Grace Inertia Connector System 2.0 EV Series

1. SCOPE

1.1. Content

This specification covers performance, tests, and quality requirements for the Grace Inertia Connector system 2.0 EV.

1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 2 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

1.3. Qualification Test Results

Successful qualification testing on the subject product line was completed at the Shanghai Electrical Components Test Laboratory. The Qualification Test Report number for this testing is 501-106010.

1.4. Revision Summary

Revisions to this specification include:

- Added qualification test report
- Updated gage tolerance in Figure 6
- Updated wire sizes in Figure 8
- Change temperature Rating from “–30°C to +105°C” to “–40°C to +105°C”

2. APPLICABLE DOCUMENTS AND FORMS

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

2.1. TE Connectivity Specifications

114-5425	Application Specification – Grace Inertia Connector System 2.0 EV Series
501-106010	Qualification Test Report

2.2. Reference Documents

109-1	General Requirements for Testing

3. REQUIREMENTS

3.1. Design and Construction

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

3.2. Materials

Materials used in the construction of this product shall be as specified on the applicable TE drawing.

A. Housing: 66 Nylon (Glass Filled) UL 94 V-0, UL Level 2 Tracking Index

B. Contacts: Pre-Tin Copper Alloy or Pre-Tin Phosphor Bronze (Tin Plating: 0.8µm minimum)

C. Header: 66 Nylon (Glass Filled) UL 94 V-0, UL Level 2 Tracking Index with Copper Alloy Tin Plated Contacts (Tin Plating: 0.8µm minimum)

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3.3. Ratings

A. Voltage Rating: 50VAC

B. Temperature Rating: –40°C to +105°C

C. Current Rating: See Figure 1

Wire Size	Current [A]
24	2.2
26	2
28	1.5

Figure 1

3.4. Performance Requirements and Test Description

The product should meet the electrical, mechanical and environmental performance requirements specified in Figure 2. All tests shall be performed at ambient environmental conditions otherwise specified.

3.5. Test Requirements and Procedure Summary

Test Description	Requirement	Procedure
Examination of Product	No physical damage or corrosive influence. Meets requirements of product drawing and application specification.	Visual Inspection
Electrical		
Termination Resistance (Low Level)	Initial: 10 mΩ (maximum) Final: 20 mΩ (maximum)	109-5311-1 Measure between mating tab and at point on wire 75 mm from contact. Subtract the bulk resistance of the wire from the measurement. (Protect wire from corrosion during testing.) Test on mated connectors. Test current: <100mA Voltage: <20mV See Figure 3.
Insulation Resistance	Initial: 1000 MΩ (minimum) Final: 500 MΩ (minimum)	109-5302, MIL-STD-202, Method 302, Condition B Apply 500 VDC between adjacent contacts. Test between adjacent circuits and between the surface of housing and contact of mated connectors.
Dielectric Withstanding Voltage	No breakdown or flashover. Leakage current: 5.0 mA (maximum)	Apply 1.1 kVAC to adjacent contacts and hold at specified voltage for 1 minute. Test between adjacent circuits and between the surface of housing and contact of mated connectors.

Figure 2 (continued)

