



All numerical values are in metric units [with U.S. customary units in brackets]. Dimensions are in millimeters. Figures and illustrations are for identification only and are not drawn to scale.

### 1. INTRODUCTION

This specification covers the requirements for application of SOLARLOK Z-Rail junction box onto a photovoltaic (PV) solar panel. Each junction box consists of a base (with or without standoffs), lid, plug connector cable assembly and socket connector cable assembly or no connector cable assembly for connectorized version.

The junction box is available in 2 types: foil clamp and welded. The foil clamp junction box features a serrated interface tab and requires foil clips (available separately) to terminate the junction box to the solar panel. The welded junction box features a flat interface tab (no serrations).

When corresponding with personnel, use the terminology provided in this specification to facilitate your inquiries for information. Basic terms and features of this product are provided in Figure 1.

#### Foil Clamp Type and Welded Type Junction Box

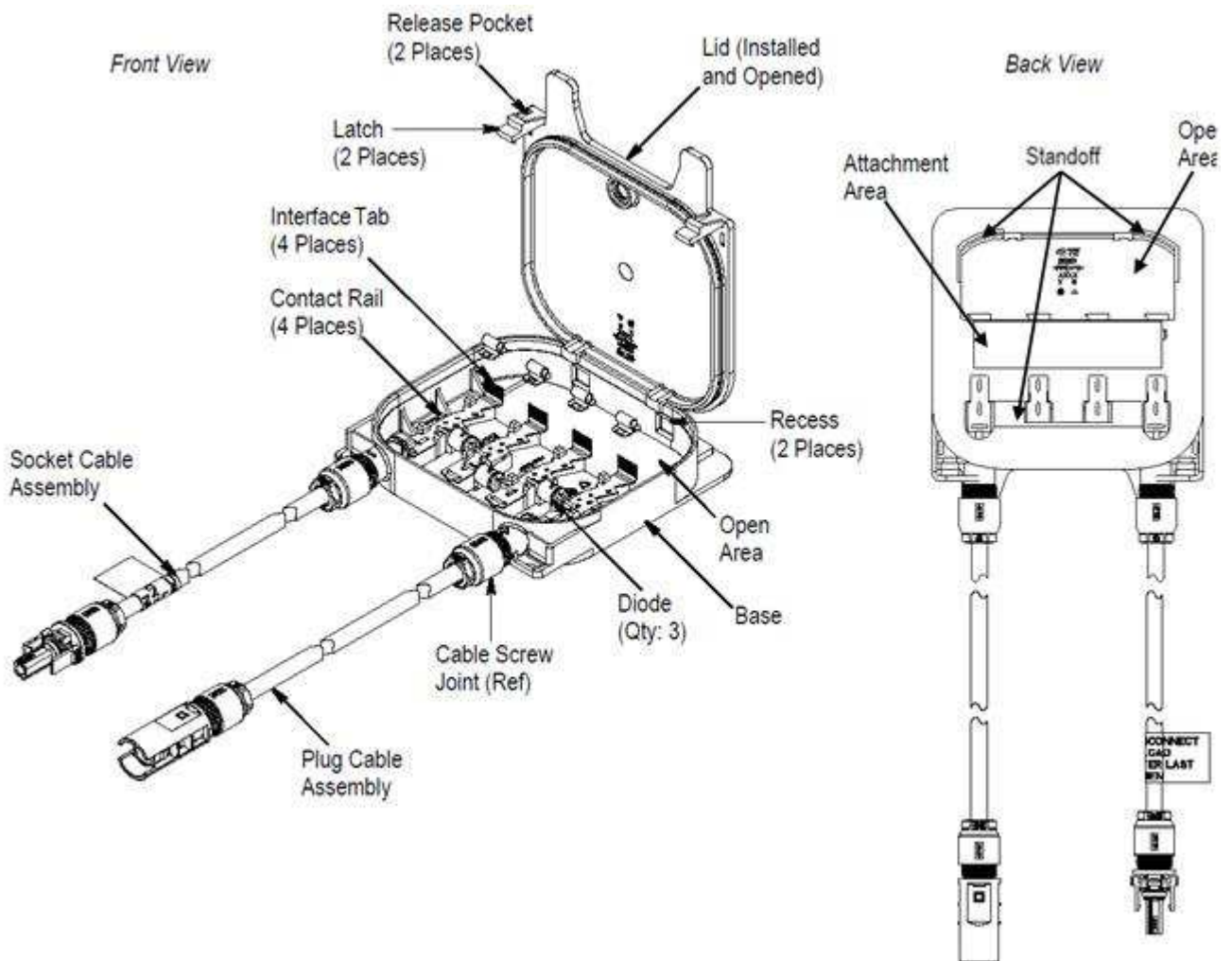


Figure 1



The base features an open area, 4 contact rails, 3 diodes or 3 contact rails, 2 diodes. Each contact rail provides interface tabs for terminating the foil tabs of the solar panel. The open area allows the foil tabs to reach the interface tabs while maintaining a seal between the junction box and solar panel. Each diode features 2 legs that support it in place on the contact rails. Damaged diodes can be replaced. The back of the base features an attachment area used in mounting the junction box onto the solar panel.

The lid features an O-ring that, when the lid is closed, ensures a tight seal. The lid has attachment tabs and latches. The latches ensure that the lid is locked and requires an instrument (such as a flat blade screwdriver) to release the latches.

## **NOTIFICATION:**

The application of the TE Connectivity SOLARLOK Z-rail junction box on the solar panel as well as the installation of the solar panel is not part of the scope of services offered by TE. In addition, TE does not offer a warranty for the SOLARLOK Z-rail junction box with integrated solar cable assemblies if those cable assemblies will be exchanged or unfixed after delivery from TE. A cable extension has to be made at the coupling end of the cable (plug connector) and only with TE components. If single connectors without attached cable are delivered by TE, the mounting of the cable is also not in the scope of services offered by TE. This is also the case for subsequent mounting or replacing diodes

