

Ampulse HELICASE Solar Junction Box

2286016-1 & 2286016-2

1. SCOPE

1.1. Content

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

TE supplies the junction box without cables to the solar panel developer. Solar panel developer assembles the junction box to the solar panel and it is shipped to installer. The corresponding connecting cables including connectors are fixed to the terminal box by the installer. 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. These boxes can be used with PV cables ranging from minimum 4.5mm to maximum 5.5mm outer diameters.

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. There also an option for use of ring termination for specific range of wires.

The cover of the box serves multiple purpose like compliance to IP65, provided retention force of the cable and basic protection of the junction box.



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

- 114-32131: Application Specifications (Low cost Junction Box)
- 501- XXXX: Qualification Test Report(Low cost Junction Box)

2.2. Commercial Standard

- 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 60068: Electrical engineering, Environmental testing
- Safety class II
- EN 50548:2011: Junction boxes for photovoltaic modules

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 drawings.

3.3. Ratings

- Rated System Voltage :
2286016-1 1000V DC
2286016-2 TÜV: 1000V DC

- Current carrying capability Junction Box
 - 2286016-1 and 2286016-2 Current : 8 A
 - Cable connector : 35A Max. For 4.0mm² / AWG12
- Operating temperature : -40°C ~+85°C
- Storage temperature : -40°C ~+85°C
- IP Code : IP65
- Application class : Class A
- Wire size : 2.5 to 4.0mm² /AWG12
- PV Cable outer diameter : Min 4.5mm to Max. 5.5mm
- Two versions of product:
 - I. One version shall be tested and validated by TE Connectivity spec. (2286016-1)
 - II. Second version certified by TÜV lab per EN 50548: 2011 (2286016-2)

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.

3.5. Test Requirements and Procedures Summary

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 EN 50548
3.5.1.2	Technical documentation	Information according to 4.2.3 and additional information all material test certificate to be given to TÜV	Visual examination Per 4.2.3 of EN 50548
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 EN 50548
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 EN 50548

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 EN 50548

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 EN 50548
		Requirements of relevant clauses shall be fulfilled.	Mechanical test of suitability of terminals and connections Per 5.3.19 of EN 50548
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 EN 50548
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 EN 50548
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 EN 50548 Per 5.3.22 of EN 50548

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 EN 50548
3.5.5.2	Dielectric strength (impulse withstand)	No flashover or breakdown of voltage	Impulse withstand test with a voltage having a 1,2/50 μs 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 EN 50548

3.5.5.3	Wet leakage current test	Insulation resistance shall be not less than 400 MΩ	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: 3500Ω.cm or less surface tension: 0.03N.m ⁻¹ or less temperature: 22°C ± 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 EN 50548
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3.5.5.4	Bypass diode thermal test	<ul style="list-style-type: none"> 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 ± 5) °C. Apply a current to the specimen equal to the rated current ± 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 ± 5) °C. Maintain the current flow for 1 h. Per 5.3.18 of EN 50548
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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	The transfer time between upper and lower temperature shall not exceed 100°C/h; 50 cycles Per 5.3.9 of EN 50548
3.5.6.2	Damp heat test	No visible damages, which could impair function or safety	Test temperature: (+ 85 ± 2) °C; Relative humidity: (+ 85 ± 5) %; Test duration: 1000 h. Per 5.3.10 of EN 50548
3.5.6.3	Humidity-freeze test	No evidence of major visual defects	From +85°C ± 2°C, 85%RH ± 5% to -40°C ± 2°C; 20h Min at upper, 0.5h Max at lower; The transfer time between upper and lower temperature shall not exceed 100°C/h; 10 cycles Per 5.3.17 of EN50548
3.5.6.4	Salt Mist Corrosion Test	Metal parts of boxes and enclosures shall be adequately protected against corrosion.	Test Per 5.3.7 of EN 50548
3.5.6.5	Reverse current test	There shall be no flaming of the junction box, nor flaming or charring of the cheesecloth in contact with the junction box	Test Per 5.3.23 of EN 50548

Table 1

3.6. Qualification and Requalification Test Sequences

SL. NO.	Test Items Test Sequence (a)		Test Group									
			A	B	C	D	E	F	G	H	I	
1	3.5.1.1	Marking	1	1								
2	3.5.1.2	Technical documentation	2									
3	3.5.1.3	Approval of attached components	3									
4	3.5.2.1	Resistance against ageing		4								
5	3.5.3.1	Degree of protection		3,5			1					
6	3.5.4.1	Terminations and connection methods			1	1						
7	3.5.4.2	Cord anchorage				2						
8	3.5.4.3	Mechanical strength at lower temperatures				3						
9	3.5.4.4	Retention on mounting surface				4						
10	3.5.5.1	Dielectric strength (r.m.s. withstand voltage)					2,5	3				
11	3.5.5.2	Dielectric strength (impulse withstand)					6					
12	3.5.5.3	Wet leakage current test					3	1,4	3	2		
13	3.5.5.4	Bypass diode thermal test								1		
14	3.5.6.1	Thermal cycle test (Test cycle 50)					4		1			
15	3.5.6.2	Damp heat test						2				
16	3.5.6.3	Humidity freeze test							2			
17	3.5.6.4	Resistance to corrosion		2								
18	3.5.6.5	Reverse current test										1

(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.

No. of samples required:

- With Junction Box fixed to Backsheet with the sealant/Glue: 10 Nos.
- Only Junction Box: 5 Nos.
- Terminal Block: 5 Nos.

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.