System, 5 Position, Battery Interconnect

1. SCOPE

1.1. Content

This specification covers performance, tests and quality requirements for the TE Connectivity (TE) 5 position battery interconnect system. System consists of a battery housing assembly and a printed circuit board mounted header assembly. Battery housing and header assembly are loaded with contacts for resistive welding and thru-hole soldering respectively.

1.2. Qualification

When tests are performed on subject product line, procedures specified in 109 Series Test Specifications shall be used. All inspections shall be performed using applicable inspection plan and product drawing.

2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, latest edition of the document applies. In the event of conflict between requirements of this specification and product drawing, product drawing shall take precedence. In the event of conflict between requirements of this specification and referenced documents, this specification shall take precedence.

2.1. TE Documents

- 109-1: General Requirements for Test Specifications
- 109 Series: Test Specifications as indicated in Figure 1
- 501-305: Qualification Test Report

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of design, construction and physical dimensions specified on applicable product drawing.

3.2. Materials

- Contact:
  - Battery: Copper alloy, nickel plating
  - Header: Copper alloy, nickel plating overall, tin-lead plating in solder tail area
- Housing:
  - Battery: Thermoplastic, black, UL94V-0
  - Header: Thermoplastic, black, UL94V-0

3.3. Ratings

- Voltage: 50 volts DC
- Current: See Figure 4 for applicable current carrying capability
- Temperature: -30 to 70℃

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3.4. Performance and Test Description

Product is designed to meet electrical, mechanical and environmental performance requirements specified in Figure 1. Unless otherwise specified, all tests shall be performed at ambient environmental conditions per Test Specification 109-1.

3.5. Test Requirements and Procedures Summary

Test Description	Requirement	Procedure
Examination of product.	Meets requirements of product drawing.	Visual, dimensional and functional per applicable quality inspection plan.
ELECTRICAL		
Termination resistance.	5.5 milliohms maximum.	TE Spec 109-6-1. Subject mated contacts assembled in housing to 50 mv maximum open circuit at 100 ma maximum. See Figure 3.
Insulation resistance.	1000 megohms minimum.	TE Spec 109-28-4. Test between adjacent contacts of mated samples.
Dielectric withstanding voltage.	150 vac at sea level. 50 vac at 50000 feet.	TE Spec 109-29-1. Test between adjacent contacts of mated samples.
Temperature rise vs current.	30°C nominal temperature rise at specified current.	TE Spec 109-45-1. Measure temperature rise vs current. See Figure 4.
MECHANICAL		
Solderability.	Solderable area shall have minimum of 95% solder coverage.	TE Spec 109-11-2. Subject contacts to solderability.
Vibration, random.	No discontinuities of 1 microsecond or longer duration. See Note.	TE Spec 109-21-7. Subject mated samples to 3.13 G's rms. 20 minutes in each of 3 mutually perpendicular planes. See Figure 5.
Physical shock.	No discontinuities of 1 microsecond or longer duration. See Note.	TE Spec 109-26-9. Subject mated samples to 100 G's sawtooth shock pulses of 6 milliseconds duration. 3 shocks in each direction applied along 3 mutually perpendicular planes, 18 total shocks. See Figure 5.
Durability.	See Note.	TE Spec 109-27. Mate and unmate non-energized samples for 1000 cycles for battery housings and 5000 cycles for headers at maximum rate of 600 cycles per hour.

Figure 1 (continued)

Test Description	Requirement	Procedure
Contact retention.	Contacts shall not dislodge from connector housing.	TE Spec 109-30. Apply load of 10 Newtons to contacts.
Mating force.	8 Newtons maximum per contact.	TE Spec 109-42, Condition A. Measure force necessary to mate samples a distance of 3mm for mating orientation 1 and 5mm for mating orientation 2 from point of initial contact at maximum rate of 1.5mm per second. See Figure 6.
Unmating force.	1 Newton minimum per contact.	TE Spec 109-42, Condition A. Measure force necessary to unmate samples at maximum rate of 1.5mm per second.
ENVIRONMENTAL		
Thermal shock.	See Note.	TE Spec 109-22. Subject mated samples to 25 cycles between -30 and 105℃.
Humidity-temperature cycling.	See Note.	TE Spec 109-23-3, Condition B. Subject mated samples to 10 cycles between 25 and 65℃ at 95% RH.
Temperature life.	See Note.	TE Spec 109-43. Subject mated samples to temperature life at 105℃ for 480 hours.

