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# Compact Medium SOLARLOK Junction Box

## DESIGN OBJECTIVE

The product described in this document has not been fully tested to ensure conformance to the requirements outlined below. Therefore Tyco Electronics makes no representation or warranty, express or implied that the product will comply with these requirements. Further, Tyco Electronics may change these requirements based on the results of additional testing and evaluation. Contact Tyco Electronics Engineering for further details.

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## 1. SCOPE

### 1.1. Content

This specification covers the performance, tests and quality standards for a connecting system which allows the electrical connection of photovoltaic (PV) panels.

The corresponding connecting cables include connectors are fixed with the terminal box.

The connectors at the cables are labeled with their polarity. A neutral product is also possible used (without a polarity-label). It is important to take care of the polarity before connecting. This connector is to be used only to interconnect firmly fixed cables!

The connection box has 2 connection facilities (see Fig. 1-3) for 2,5mm<sup>2</sup> or 4mm<sup>2</sup> or 6.0 mm<sup>2</sup> cables. Each connection box offers to connect the contact foils located at the photovoltaic panel with spring force contact or solder, which makes the connection to the panels (see Fig. 8 - 9).

The cover of the connection box (see Fig. 6 - 7) has a seal is used for the sealing of the connection box.

### 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.



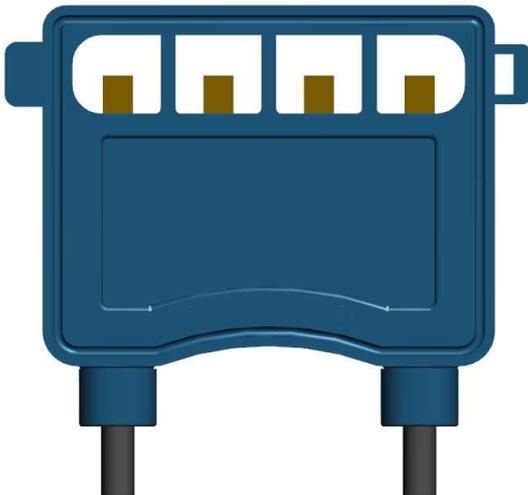
**See Fig 1**  
**Junction box with cover**



**See Fig 2**  
*Junction box without cover*  
*For foil solder type*



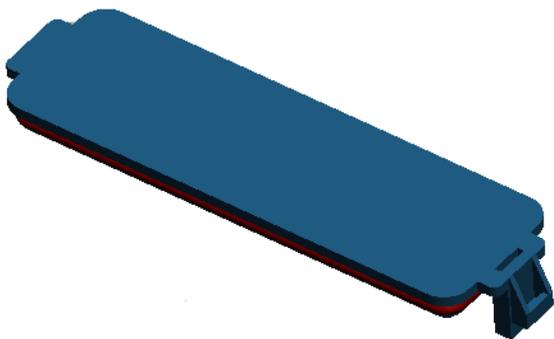
**See Fig 3**  
*Junction box without cover*  
*For foil clip type*



**See Fig 4**  
*Junction box - bottom side*  
*For foil solder type*



**See Fig 5**  
*Junction box - bottom side*  
*For foil clip type*



**See Fig 6**



**See Fig 7**

*Junction box cover*

**See Fig 8**  
**Foil clip**

*Junction box cover-bottom side*

**See Fig 9**  
**Junction box with foil clip for foil clip type**

## 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. Tyco Electronics Documents

- 109-197: Test Specification (AMP Test Specifications Vs EIA and IEC Test Methods)
- 114-106003: Application Specifications
- 501-106024: Qualification Test Report

### 2.2. Commercial Standard

- EIA-364: Electrical Connector/Socket Test Procedures Including Environmental Classifications
- 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: Photovoltaic (PV) Modules - Design Qualification and Type Approval
- IEC 60068: Electrical engineering, Environmental testing

