3	480N Min.	285N Min.	OK
	6mm²Wire	3	448N Min.	370N Min.	OK

2.17. Coding contact activation – Test Group 1.

First power contacts were activated

2.18. Rapid change of temperature – Test Group 4.

No physical damage was found after test.

2.19. Climatic sequence – Test Group 4.

No evidence of abnormities was found after test.

2.20. Damp/heat steady state – Test Group 4.

No evidence of abnormities was found after test.

2.21. Thermal shock – Test Group 6.

No physical damage was found after test.

2.22. Temperature life – Test Group 6.

No physical damage was found after test.

3. TEST REQUIREMENTS AND PROCEDURES SUMMARY

VISUAL		
Test Description	**Performance Requirements**	**Procedures**
Examination of product	• Meets requirements of product drawing and applicable instructions on customer drawing, instruction sheet and application specification.	• Visual, dimensional and functional per applicable inspection plan.

ELECTRICAL		
Test Description	**Performance Requirements**	**Procedures**
Termination resistance power contacts	• Termination resistance 1: Requirement: 0.8mΩ max. (Initial) 0.8mΩ max. (Final) • Termination resistance 2: Requirement: 0.3mΩ max. (Initial) 0.3mΩ max. (Final)	• In acc. with IEC 60512-2-1 • Max. Open voltage 20mV. • Max. Current 100 mA DC. • All contacts to be ensured. • Measuring points shall be as indicated in Figure 1
Termination resistance coding contacts	• Termination resistance 3: Requirement: 15 mΩ max. (Initial) ΔR 5mΩmax (Final)	• In acc. with IEC 60512-2-1 • Max. Open voltage 20mV. • Max. Current 100 mA DC. • All contacts to be ensured. • Measuring points shall be as indicated in Figure 1
Insulation resistance	• $5x10^3$ MΩ minimum Initial • $1x10^3$ MΩ minimum final	• In accordance with IEC 60512-3-1 • Test voltage 100V DC. • Duration: 1 minute. • Test between adjacent contacts.
Voltage proof	• No break-down or flash-over	• In acc. with IEC 60512-4-1 • Test voltage 750 Vrms for adjacent contacts unmated • Duration 1 minute. • Test is applicable for unmated board-connector and unmated cable-connector
Electrical load and temperature	• Temperature rise is 30℃ maximum over ambient temperature.	• In accordance with IEC 60512-9-2 • Oven temperature: 65℃ • Duration: 1000 hrs • Current: For 4mm² conductor, 26A, all contacts charged. For 6mm² conductor, 35A, all contacts charged.
Current temperature de-rating curve	• Temperature rise is 30℃ maximum over ambient temperature	• In acc. with IEC 60512-5-2 test 5b • 26 A for 4mm² Conductor and 35A for 6mm² Conductor
Short-circuit capacity power contacts		• Test-current 3000 A/ 10 ms on a mated connector-system • Max 5 operations • Executed by customer
Resistance at crimp	• 4mm² Conductor=0,103mΩ • 6mm² Conductor=0,073mΩ	• Current should be 1 A max. • Open voltage should be 0.5 V max. • The conductor with the length 1mm should be subtracted. • Measuring points shall be as indicated in Figure 3

MECHANICAL

Test Description	Performance Requirements	Procedures
Vibration Sinusoidal	• no discontinuity > 1µs. is allowed (power-contacts and shielding-contacts) • no physical damage is allowed	• In accordance with IEC 60512-6-4 • 10-500 Hz sweeping • 1 oct./min. • displacement 0,75mm • peak-acceleration: 10g • duration of 30 minutes in each of 3 mutual perpendicular axes.
Physical shock	• no discontinuity > 1µs. is allowed (power-contacts and shielding-contacts) • no physical damage is allowed	• In accordance with IEC 60512-6-3 • Subject connector to 50 g half sine shock, pulses of 11ms duration. • 6 shocks in each of 3 mutual perpendicular axes.
Insertion/withdrawal forces	• total mating force 50N maximum • total un-mating force 10N minimum, 30N maximum	• In accordance with IEC 60512-13-2 • Mate and un-mate connector-pair • Speed: 10 mm/min.
Insertion forces during wrong polarization.	• no physical damage is allowed • creating an electrical connection between male and female power-contacts is not allowed	• In accordance with IEC 60512-15-1 • Apply 250 N straight force at the cable connector, in mating direction during 10 sec.
Latch activation force	• maximum force needed to open latch: 20N	• In accordance with TE lab-procedures.
Mechanical operation	• no functional damage is allowed • Locking latch shall latch into the PCB connector.	• In accordance with IEC 60512-9-1 • Mate and un-mate connector-pair • Rate: 500 cycles/hour. Speed: 10 mm/s • Operation cycles: 50 times at -10°C to +65°C 1 times at -40°C to -10°C and +65°C to +85°C
Contact retention force in cable connector.	• maximum allowed displacement is 0,2 mm	• In accordance with IEC 60512-15-1 • Apply 50 N straight force at a contact of the cable connector, in un-mating direction during 10 sec.
Cable pull in 5 directions	• no functional damage is allowed • latch should be in place. • Termination resistance 1: 0.8mΩ max. • Termination resistance 3: 20mΩ max.	• In accordance with IEC 60512-17-3 • Cable connector mated on board connector. • Directions: un-mating, up, down, left, right • Pull on pair of wires with 60 N forces, during 10 sec.
Locking latch strength	• no functional damage is allowed • latch should be in place. • Termination resistance 1: 0.8mΩ max. • Termination resistance 3: 20mΩ max.	• In accordance with IEC 60512-15-1 • Apply 100 N straight force at the mated cable connector, in un-mating direction.
Crimp tensile.	• Power Contact Conduct Size Tensile 4mm² 285N min. 6mm² 370N min.	• In accordance with IEC 60512-16-4, Test 16d Tensile strength (crimped connections) • Determine crimp tensile at a rate of 25 to 100mm per minute. • The cable clamp should not be attached (it must be left open) when performing the tensile test.
Coding contact activation	• The coding contacts shall only make contact when the power contacts are mated. See figure 2.	