NOTE *Shall meet visual requirements, show no physical damage and shall meet requirements of additional tests as specified in Test Sequence in Figure 2.*

Figure 1 (end)

3.6. Product Qualification and Requalification Test Sequence

Test or Examination	Test Group (a)				
	1(c)	2	3	4	5
	Test Sequence (b)				
Examination of product	1,9	1,9	1,8	1,3	1,3
Termination resistance	3,7	2,7			
Insulation resistance			2,6		
Dielectric withstanding voltage			3,7		
Temperature rise vs current		3,8			
Solderability					2
Vibration	5	6(e)			
Physical shock	6				
Contact retention				2	
Durability	4				
Mating force	2				
Unmating force	8				
Thermal shock			4		
Humidity-temperature cycling		4(d)	5		
Temperature life		5			

NOTE

(a) See paragraph 4.1.A.

(b) Numbers indicate sequence in which tests are performed.

(c) Each header assembly will mate with 1 battery housing only and both be subjected to 1000 cycles during durability cycling.

(d) Precondition header assembly with 5000 cycles durability. Each battery housing assembly will cycle with header assembly for 1000 cycles only. Therefore, after every 1000 cycles, the battery housing shall be replaced with a new housing until 5000 cycles is reached.

(e) Discontinuities shall not be measured. Energize at 18℃ level for 100% loadings as determined in AMP Specification 109-151.

Figure 2

4. QUALITY ASSURANCE PROVISIONS

4.1. Qualification Testing

A. Sample Selection

Samples shall be prepared in accordance with applicable Instruction Sheets and shall be selected at random from current production. Test group 1 shall consist of a minimum of 12 header assemblies and 60 battery housing assemblies where a minimum of 6 header assemblies and 6 battery housing assemblies are used with each mating configuration per Figure 6. Test group 2 shall consist of minimum of 6 header assemblies and 30 battery housing assemblies and shall be used in mating orientation 1 per Figure 6. Test group 3 shall consist of minimum of 6 header assemblies and 6 battery housing assemblies and shall be used with mating orientation 1 per Figure 6. Test groups 4 and 5 shall consist of minimum of 6 header assemblies and 6 battery housing assemblies and shall be used with mating orientation 1 per Figure 6.

B. Test Sequence

Qualification inspection shall be verified by testing samples as specified in Figure 2.

4.2. Requalification Testing

If changes significantly affecting form, fit or function are made to product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of original testing sequence as determined by development/product, quality and reliability engineering.

4.3. Acceptance

Acceptance is based on verification that product meets requirements of Figure 1. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify product. When product failure occurs, corrective action shall be taken and samples resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

4.4. Quality Conformance Inspection

The applicable quality inspection plan will specify sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with applicable product drawing and this specification.

