

SOLARLOK BREEZE Junction Box

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1. SCOPE

1.1. Content

This specification covers performance, tests and quality requirements for the TE Connectivity SOLARLOK BREEZE Junction Box used for distributing energy captured by solar panels used in the Photovoltaic (PV) industry.

The corresponding connecting cables including connectors are fixed with the terminal box. The connectors at the cables are marked with their polarity. It is important to take care of the polarity before connecting. This connector is to be used only to interconnect firmly fixed cables!

The junction box allows electrical connection between Photovoltaic (PV) panels and allows connection of the foils exiting the solar panel. This connection is made by soldering the foil to the rail whose interface surface is in a horizontal position and then potting.

The cover of the junction box is used for basic protection of junction box not to be exposed since all the live parts are completely encapsulated by potting material.

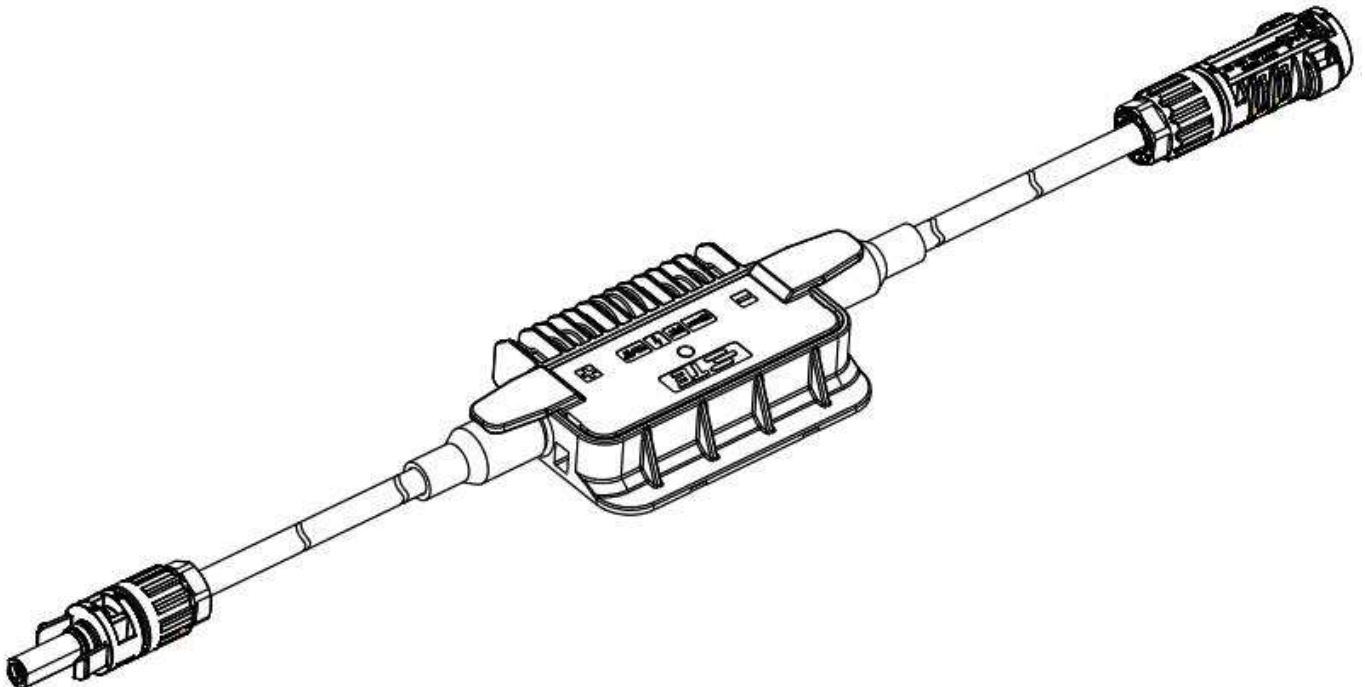


Fig. 1
Junction Box Overview

1.2. Qualification

When tests are performed the following specified specifications and standards shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. In the case of a conflict between the requirements of this specification and the product drawing or of conflicts between the requirements of this specification and the referenced documents, this specification shall take precedence.