## **2. REFERENCE MATERIAL**

### **2.1. Revision Summary**

Initial release of application specification

### **2.2. Customer Assistance**

Reference Product Base Part Number 2270178(Omega Clip), 2270176(S-clip), 2270267(welding version) for representative of SOLARLOK Z-Rail junction box. Use of these numbers will identify the product line and expedite your inquiries through a service network established to help you obtain product and tooling information. Such information can be obtained through a local Representative or, after purchase, by calling PRODUCT INFORMATION at the number at the bottom of page 1.

### **2.3. Drawings**

Customer Drawings for product part numbers are available from the service network. If there is a conflict between the information contained in the Customer Drawings and this specification or with any other technical documentation supplied, call PRODUCT INFORMATION at the number at the bottom of page 1

### **2.4. Specifications**

Product Specification 108-2471-1 provides approved product performance and test results for SOLARLOK Z-Rail product line.

Application Specification 114-18488-1 provides product description and application requirements for Solarlok connector. Application Specification 114-94061-1 provides product description and application requirements for the SOLARLOK contacts. Application Specification 114-137077 provides product description and application requirements for the PV4-S connector.

### **2.5. Instructional Material**

Instruction Sheets (408-series and 411-series) provide product assembly instructions or tool setup and operation procedures. Documents available which pertain to this product are:

- 408-10417      Repair Tool Kits 2152179-[ ] for Installing Replacement Diodes into SOLARLOK Z-Rail Junction Boxes
- 411-18305-1    SOLARLOK Interconnect System
- 411-137003    4 IN 1 tool for Z-rail Omega foil-clip installation
- 114-137077    PV4-S application specification

### 3. REQUIREMENTS

#### 3.1. Safety

- Appropriate gloves and eye protection must be used throughout the entire installation of the junction box.
- Adequate ventilation must be ensured at all times during the installation of the junction box.
- Eating, drinking, and smoking must not be allowed in the vicinity when installing or working with the junction box.
- DO NOT expose the junction box to open flames.