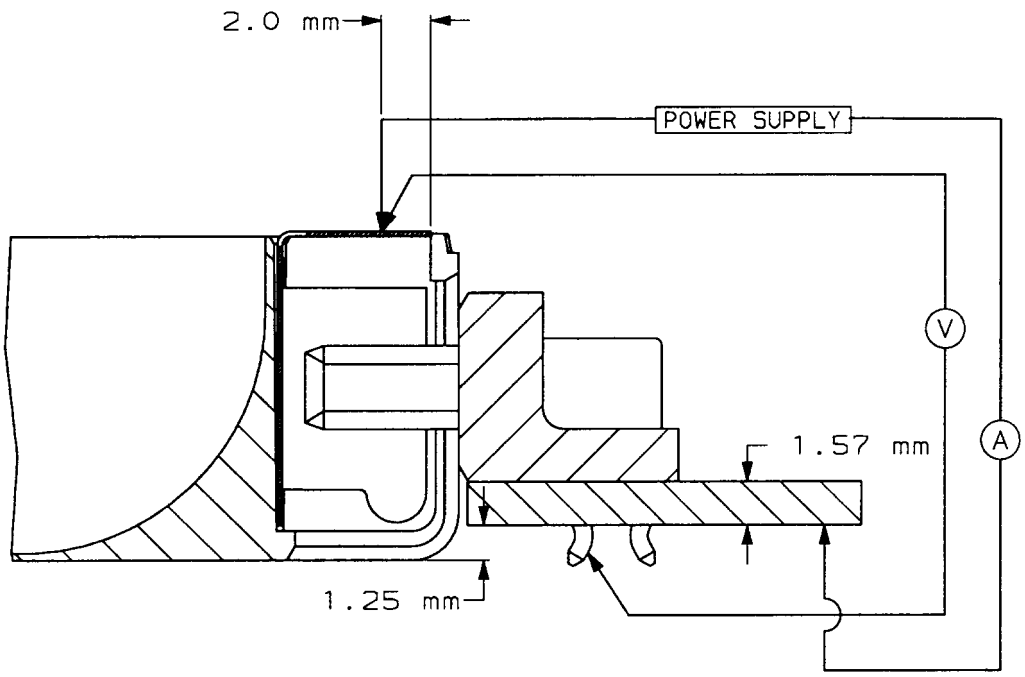


Figure 3
Termination Resistance Measurement Points

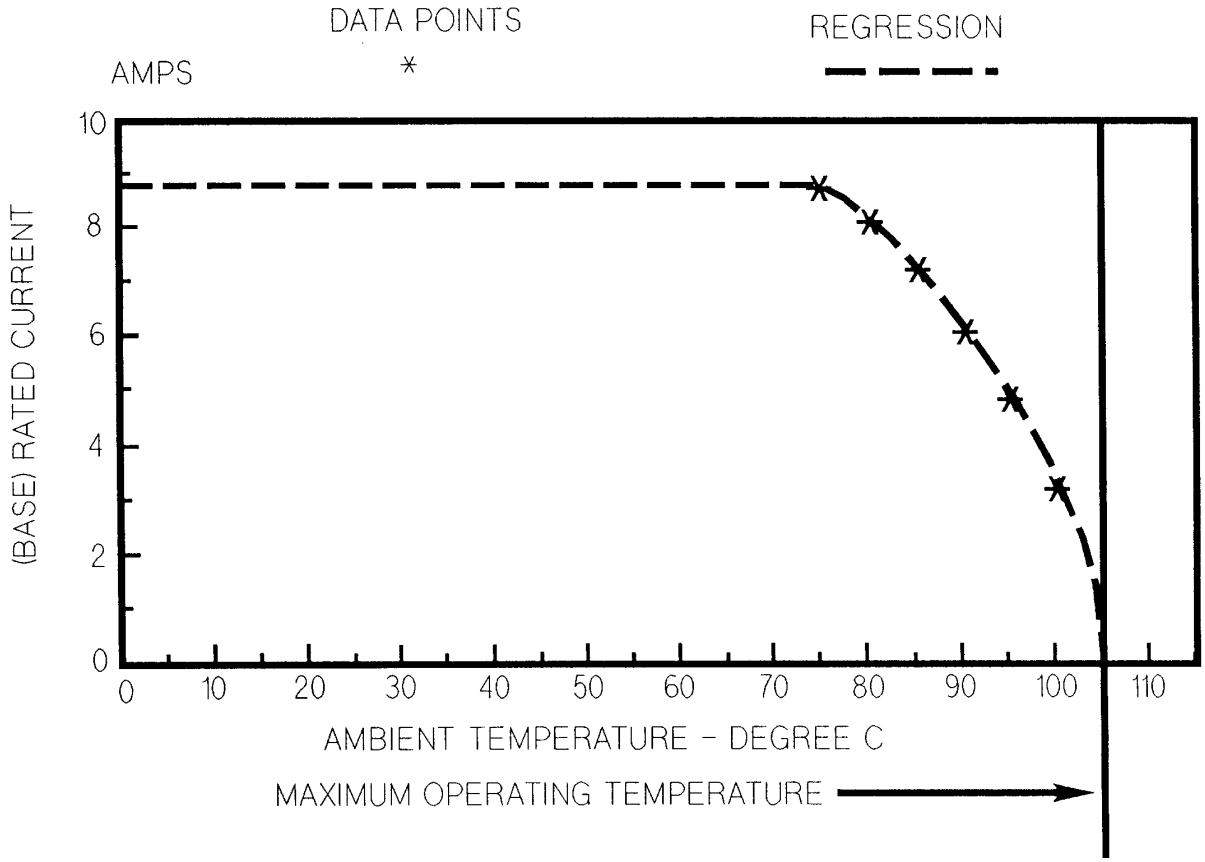


Figure 4A
Current Carrying Capability

Connector Loading	Equivalent Wire Gage (See Note)		
	0.4mm^2	0.2mm^2	0.14mm^2
Single Contact	1.0	0.8179	0.6799
2	0.9757	0.7981	0.6634
3	0.8822	0.7217	0.5999
4	0.7960	0.6511	0.5412
5	0.7162	0.5858	0.4870

NOTE

Current rating is based on same equivalent wire gage on both header and battery housing contacts. Equivalent wire gage refers to current rating of conductor equivalent to that of copper wire. Such conductor could be copper printed circuit board traces for header assembly contacts or conductive straps for battery housing assembly contacts. For example, if a printed circuit board trace is desired for only 1 header assembly contact requiring a current rating of 7 amperes, then by referring to EIA RS-214, a 0.4mm^2 equivalent wire gage is necessary for a 30℃ tempe rature rise above ambient. Then, by referring to ANSI/IPC-D-275 dated 09/91, a conductor width of approximately 1mm and a thickness of approximately 0.07mm are required. Derating is necessary for multiple contacts. This example uses a 1.57mm printed circuit board. Additional derating of 15% (current wise) is suggested for printed circuit board thickness of 0.8mm or less or conductor thickness of 0.108mm or thicker.