2.1. TE Connectivity Documents

- 114-106082: Application Specifications (SOLARLOK Breeze Junction Box)
- 501-106082: Qualification Test Report(SOLARLOK Breeze Junction Box)

2.2. Commercial Standard

- EIA-364: Electrical Connector/Socket Test Procedures Including Environmental Classifications
- EN 50521: Connectors for photovoltaic systems - Safety requirements and tests
- IEC 60512: Electromechanical Components For Electronic Equipment; Basic Testing Procedures and Measuring Methods Part 1: General
- IEC 60529: Degrees of Protection Provided by Enclosures (IP Code)
- IEC 61215: Crystalline silicon Photovoltaic (PV) Modules - Design Qualification and Type Approval
- IEC 61646: Thin-film Photovoltaic (PV) Modules - Design Qualification and Type Approval
- IEC 60068: Electrical engineering, Environmental testing
- UL1703: Flat-Plate Photovoltaic Modules and Panels
- Safety class II
- EN 50548:2011: Junction boxes for photovoltaic modules
- UL 3730: Safety for Photovoltaic Junction Boxes

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of the design, construction 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 product drawing.

3.3. Ratings

- Rated System Voltage

BREEZE 4GBN3JA	TUV:1000V DC/UL:600V DC
BREEZE 4GBR3JA	TUV:1000V DC/UL:1000V DC
BREEZE 4GBD3JA	TUV:1000V DC
BREEZE 4GBR3SA	TUV:1000V DC/UL:1000V DC
BREEZE 4GBX3SA	TUV:1500V DC/UL:1000V DC

- Current carrying capability

- ◆ Junction Box

BREEZE 4GBN3JA	11A
BREEZE 4GBR3JA	11A
BREEZE 4GBD3JA	11A
BREEZE 4GBR3SA	12.5A
BREEZE 4GBX3SA	12.5A
35A Max. for 4.0mm ² / AWG12	

- ◆ Cable connector

● Operating temperature	-40°C ~+85°C
● Storage temperature	-40°C ~+85°C
● IP Code	IP67
● Application class	Class A
● Wire size	4.0mm ² / AWG12

3.4. Performance and Test Description

Product shall be designed to meet the electrical, mechanical and environmental performance requirements specified in Paragraph 3.5. Unless otherwise specified, all tests shall be performed at ambient environmental conditions per EN50548 and UL3730.

3.5. Test Requirements and Procedures Summary

Table 1

3.5.1 GENERAL INSPECTIONS			
No.	Test Description	Requirement	Procedure According
3.5.1.1	Marking	The marking shall be indelible and easily legible.	Visual examination Per 4.2.2 of EN50548
3.5.1.2	Technical documentation	Information according to 4.2.3 and additional information	Visual examination Per 4.2.3 of EN50548
3.5.1.3	Approval of attached components	Components shall comply with the relevant standards.	Visual examination Per 4.4,4.5,4.6 of EN50548
3.5.2 Material Test			
No.	Test Description	Requirement	Procedure According
3.5.2.1	Resistance against ageing	The sealing characteristic shall not be impaired; Compliance shall be checked by verifying the IP-code according to EN 60529.	Accelerated ageing in oven. Gaskets, e.g. separate polymer seals, shall be stored in a heating cabinet for 240 h at (100 ± 5) °C and subsequently cooled down for 16 h at ambient temperature. Per 5.3.15 of EN50548
3.5.3 Constructional Requirements			
No.	Test Description	Requirement	Procedure According
3.5.3.1	Degree of protection	No ingress of dust and water	Test IP-code per IEC 60529 Gaskets shall be aged Per 5.3.4.2 of EN50548
3.5.3.2	Mold Stress-Relief Distortion Test	Not cause softening of the material as determined by handling immediately after the conditioning, nor shall there be shrinkage, warpage, or other distortion as judged after cooling to room temperature	One sample of the complete equipment (in the case of an enclosure) or the part under consideration, is to be placed in a full draft circulating air oven maintained at a uniform temperature at least 10°C (18°F) higher than the maximum temperature of the material measured under actual operating conditions, but not less than 70°C (158°F) in any case. The sample is to remain in the oven for 7 hours. After its careful removal from the oven and return to room temperature, the sample is to be investigated Per Section 25 of UL Subject 3730
3.5.4 Mechanical Tests			
No.	Test Description	Requirement	Procedure According
3.5.4.1	Terminations and connection methods	Fix position of terminals	Visual examination, of protection for lead or cable Per 4.4.1 & 4.4.4 of EN50548
		Requirements of relevant clauses shall be fulfilled.	Mechanical test of suitability of terminals and connections Per 5.3.19 of EN50548
3.5.4.2	Cord anchorage	a) Elongation less than 2mm b) Torsion shall not exceed 45°.	Pull- and Torsion Test Pull the cable for duration of 1 s, 50 times with a force of 30N, afterwards apply a torque of 0.1Nm for 1 min. Per 5.3.21 of EN50548