ENVIRONMENTAL

Test Description	Performance Requirements	Procedures
Rapid change of temperature	See Note.	• In accordance with IEC 60512-11-4 • -40°/90°C, 0,5 hrs / 0,5 hrs, 5 cycles
Climatic sequence	See Note.	• In accordance with IEC 60512-11-1 • Sequence: 90°C, 16 hrs 25°/55°C, RH 93%, 24 hrs -40°C, 2 hrs 25°/55°C, RH 93%, 24 hrs
Damp/heat steady state	See Note.	• In accordance with IEC 60512-11-3 • Temperature 40°C, RH 95%, • Duration: 21 days
Corrosion mixed flowing gas	See Note.	• In accordance with IEC 60512-11-7 • Temperature 25°C, RH 75%, • Cl2 10 ppb, NO2 200 ppb, H2S 10 ppb, SO2 200 ppb. Duration: 10 days
Thermal shock	• no functional damage is allowed • Locking latch shall latch into the PCB connector.	• EIA-364-32F, Test Condition II. • Subject mated specimens to 5cycles between -65 and 105°C with 120 minute dwells at temperature extremes.
Temperature life	• no functional damage is allowed • Locking latch shall latch into the PCB connector.	• EIA-364-17, Method B, Test Condition 4, Test Time Condition C. • Subject mated specimens to 105°C for 1000 hours.

NOTE *Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Requalification Test Sequence shown in 1.5.*

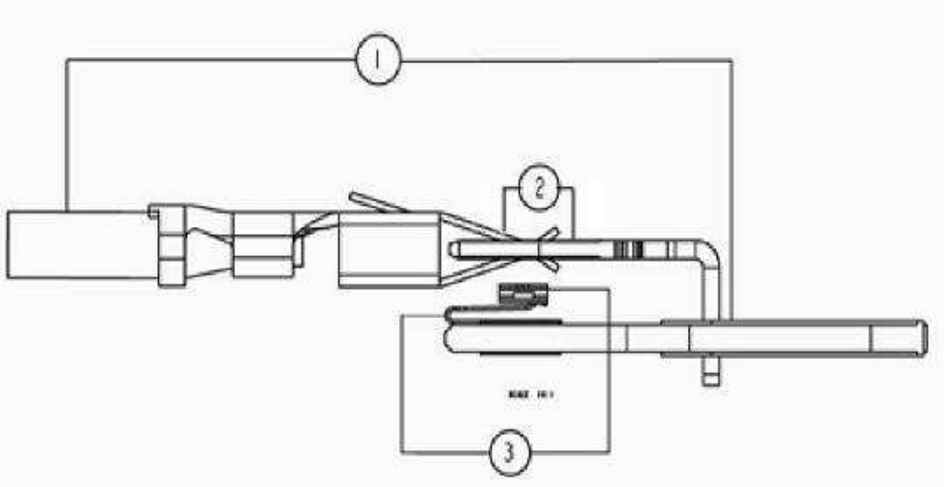


Figure 1 (measurement termination resistance)

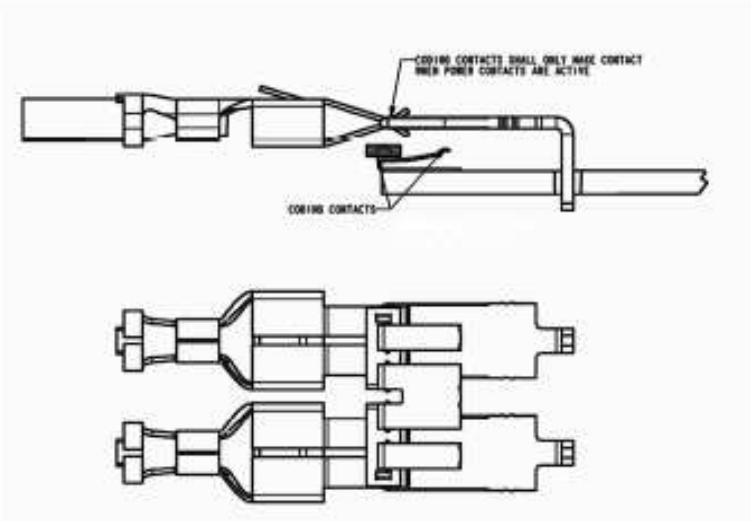


Figure 2 (coding contact activation)

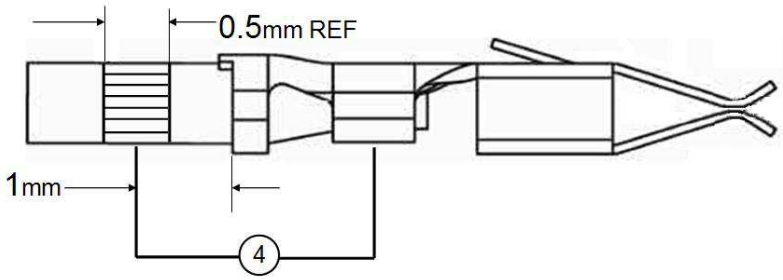


Figure 3 (Resistance at crimp)