Temperature Rise	30°C (maximum) temperature rise	109-5310 Measure the temperature rise above ambient created by the energizing current in Figure 1. Measurement must be taken at a place where there is no influence from air convection. Contacts to be assembled in housing with all circuits connected. The thermocouple is to be attached to the contact in the center circuit. See Figure 3.
Mechanical		
Vibration (Low Frequency)	No electrical discontinuity greater than 1 µs. Final LLCR: 20mΩ (maximum)	109-5201 & MIL-STD-202, Method 201A Subject mated connectors to 10-55-10 Hz frequency range traversed in 1 minute at an amplitude of 1.52 mm. Apply for 2 hours in each of 3 mutually perpendicular planes. 100 mA applied electrical load. See Figure 4.
Mechanical Shock	No electrical discontinuity greater than 1 µs. Final LLCR: 20mΩ (maximum)	109-5208 & MIL-STD-202, Method 213, Condition A Subject mated connector to 50G's half-sine shock pulse of 11ms duration. 3 drops each to normal and reversed directions of X, Y and Z axis. Total of 18 drops. See Figure 4.
Connector Mating Force	(2.55 x Pos.) N (maximum) (260 x Pos.) g (maximum)	Operation speed: 100 mm/min. Measure the force required to mate connectors without locking latches.
Connector Unmating Force	1st Unmating: (0.12 x Pos.) N (minimum) (12 x Pos.) g (minimum) 6th Unmating: (0.08 x Pos.) N (minimum) (8 x Pos.) g (minimum)	Operation speed: 100 mm/min. Measure the force required to unmate connectors without locking latches.
Contact Insertion Force	4.9 N (0.5 kgf) (maximum) per contact	109-5211 Measure the force required to insert a contact into the housing.
Contact Retention Force	14.7 N (1.5 kgf) (minimum)	109-5210 Operation speed: 100 mm/min. Apply an axial pull force to the crimped wire while the housing is secured.
Contact Mating Force	(2.55 x Pos.) N (maximum) (260 x Pos.) g (maximum)	109-5206 Operation speed: 100 mm/min. Measure using gage tab. See Figure 5.
Crimp Tensile Strength	**Wire Size [mm²]** / **Crimp Tensile [N (kgf)] (min)** 0.079 / 9.8 (1) 0.14 / 19.6 (2) 0.24 / 29.4 (3)	109-5205 Operation Speed: 100 mm/min. Apply an axial pull force to the crimped wire. Contact to be secured on the tester. Insulation barrel to be disabled.

Figure 2 (continued)