3.5.4.3	Mechanical strength at lower temperatures	No damage, which may impair function	Placed on a steel of 20mm thickness for 5h in -40°C, then knock 4 uniformly distributed positions with 1 joule evenly on specimen Per 5.3.8 of EN50548
3.5.4.4	Retention on the mounting surface	No loosening or displacement of Specimen; Insulation resistance not less than 400 MΩ	Pre aged at TC 200 and Damp heat test respectively, A force of 40 N shall be gradually increased and applied for 30 min in each direction parallel to the mounting surface and perpendicular to the mounting surface. Wet leakage current test according to 5.3.16 of EN50548 Per 5.3.22 of EN50548
3.5.4.5	Strain relief test	Without transfer of the force to the electrical connection, or damage to the lead or cable, and its connecting means; Without damage to the connector, the junction box, or the mounting of the connector to the junction box, or separation of the two mating connectors.	A lead or cable for connection to external wiring, or a lead or cable terminated at both ends on the shall withstand for 1 min a force of 20 lb (89 N) applied in any direction permitted by the construction; A separable connector not enclosed by a wiring compartment, and such connector's joining to its mating connector, shall withstand for 1 min a force of 20 lb (89 N) applied in any direction permitted by the construction, either directly or through any wire or cable attached to the mating connector Per Section 26 of UL Subject 3730
3.5.4.6	Crush Test	Without resulting in any of the following: a) Reduction of spacings below the minimum acceptable values. b) Making bare live parts or internal wiring accessible to contact. c) Such breakage, cracking, rupture, and the like as to produce an adverse effect on the insulation. d) Producing any other condition that would increase the likelihood of electric shock or fire, or both, during use of the equipment.	The junction box are to be supported on the mounting side by a fixed rigid supporting surface, in the position that is recommended by the manufacturer. Crushing force is to be applied to the exposed surfaces of the junction boxes for 1 min. The compression force is to be applied by flat surfaces each 102 by 254 mm (4 by 10 inches). Each force applicator is to exert 45.4 kg (100 lb) on the sample. Per Section 27 of UL Subject 3730
3.5.4.7	Wiring Compartment Securement Test	The tensile force required to separate a wiring compartment or box from a module shall not be less than 35 lbf (155.7 N) or 4 times the wiring compartment or box weight, whichever is greater	Samples are to be tested in the as-received condition, after being conditioned in accordance with Temperature Cycling Test and after conditioning in accordance with Humidity Test Per clause 42 of UL1703

3.5.5 Electrical Tests

No.	Test Description	Requirement	Procedure According
3.5.5.1	Dielectric strength (r.m.s. withstand voltage)	No flashover or breakdown of voltage	Apply an r.m.s. withstand voltage (50/60 Hz) with a r.m.s.-value of 2 000 V + 4 times rated voltage for 1 min. Per 5.3.6 b) of EN50548
3.5.5.2	Dielectric strength	No flashover or breakdown of	Impulse withstand test with a voltage

	(impulse withstand)	voltage	having a 1,2/50 μ s waveform according to EN 60060-1 with three impulses of each polarity and an interval of at least 1s between pulses. Per 5.3.6 a) of EN50548
3.5.5.3	Wet leakage current test	Insulation resistance shall be not less than 400 M Ω	A shallow trough or tank of sufficient size to enable the module with frame to be placed in the solution in a flat, horizontal position, it shall contain a water/wetting agent solution meeting the following requirements: resistivity: 3500 Ω .cm or less surface tension: 0.03N.m ⁻¹ or less temperature: 22 °C \pm 3 °C applied a 500V or the maximum rated system voltage of the module(Per 10.15 of IEC 61215) Hold this voltage for 2 min. Per 5.3.16 of EN50548
3.5.5.4	Bypass diode thermal test	a) the diode T _j shall not exceed the diode manufacture maximum rating T _j b) no evidence of major visual defects; c) the diode shall be still operational.	Heat the specimen to (75 \pm 5) °C. Apply a current to the specimen equal to the rated current \pm 2 % of the junction box. After 1 h, measure the temperature of each bypass diode and at the insulating material, where the highest temperature is expected. Increase the applied current to 1,25 times of the rated current of the junction box while maintaining the box temperature at (75 \pm 5) °C. Maintain the current flow for 1 h. Per 5.3.18 of EN50548
3.5.5.5	Temperature test	No part shall attain a temperature that would: a) Ignite materials or components; b) Cause the temperature limits of surfaces, materials, or components as described in Table 22.1, to be exceeded; c) Cause the Relative Thermal Index – 20 degrees C of polymeric materials to be exceeded; or d) Cause creeping, distortion, sagging, charring or similar damage to any part of the product, if such damage or deterioration may impair the performance of the product under the requirements of this Outline.	Test the junction box at equilibrium while conducting rated current in the forward direction (minus to plus) through the tabbing (diodes shall be replaced in the circuit with representative tabbing); Per Section 22 of UL Subject 3730