- UL1703: Flat-Plate Photovoltaic Modules and Panels
- Safety class II

### 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        | TUV:1000V / UL:600V  |
| ● Current carrying capability |  |
| ◆ Junction Box                | 14A (x-1971222-y: x=0, 1 y=1,4,7)<br>11A (x-1971222-y: x=0, 1 y=2, 5, 8)<br>8A (x-1971222-y: x=0, 1 y=3, 6, 9) |
| ◆ Cable connector             | 25A  |
| ● Operating temperature       | -40°C ~+85°C   |
| ● Storage temperature         | -40°C ~+85°C   |
| ● IP Code                     | IP65   |
| ● Wire size                   | 4.0mm <sup>2</sup><br>AWG 12   |

#### 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 IEC 60068 and IEC 60512.

### 3.5. Test Requirements and Procedures Summary

Group A-Identification Documents			No. of samples: 1
No.	Description	Test conditions	Requirements
A.1	Visual inspection of identification	Check identification Per 4.2.1 of DIN VDE V 0126-5	a) Name, Monogram or Symbol of manufacture; b) Type or model number; n) Polarity of terminals or leads;
A.2	Visual inspection of documents	Check of marking Per 4.2.2 of DIN VDE V 0126-5	a) and b) of above must show on the minimum packing unit if with connector
A.3	Visual inspection for the verification of suitability of the components	Check of connections and termination methods, Per 4.4 of DIN VDE V 0126-5	Meet all of requirements of 4.4 of DIN VDE V 0126-5
A.4		Check of connectors Per 4.5 of DIN VDE V 0126-5	Accord with all of requirements VDE 0126-3, rating current and voltage meet junction requirements.
A.5		Check of wires Per 4.6 of DIN VDE V 0126-5	At least rating current and voltage meet junction requirements.

Group B- Material Test			No. of samples: 3
No.	Description	Test conditions	Requirements
B.1	Durability of marking	Immersion in water for 10 cycles, then wipe with 5N force according to IEC 60068-2-70 Per 5.3.2 of DIN VDE V 0126-5	a) Clear and indelible b) this test is not necessary for die-casted marking,
B.2	Protection against corrosion (only for metal part)	10 ± 1min. 10% Ammonium chloride at 20 ± 5°C, then 10min.storing at 91%-95%RH at 20 ± 5°C, drying at 100 ± 5°C, Per 5.3.7 of DIN VDE V 0126-5	No corrosion
B.3	Flammability classification	Plastic material as an enclosure and support of live part, 5VA, V0 of UL746C if no proof was presented, Per 4 of UL746C	a) Enclosure wall thickness meet requirement of 5VA b) support of live part wall thickness meet requirement of V0
B.4	Weather resistance (Enclosure)	Test per ISO 4892-2:55H at 60W/m <sup>2</sup> , 300-400nm, 65°C, 65%RH, cycles:18min.spraying, 102min.drying with xenon-lamp, total 500 h, Per 5.3.11 of DIN VDE V 0126-5	No breakage
B.5	Glow wire test	Test per IEC 60695-2-11, 650°C for enclosure Per 5.3.14.a) of DIN VDE V 0126-5	No ignition or burn less than 30 sec after removal of the glow wire
B.6	Glow wire test	Test per IEC 60695-2-11, 750°C for plastic material as support of live part,	No ignition or burn less than 30 sec after removal of the glow wire

		Per 5.3.14.b) of DIN VDE V 0126-5	
B.7	Ball pressure test (Enclosure)	Test per IEC 60695-10-2, ball pressure test at 90°C for enclosure, Per 5.3.13.a) of DIN VDE V 0126-5	press distance not more than 2.0mm,
B.8	Ball pressure test (Live part)	Test per IEC 60695-10-2, ball pressure test at 120°C, for plastic material as support live part, Per 5.3.13.b) of DIN VDE V 0126-5	press distance not more than 2.0mm,
B.9	Resistance against ageing	Sealing or Gaskets storing for 24h at 100°C Per 5.3.15 of DIN VDE V 0126-5	Still meet excellent seal performance requirement
B.10	Determination of CTI	Plastic material as an enclosure and support of live part, Per 9 of UL746C	A maximum CTI PLC of 2