#### 3.2. Limitations

The junction box location and the installation and assembly procedures for the junction box, connectors, and cable assemblies must agree with the ESD items

- Equip floor and workstation by ESD lino
- Equip work tables by safety wrist & ankle straps
- Equip ESD shoes for every worker
- ESD tester in front of operation room door. Everyone who enters workshop should pass the ESD test.
- Equip heel strip for visitors who do not wear ESD shoes
- Equip a tester to verify if wrist & ankle straps are well-grounded. Every shift!

#### 3.3. Storage

Product shipping containers must not be stacked so high that the containers buckle or deform. Product should remain in the shipping containers until ready for use to prevent damage. Junction boxes, cable assemblies, and connectors must be stored in a clean, dry location.

#### 3.4. PV Solar Panel

Before installing the junction box onto the solar panel, the following requirements apply:

1. The installation procedure described in this document may be used on either glass or glass with Tedlar polyvinyl fluoride (PVF) laminate substrate solar panels.
2. The attachment area (located on the bottom) of the solar panel must be dry, oil-free, fat-free, and free of any dust, oil, and contaminants. The attachment area must be thoroughly cleaned using a soft cloth lightly moistened (for example, by using a dosing unit) with isopropyl alcohol. Auxiliary and other cleaning agents must be tested by the customer and proven suitable for use on the solar panel and junction box before being used.

The attachment area must be free of condensation and moisture.

3. The foil tabs must be bent so that they extend perpendicular from the surface of the solar panel.

#### 3.5. Connectors

The mating face of each connector must be protected from contaminants (such as moisture, dust, humidity, environmental pollution, etc.). It is recommended that a suitable dust cover be installed onto each unplugged connector. Connectors must be kept clean and dry.



*To avoid personal injury by electric current, the junction box and connectors must be completely separate from other sources of voltage during installation and assembly. The connectors must not be connected or disconnected when under electrical load.*



*Only same PV connectors series (male and female) from the same manufacturer are allowed to mate together. **Using a cable assembly jumper** (with PV connectors from various manufacturers on each cable side) for a safety power transition in case of connection needs between boxes with different type output PV connector.*

**NOTE**

*Rated voltage of the connectors and cables must match with the rated voltage of the junction box.*



### 3.6. Installation

The following installation requirements are intended as a guideline.

**NOTE**

*All tools and materials used for installation are covered in detail in Section 5.*

*Before beginning installation, the manufacturer's Material Safety Data Sheet (MSDS) must be reviewed for characteristics and handling of primer, sealant.*



#### A. Cleaning

Any type of exposure to contaminants (such as moisture, dust, humidity, environmental pollution, etc.) can negatively affect function of the junction box over the duration of use. This especially applies to connector seals and terminated connections. The environment of the area for installation and assembly must be clean and dry.

The junction box, cable assembly, and connectors should be cleaned using a soft clean cloth moistened with isopropyl alcohol.

In case the customer decide to clean the surface with Isopropanol he have to check with the supplier of this cleaner what time is necessary for the next process step, mean what time is defined till really all Isopropanol is removed and no longer "pollute" the surface. (And have may negative impact to the sticking of Silicone or tape).

**NOTE**

*Cleaning products that can erode the plastic parts of the connectors and junction box must not be used. Oils or lubricants of any type other than mentioned in this document must not be used on or around the junction box.*



It is recommended that the mating face of each connector be protected by a suitable dust cover until the connector is connected.

#### B. Preparation (Optional)

The attachment area of the junction box can be thoroughly covered by primer (this will improve adherence capability). The primer can be applied using a small spatula brush. Application of the primer must be in accordance with supplier instructions.

#### C. Mounting

1. TE junction boxes can be mounted with the connectors in either upwards or downwards directions when the solar panel is expected to be operating under normal environmental conditions. To ensure the JB and connectors are fully protected from adverse environmental conditions TE recommends that the Junction box is mounted with the connectors facing downwards.

2. When applying the silicone sealant or double sided adhesive tape to mount the junction box to the solar panel, it is recommended that the junction box remains open and the junction box cover is not attached.