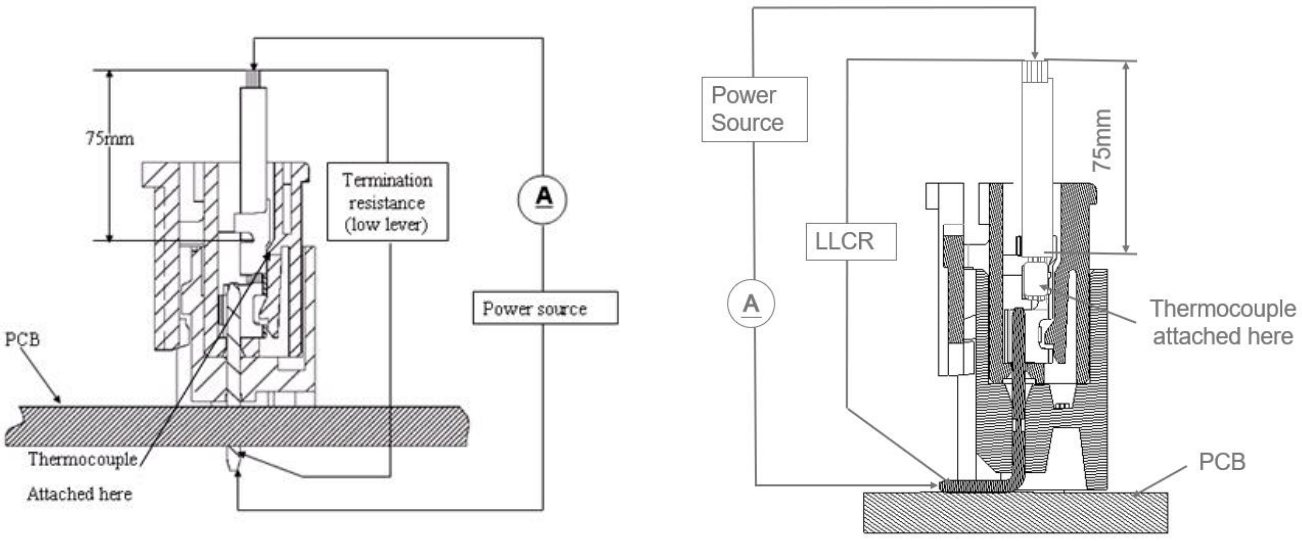
Durability	Final LLCR: 20 mΩ (maximum)	Manually mate and un-mate specimens for 6 cycles.
Housing Locking Strength	2P-10P Housings: 19.6 N (2.0 kgf) (minimum)	109-5210 Operating Speed: 100 mm/min. Measure connector locking strength.
Post Retention Force	14.7 N (1.5 kgf) (minimum)	Operating Speed: 100 mm/min Measure post retention force.
Environmental		
Thermal Shock	Final LLCR: 20mΩ (maximum)	109-5103, Condition A & MIL-STD-202, Method 107-1, Condition A-1 Subject mated specimens to 192 cycles between -55 ºC and 85 ºC with 30minute dwell time at temperature extremes. This measurement is taken after specimens are held at ambient room temperature for 3 hours.
Temperature-Humidity Cycling	Final LLCR: 20mΩ (maximum) Final Insulation Resistance: 500 MΩ (minimum) Final Dielectric Withstanding Voltage: No breakdown or flashover when 1.1 kVAC applied to adjacent contacts for 1 minute.	109-5106 MIL-STD-202, Method 106, Condition D Subject mated specimens to 10 cycles between 25ºC and 65ºC at 80-98% R.H. Measurements to be recorded after specimens are held for 3 hours at ambient temperature and humidity. 1 cycle is 24 hours.
Salt Spray	Final LLCR: 20mΩ (maximum) No corrosive influence on performance	MIL-STD-202, Method 101, Condition B Subject mated connectors to 5±1% salt concentration for 48 hours. Measurement is taken after removing the salt. Specimens dried per the specification.
Heat Aging	Final LLCR: 20mΩ (maximum)	109-5104-3, Condition A Subject mated connector to 105±2ºC for a duration of 192 hours. Measurement to be recorded after specimens are held for 3 hours at ambient temperature and humidity.
Resistance to Cold	Final LLCR: 20mΩ (maximum)	109-5108-3, Condition D Subject mated connector to –40±2ºC for a duration of 192 hours.
H_2S	Final LLCR: 20mΩ (maximum) No corrosive influence on performance	Subject mated connector to 3±1 ppm for 96 hours at 40±2°C.
NH_3 Gas	Final LLCR: 20mΩ (maximum) No corrosive influence on performance	Subject mated connector to 25 ml/l of 3% NH_3 for 7 hours.
Solderability	95% (minimum) wet solder coverage	MIL-STD-202, Method 208 Eutectic Solder: Solder Temperature: 230±5°C Immersion Duration: 3±0.5 seconds Lead-Free Solder: Solder Temperature: 240±5°C Immersion Duration: 3±0.5 seconds

Figure 2 (continued)

Resistance to Soldering Heat	No physical damage shall occur. SMT: Conduct an inspection of all plastic housings under 30X maximum magnification and note any blisters, deformation/ warpage, melting or physical damage detrimental to product performance.	109-5204, Condition B & MIL-STD-202, Condition 210 Solder Temperature: 260±5°C Immersion Duration: 10±0.5 seconds Test connector on through hole PCB. In case of manual soldering iron, apply at 360±10°C for 3±0.5 seconds without forcing pressure to affect the tine of contact. SMT Type: Follow TE Spec 109-201, method B condition B. Peak temperature: 260+0/-5°C

Figure 2 (end)

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 Figure 6.