<b>Group C- Construction</b>		<b>No. of samples: 1</b>	
<b>No.</b>	<b>Description</b>	<b>Test conditions</b>	<b>Requirements</b>
C.1	Protection against electric shock	Check Per 4.3.3 of DIN VDE V 0126-5	No breakage or movement
C.2		Test finger IP20 at 20N Per 60529 Per 5.3.4.1 of DIN VDE V 0126-5	IP20
C.3	Construction	Check of wall thickness between main part or adjacent live part Per 4.8.5 of DIN VDE V 0126-5	Meet requirement of IEC61140
C.4		Check of matching between cable and body of junction box, Per 4.8.3 of DIN VDE V 0126-5	a) no sharp edges and corners b) match the specification of cable
C.5	Connections	Check of protection for lead or cable, Per 4.4.1 & 4.4.4 of DIN VDE V 0126-5	Reliable connection
C.6	Clearances and Creepage distance	IEC 60664-1, Per 5.3.5 of DIN VDE V 0126-5	a) Base insulation between live part b) reinforce insulation between live part and enclosure
C.7	Cover	Check Per 4.3.2 of DIN VDE V 0126-5	Can not open without special tool

<b>Group D- Mechanical Test</b>		<b>No. of samples: 4</b>	
<b>No.</b>	<b>Description</b>	<b>Test conditions</b>	<b>Requirements</b>
D.1	Connections and Terminations Methods	Check Per 5.3.19 of DIN VDE V 0126-5	meet IEC60352-2 for crimp or cramp
D.2	Covers of openings	Use a stick of diameter 6mm, flat bottom, press $45 \pm 1$ N for $15 \pm 1$ s Per 5.3.20 of DIN VDE V 0126-5	No breakage
D.3	Cord anchorage	Pull 50 times in axis direction with force of table 3, each time for 1s Per 5.3.21 of DIN VDE V 0126-5	a) elongation less than 2mm b) rotation angle less than 45°
D.4	Mechanical test at low temperature	Placed on steel of 20mm thickness for 5h in -40°C, then knock 4 times with 1 joule evenly on specimen	No breakage

		Per 5.3.8 of DIN VDE V 0126-5	
D.5	Fixing of cover	After E and F test group, probe put in any position with 75N for 1min. Per 5.3.3 of DIN VDE V 0126-5	No breakage or relaxation

<b>Group E-Electrical Test</b>			<b>No. of samples: 1</b>
<b>No.</b>	<b>Description</b>	<b>Test conditions</b>	<b>Requirements</b>
E.1	Protect against electric shock	Test IP 67 per IEC 60529 Per 5.3.4.2 of DIN VDE V 0126-5	IP 67, No ingress of water or dust
E.2	Dielectric strength	Test with 2000V AC (50/60Hz) plus(4 X rated voltage) for 1 min. Per 5.3.6 b) of DIN VDE V 0126-5	Insulation resistance shall be not less than 400 MΩ Wet leakage current shall not exceed than 50uA (UL1703)
E.3	Wet leakage current test	Test Per 10.15 of IEC 61215, Per 5.3.16 of DIN VDE V 0126-5	Insulation resistance shall be not less than 400 MΩ
E.4	Thermal cycle test	-40°C ±2°C to +85°C ±2°C, dwell time 10 minutes min each extreme, 200 cycles Per 5.3.9.1 of DIN VDE V 0126-5	No evidence breakage
E.5	Dielectric strength	Test with 2000V AC (50/60Hz) plus(4 X rated voltage) for 1 min. Per 5.3.6 b) of DIN VDE V 0126-5	No breakdown
E.	Dielectric strength (Impulse test voltage)	Impulse test voltage with Table F1 and F5 of IEC60664-1), applied three times for 1s in each polarity. Per 5.3.6 a) of DIN VDE V 0126-5	No breakdown