**NOTE**

*The referenced double-sided adhesive tape should be tested by the customer for suitability before using it on solar panels that are not entirely flat..*

**DANGER**

*When working with silicone sealant, avoid contact with eyes. If eye contact occurs, rinse the eyes for 15 minutes and seek medical attention.*



*Avoid prolonged contact of silicone sealant with skin.*

3. A 7- to 10-mm wide band of the silicone sealant must be applied to the attachment area (located on the bottom) of the base (shown in Figure 1). The band must be continuous and free of gaps. If desired, the band

may be smoothed using a small spatula or brush to ensure a uniform and gap-free application.

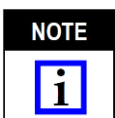
4. The junction box must be placed onto the attachment area of the solar panel with the foil tabs of the solar panel routed through the back of the open area of the junction box.

5. The junction box must be oriented horizontally, then be pressed onto the solar panel until it is secure. The diodes, diode legs, and contact rails must not be handled or pressed when securing the junction box to the solar panel. To ensure adequate silicone sealant coverage in the attachment area, a 1-kg [2-lb] metal weight can be positioned on the top of the closed lid of the junction box.

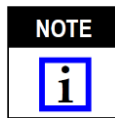


*Handling or pressing the diodes, diode legs, or contact rails can cause mechanical stress on the components and result in malfunction of the solar panel.*

6. The junction box must be kept in a horizontal position until the adhesive has fully cured. The silicone sealant must be fully cured before terminating or testing the junction box.

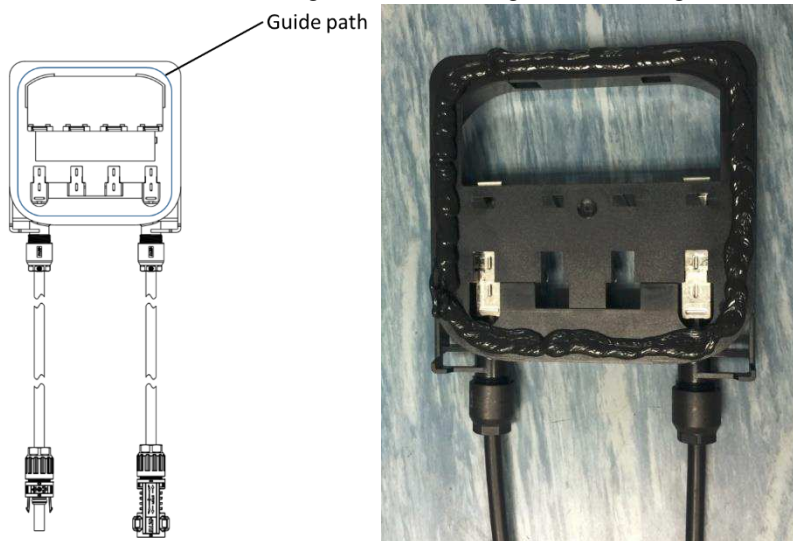


*The silicone adhesive must be allowed 20 hours at room temperature to fully cure.*



**Silicon gel use guide**

Shown as the picture, the contacted region of the silicon gel is suggested to be around the guide line in 6mm, the width of the contacted region should be bigger than 6mm, the suggested height of the silicon gel on the bottom of the box is 3.5-5 mm. And the silicon gel need to overflow out of the edge of the box for about 2-4mm, the height of the silicon gel must be higher than 1.5mm.



**Figure 2**

**3.7. Termination**

1. Each foil tab of the solar panel must be positioned on the junction box as follows:

JUNCTION BOX TYPE	FOIL TAB THICKNESS	FOIL TAB POSITION	REFER TO
Foil Clamp(omega clip)	0-0.4mm	Wrapped Over Interface Tab of Contact Rail(See Table Note)	Figure 3
	>0.4mm	Laid Against One Side of Interface Tab of Contact Rail	
Foil Clamp(S clip)	0-0.6mm	Insert the foil tab into clamp gap while opening the clamp	
Welded	Any	Wrapped Over Interface Tab of Contact Rail	Figure 4

**Table 1**

**Table Note:** To avoid buckling and improper seating of the foil clip, the foil tab should be wrapped over the interface tab as far as possible past the serrations of the interface tab without touching the contact rail. Refer to Figure 3