3.5.6 Environment Tests

No.	Test Description	Requirement	Procedure According
3.5.6.1	Thermal cycle test	No visible damages, which could impair function or safety	From -40 °C \pm 2 °C to +90 °C \pm 2 °C ; Dwell time 0.5h min, 1.75h max. each extreme, The transfer time between upper and lower temperature shall not exceed 120°C/h;

			50 cycles. Per Section 39 of UL Subject 3730
3.5.6.2	Damp heat test	No visible damages, which could impair function or safety	Test temperature: $(+ 85 \pm 2) ^\circ\text{C}$; Relative humidity: $(+ 85 \pm 5) \%$; Test duration: 1 000 h. Per 5.3.10 of EN50548
3.5.6.3	Humidity-freeze test	No evidence of major visual defects	From $+85 ^\circ\text{C} \pm 2 ^\circ\text{C}$, $85\%\text{RH} \pm 5\%$ to $-40 ^\circ\text{C} \pm 2 ^\circ\text{C}$; 20h Min at upper, 0.5h Max at lower; The transfer time between upper and lower temperature shall not exceed $100 ^\circ\text{C}/\text{h}$; 10 cycles Per 5.3.17 of EN50548
3.5.6.4	Thermal cycle test	No visible damages, which could impair function or safety	From $-40 ^\circ\text{C} \pm 2 ^\circ\text{C}$ to $+90 ^\circ\text{C} \pm 2 ^\circ\text{C}$; Dwell time 0.5h min, 1.75h max. each extreme, The transfer time between upper and lower temperature shall not exceed $120 ^\circ\text{C}/\text{h}$; 200 cycles. Per Section 39 of UL Subject 3730
3.5.6.5	Salt Mist Corrosion Test	a) No corrosion influence performance b) The insulation resistance shall not be less than 400 Mohm c) The overall resistance shall not increase by more than 5 % of the initial value.	Salt mist test according to any one of the severities included in IEC 60068-2-52, severity 3 Per IEC 61701

3.6 Qualification and Requalification Test Sequences

Test Items		Test Group												
		A	B	C	D	E	F	G	H	I				
		Test Sequence (a)												
3.5.1.1	Marking	1												
3.5.1.2	Technical documentation	2												
3.5.1.3	Approval of attached components	3												
3.5.2.1	Resistance against ageing				3									
3.5.3.1	Degree of protection				1, 4	1								
3.5.3.2	Mold Stress-Relief Distortion Test			2										
3.5.4.1	Terminations and connection methods		1											
3.5.4.2	Cord anchorage		2											
3.5.4.3	Mechanical strength at lower temperatures		3											
3.5.4.4	Retention on the mounting surface					8	6							
3.5.4.5	Strain relief test		4	3										
3.5.4.6	Crush Test		5											
3.5.4.7	Wiring Compartment Securement Test		6			10		7						
3.5.5.1	Dielectric strength (r.m.s. withstand voltage)					2, 5	1, 4	1, 5		1, 4				
3.5.5.2	Dielectric strength (impulse withstand)					6								
3.5.5.3	Wet leakage current test				2, 5	3, 7, 9	2, 5, 7	2, 6	2	2, 5				
3.5.5.4	Bypass diode thermal test								1					
3.5.5.5	Temperature test			1										
3.5.6.1	Thermal cycle test (Test cycle 50)							3						
3.5.6.2	Damp heat test						3							
3.5.6.3	Humidity-freeze test							4						
3.5.6.4	Thermal cycle test (Test cycle 200)					4								
3.5.6.5	Salt Mist Corrosion Test									3				

(a) Numbers indicate the sequence in which the tests are performed.

(b) Test Group A,B is single test, for others tests to be performed consecutively in order

4. QUALITY ASSURANCE PROVISIONS

4.1. Qualification Testing

A. Specimen Selection

Specimens shall be prepared in accordance with applicable Instruction Sheets and shall be selected at random from current production. All test groups shall each consist of some random junction assemblies as highlighted.

B. Test Sequence

The samples shall be prepared in accordance with product drawings. They shall be selected at random from current production.

4.2. Requalification Testing

If changes significantly affecting form, fit or functions 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.

4.3. Acceptance

Acceptance is based on verification that the product meets the requirements of Table 1. 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 re-submittal.

4.4. 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. Bulk wire resistance shall be subtracted from resistance readings.

Annex A

Documentation Change Record

Rev	Clause	Page	Change Description	DATE	DWN	APRD
A2	3.3	4	New model code BREEZE4GBR3SA and BREEZE4GBX3SA added	27APR2015	AZ	DT