Figure 4B
Current Rating

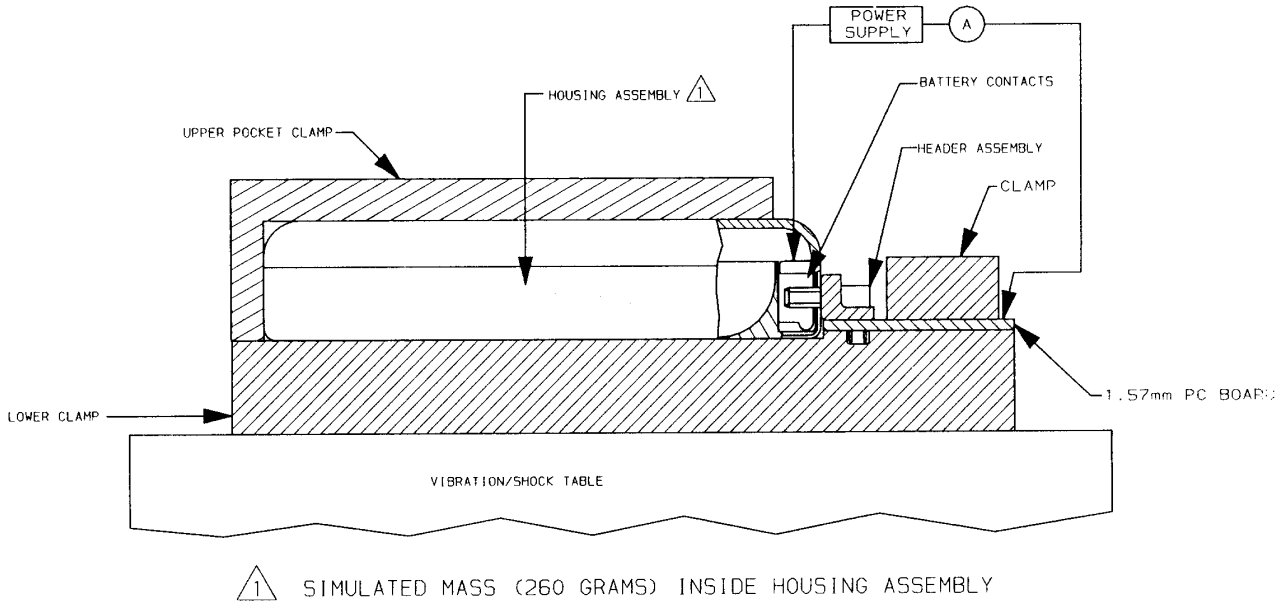


Figure 5
Vibration & Physical Shock Mounting Fixture

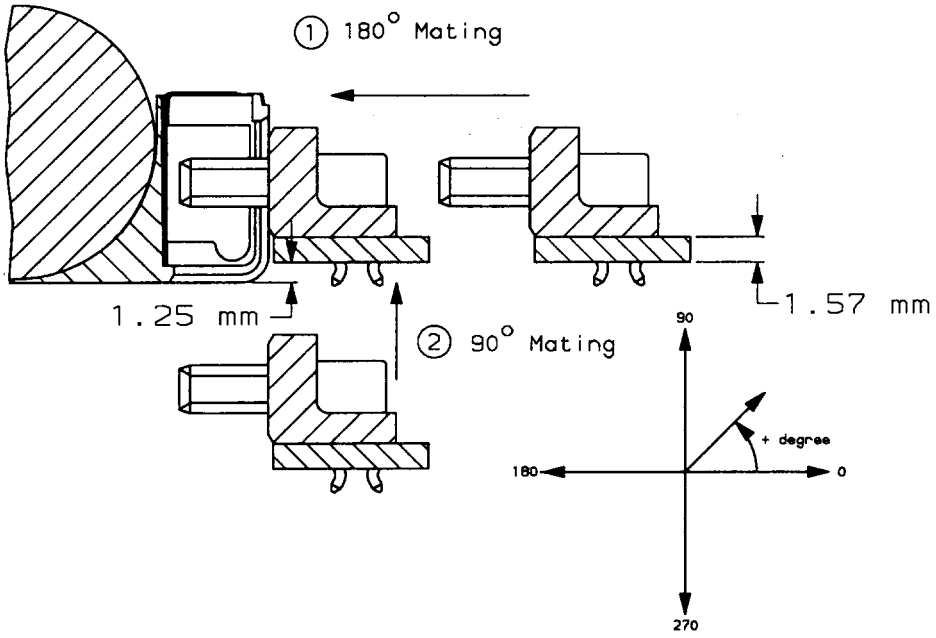


Figure 6
Mating Orientation