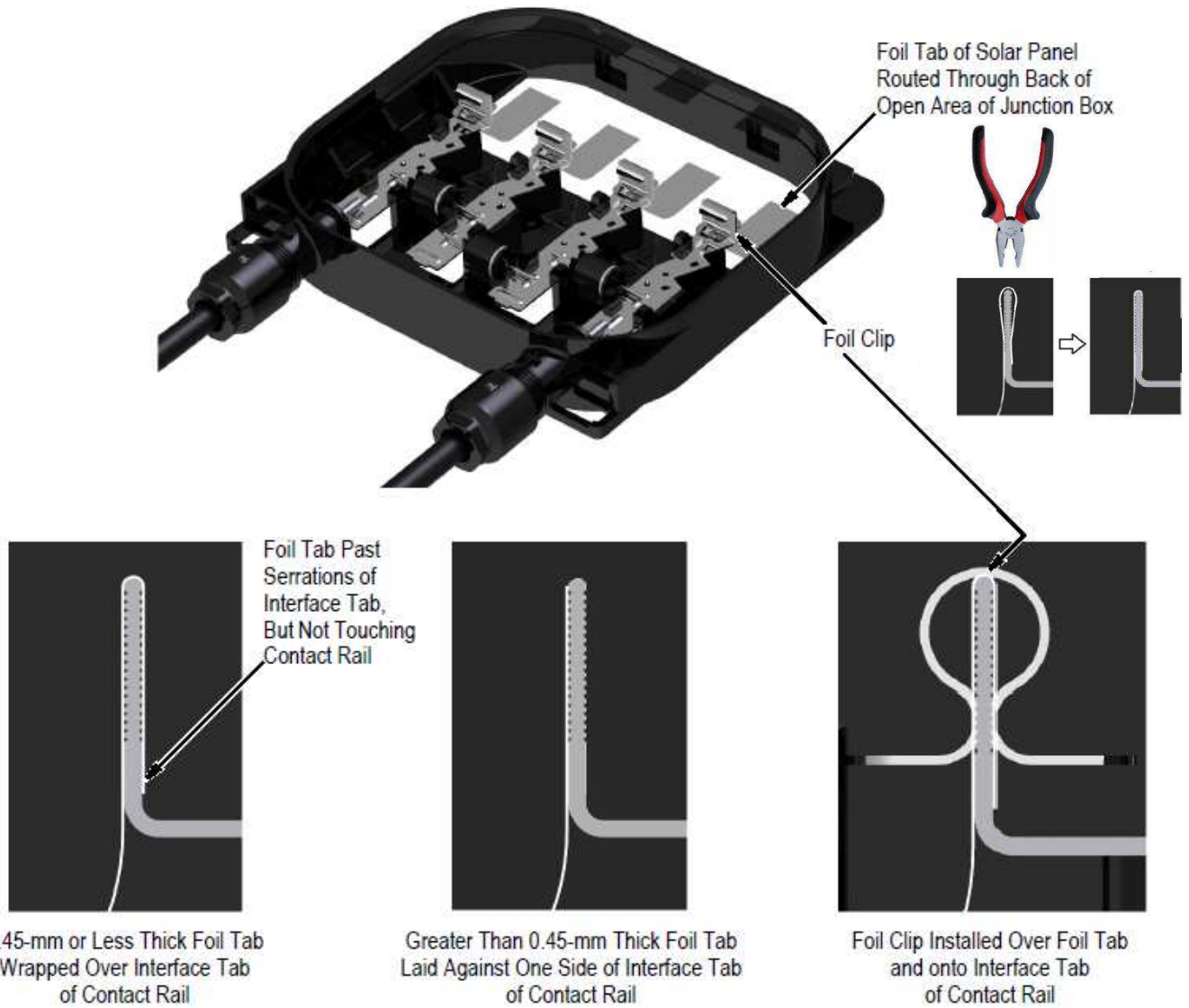
2. For the foil clamp type junction box, using the foil clip pliers, the open end of each foil clip must be spread apart to a maximum of 1.5 mm to enable the foil clip to slide over the thickness of the foil tab of the solar panel

and interface tab of its respective contact rail, and then released. One foil clip must be installed onto each interface tab. Refer to Figure 3.