Through Hole Type

Surface Mount Technology Type

Figure 3: Termination Resistance (Low Level) and Temperature Rise Vs. Current Measurement Set-Up

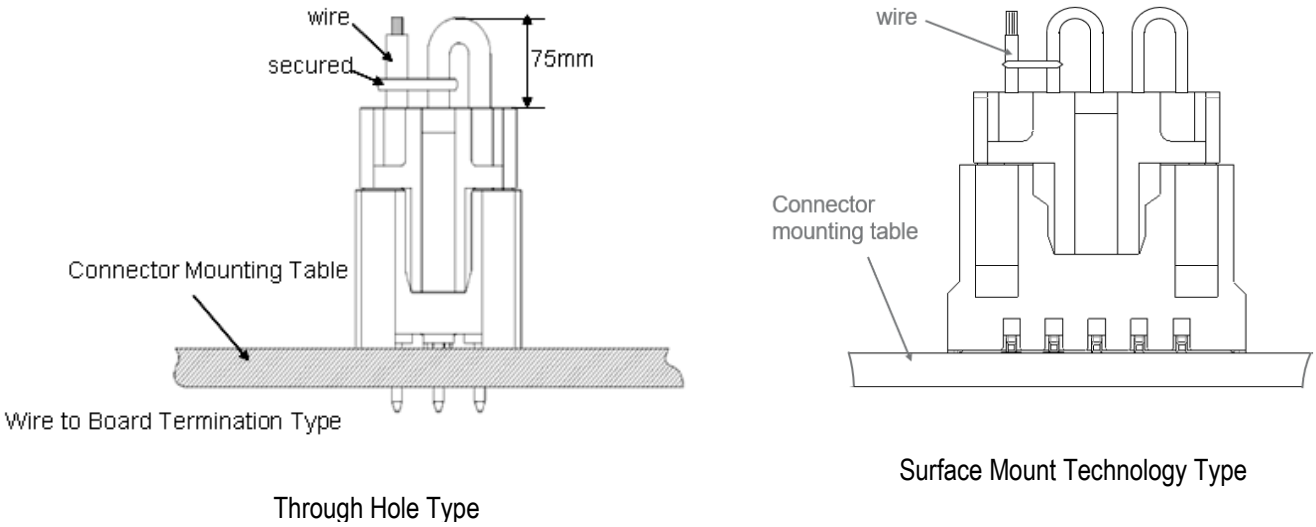


Figure 4: Connector Mounting Method for Lower Frequency Vibration and Physical Shock Tests