Group F-Environment Test		No. of samples: 1	
No.	Description	Test conditions	Requirements
F.1	Wet leakage current test	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 $\Omega$ .cm or less surface tension: 0.03N.m <sup>-1</sup> or less temperature: 22 $\pm$ 3 $^{\circ}$ C applied a 500V or the maximum rated system voltage of the module Test Per 10.15 of IEC 61215, Per 5.3.16 of DIN VDE V 0126-5	Insulation resistance shall be not less than 400 M $\Omega$
F.2	Damp heat test	1000h at +85 $^{\circ}$ C $\pm$ 2 $^{\circ}$ C and 85% $\pm$ 5%RH, 10.13 of IEC 61215 Per 5.3.10 of DIN VDE V 0126-5	No evidence breakage
F.3	Dielectric strength	Test with 2000V AC (50/60Hz) plus(4 X rated voltage) for 1 min. Per 5.3.6 b) of DIN VDE V 0126-5	No breakdown
F.4	Wet leakage current test	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 $\Omega$ .cm or less surface tension: 0.03N.m <sup>-1</sup> or less temperature: 22 $\pm$ 3 $^{\circ}$ C applied a 500V or the maximum rated system voltage of the module Test Per 10.15 of IEC 61215, Per 5.3.16 of DIN VDE V 0126-5	Insulation resistance shall be not less than 400 M $\Omega$

<b>Group G-Damage Test</b>		<b>No. of samples: 1</b>	
<b>No.</b>	<b>Description</b>	<b>Test conditions</b>	<b>Requirements</b>
G.1	Thermal cycle test	-40°C ± 2°C to +85°C ± 2°C, dwell time 10 minutes min each extreme, 50 cycles Per 5.3.9.2 of DIN VDE V 0126-5	No evidence breakage
G.2	Humidity Freeze test	10 cycles from +85°C ± 2°C, 85%RH ± 5% to -40°C ± 2°C Per 10.12 of IEC 61215 Per 5.3.17 of DIN VDE V 0126-5	No evidence breakage
G.3	Wet leakage current test	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 <sup>-1</sup> or less temperature: 22 ± 3°C applied a 500V or the maximum rated system voltage of the module Test Per 10.15 of IEC 61215, Per 5.3.16 of DIN VDE V 0126-5	Insulation resistance shall be not less than 400 MΩ

<b>Group H-Bypass Diode Test</b>			<b>No. of samples: 1</b>
<b>No.</b>	<b>Description</b>	<b>Test conditions</b>	<b>Requirements</b>
H.1	Bypass diode thermal test	At the temperature $75 \pm 5^\circ\text{C}$ . applied a current to the module equal to the short circuit current of the module as measure at $\text{STC} \pm 2\%$ for 1h, calculate $T_j$ from measure case temperature, increase the current to 1.25 times the short circuit of the module for 1h, then calculate again. Test Per 10.18 of IEC 61215, (Optional: Test of heating of the Bypass-diode in worst case) Per 5.3.18 of DIN VDE V 0126-5	a) the diode $T_j$ shall not exceed the diode manufacture maximum rating $T_j$ b) no evidence breakage c) still meet function as a diode
H.2	Wet leakage current test	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: $3500 \Omega \cdot \text{cm}$ or less surface tension: $0.03\text{N}\cdot\text{m}^{-1}$ or less temperature: $22 \pm 3^\circ\text{C}$ applied a 500V or the maximum rated system voltage of the module Test Per 10.15 of IEC 61215, Per 5.3.16 of DIN VDE V 0126-5	Insulation resistance shall be not less than $400 \text{M}\Omega$

<b>Group I-Damage Test</b>			<b>No. of samples: 1</b>
<b>No.</b>	<b>Description</b>	<b>Test conditions</b>	<b>Requirements</b>
G.1	Impact test	Impact normal to the surface with 51mm diameter smooth steel sphere, weight 535g, falling through a vertical distance of 1.295m. at $25^\circ\text{C}$ and also after being cooled and maintained for 3h at a temperature of $\text{minus } 35.0 \pm 2.0^\circ\text{C}$ Per clause 30 of UL1703	Breakage of the superstrate material is acceptable provided there no particles larger than $6.5\text{cm}^2$ released from their normal mounting position

## 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 5 random connector assemblies.

#### 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 Figure 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.