For the welded type junction box, the end of each foil tab must be welded to the interface tab of its respective contact rail. Refer to Figure 4. To ensure proper welding connection use monitored welding process or more than one welding joint per contact rail.

**Terminating Foil Clamp Type Junction Box(Omega Clip)**

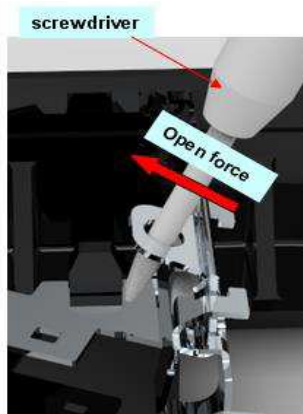
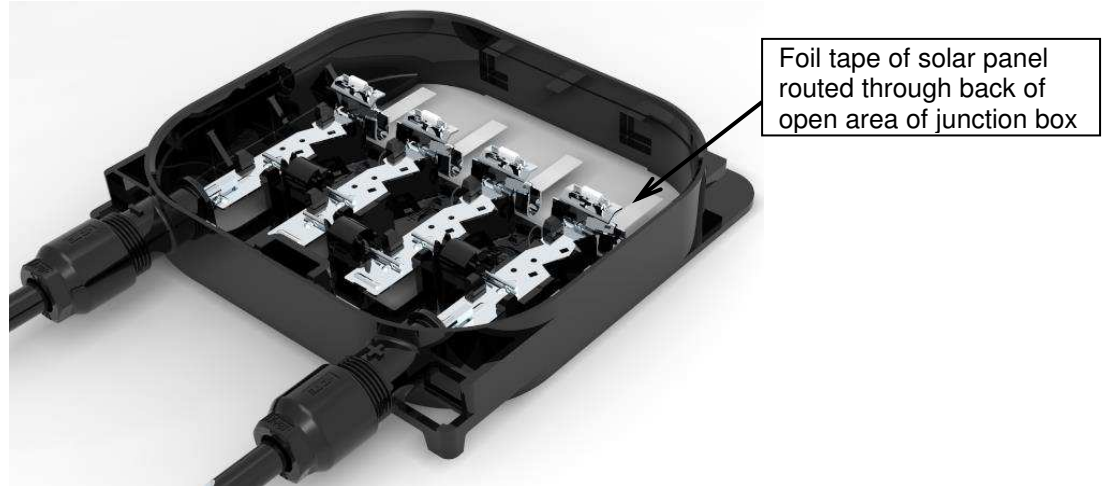
**Note:** Solar Panel Not Shown



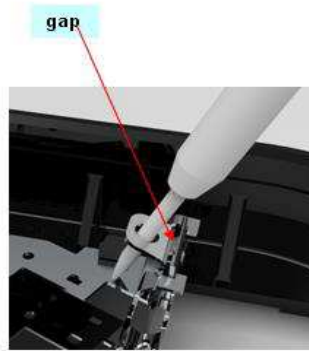
**Figure 3 (Cont'd)**

**Terminating Foil Clamp Type Junction Box (S clip)**

**Note:** Solar Panel Not Shown



Open S-clamp with a screw driver



Opening gap



Insert the foil tape into the opening gap



Remove the screwdriver to make S-clamp hold foil with contact rail

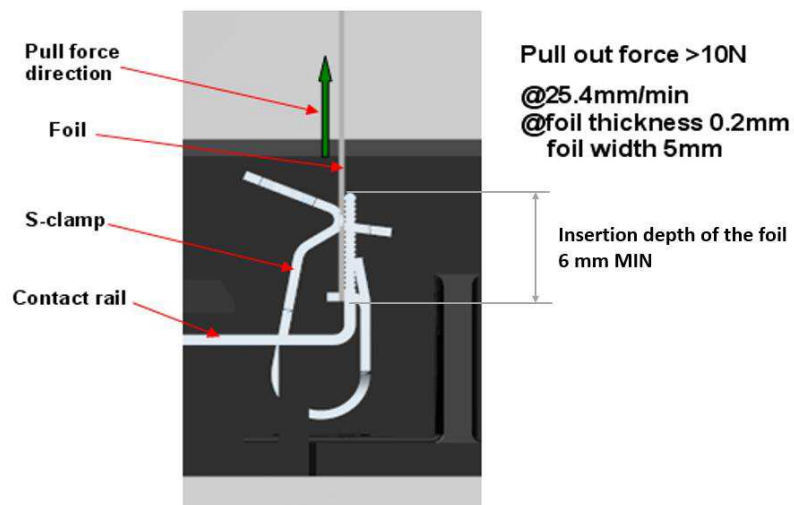


Figure 3 (End)