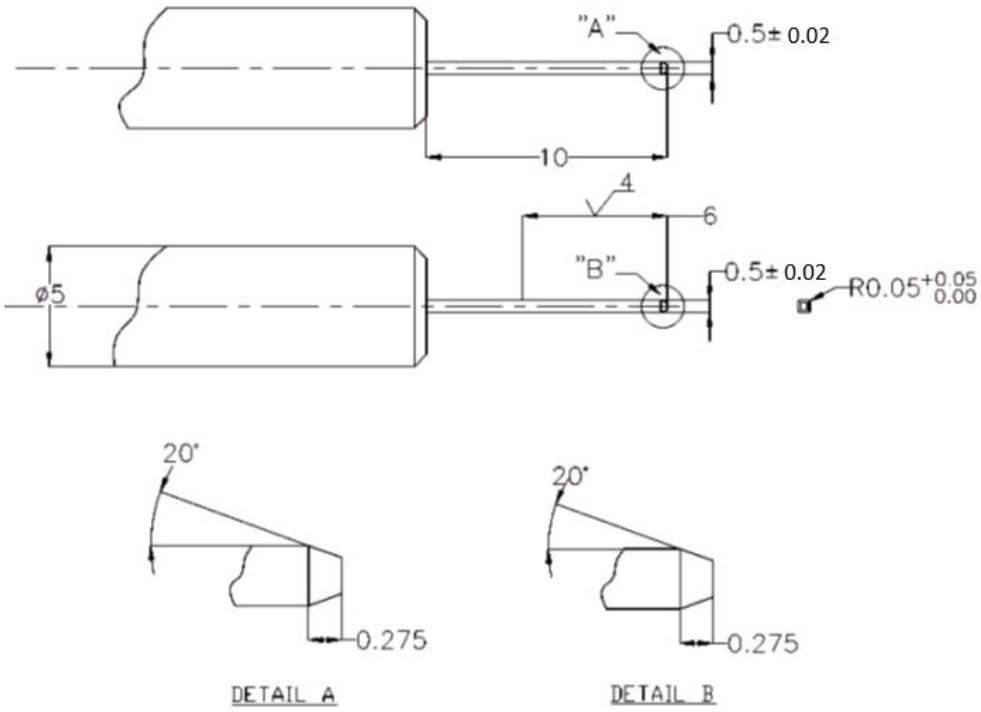


Figure 5: Gage Design for Contact Mating and Contact Unmating Force Tests

3.6. Product Qualification and Requalification Test Sequence

TEST OR EXAMINATION	TEST GROUP (a)																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	TEST SEQUENCE (b)																	
Confirmation of Product	1, 3	1, 4	1, 3	1, 3	1, 3	1, 4	1, 7	1, 7	1, 4	1, 4	1, 4	1, 4	1, 4	1, 4	1, 3	1, 3	1, 3	1, 4
Termination Resistance							2, 4, 6	2, 6	2, 5	2, 5	2, 5	2, 5	2, 5	2, 5				2, 5
Dielectric Withstanding Voltage						3				7	7							
Insulation Resistance						2				6	6							
Temperature Rise					2													
Vibration (Low Frequency)							5											
Physical Shock							3											
Connector Mating Force								3										
Connector Unmating Force								4										
Contact Insertion Force				2														
Contact Mating Force		2																
Contact Unmating Force		3																
Crimp Tensile	2																	
Durability								5										
Housing Locking Strength			2															
NH_3																		3
Humidity-Temperature Cycling										3								
H_2S														3				
Thermal Shock									3									
Salt Spray											3							
Resistance to Cold													3					
Contact Retention Force						5												
Heat Aging												3						
Post Retention Force															2			
Solderability																2		
Resistance to Soldering Heat																	2	

Figure 6

NOTE
(a) See paragraph 4.2.
(b) Numbers indicate sequence in which tests are performed.

4. QUALITY ASSURANCE PROVISIONS

4.1. Test Conditions

Unless otherwise specified, all the tests shall be performed in any combination of the following test conditions shown in Figure 7.

Temperature	15°C – 35°C
Relative Humidity	45% – 75%
Atmospheric Pressure	86.6 – 106.6 kPa

Figure 7

4.2. Qualification Testing

A. Specimen Selection

Specimens shall be prepared in accordance with applicable instruction sheets and shall be selected at random from current production. The test specimens shall conform to the requirements specified in the applicable product drawings. Crimped contacts shall be prepared in accordance with the requirements of the application specification 114-5425 on wires specified in Figure 8.

Cross-Sectional Area [AWG (mm^2)]	Diameter of Conductor (mm)	Number of Conductors	Insulation Outer Diameter (mm)
28 (0.079)	0.127	7	0.98
26 (0.14)	0.127	10	1.3
24 (0.24)	0.160	10	1.58

Figure 8

B. Test Sequence

Qualification inspection shall be verified by testing specimens as specified in Figure 6.

4.3. Requalification Testing

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

4.4. Acceptance

Acceptance is based on verification that the product meets the requirements in Figure 2. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

4.5. Quality Conformance Inspection

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

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1-794222-0 2310537-1 ROX05SJ18R SBCHE154R7K 2380312-2 936348-1 U5254-000005-030PA SMW73R0JT 2834055-1 3-1393225-0 3430B2F51RTDF CRGCQ2010J3K3 2377783-2 917696-1 RH73H2A40MKTN TE50BR39J 3631B101LL CPF0402B37K4E1 141991-2 175977-2 2-292161-3 SBCHE64R7K 1393431-1 1903112-2 1969656-1 650075-000 1-962915-1 1743455-2 2005330-1 MPT100C18RF