**Terminating Welded Type Junction Box**

**Note:** Solar Panel Not Shown

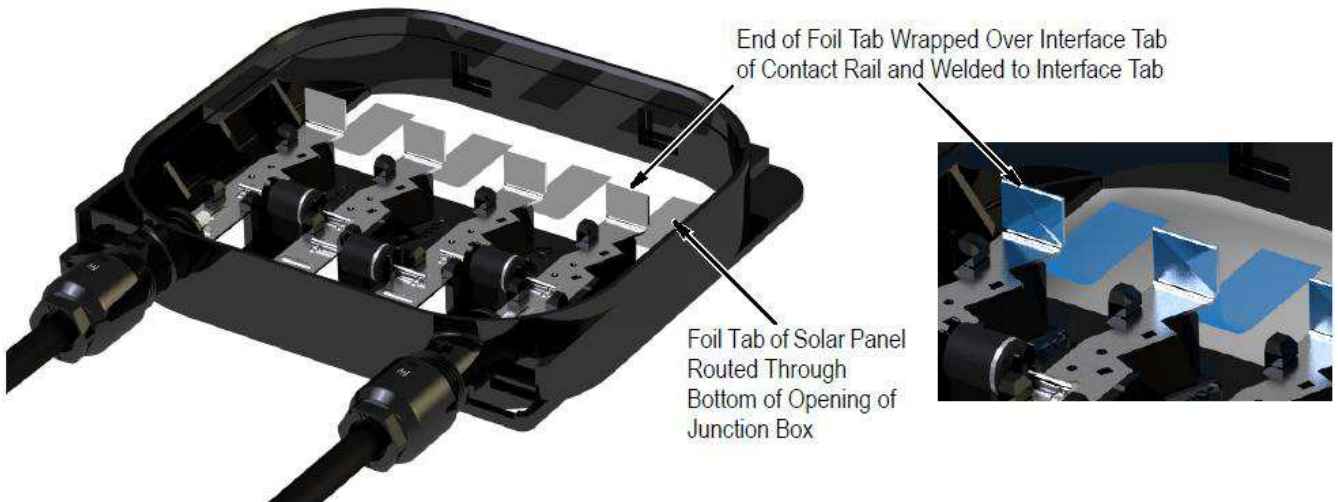
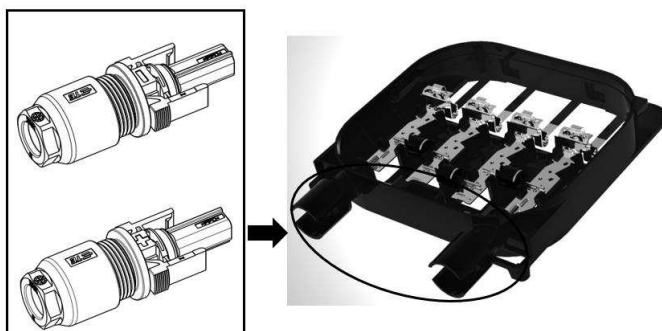


Figure 4

**FOIL CLAMP TYPE CONNECTORIZED VERSION JUNCTION BOX**

(To be connected to a cable assembly with female connector shown below for connecting between boxes)





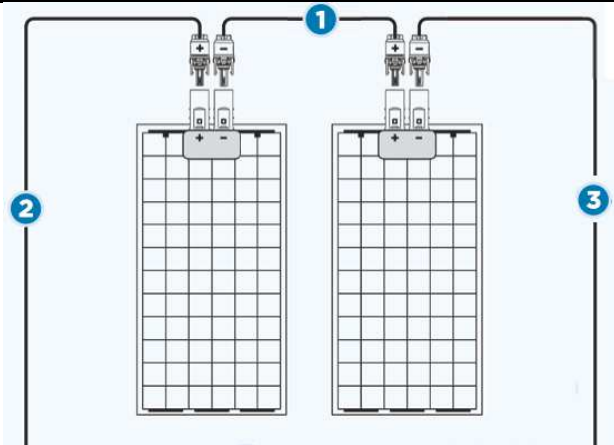
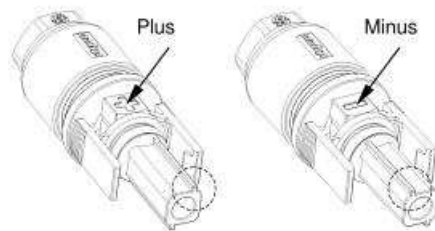


Figure 5 (Cont'd)



Female Connector

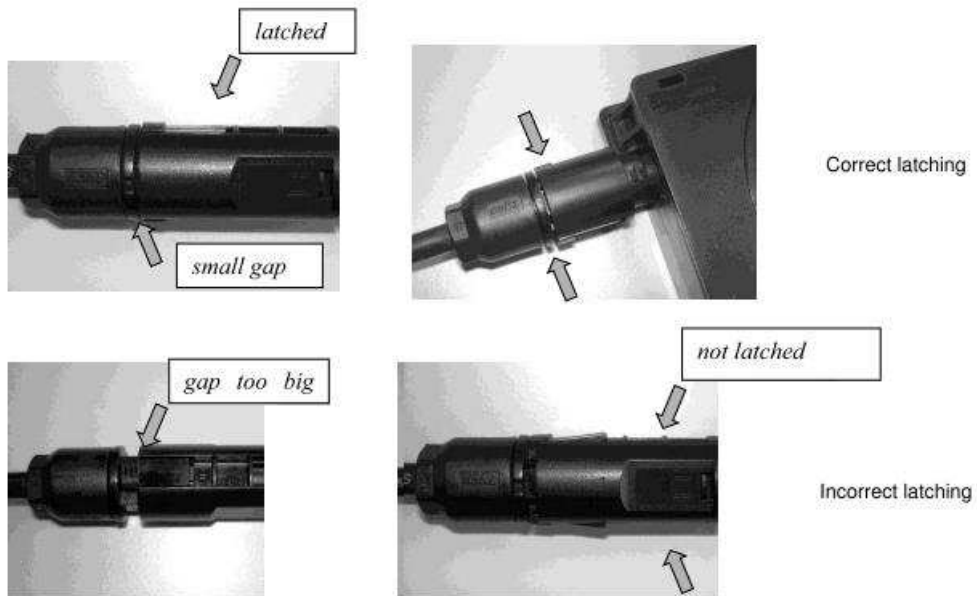


Figure 5 (End)

**NOTE**

Mating of the connectors is done by pushing the connectors together until a clear audible click is heard. This clear audible clicking sound must be heard to ensure the connectors have been mated correctly. When the connectors are correctly connected the latches should be flush against the edge of the connector.

For Type 1 jumper, variants will be available upon request (related to cable length)

For Type 2 and Type 3, variants will be available upon request (related to cable length, the connector type for other side for compliance of combiner box/inverter)

Alternatively, the Solarlok female connectors are available as complete assembly kits that contain all the necessary individual parts. A list of assembly kits can be found in table 2.

Available Connector Kits

Wire Gauges	Polarity	Female Part Number	Cables approved by TUV
4.0 mm <sup>2</sup>	+	0-1394462-3	2270259
			2270260
4.0 mm <sup>2</sup>	-	0-1394462-4	2270215
			2270245

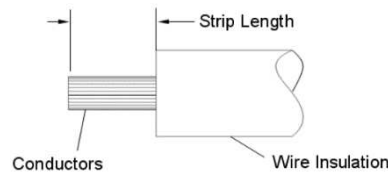
**NOTE**

**Table 2**

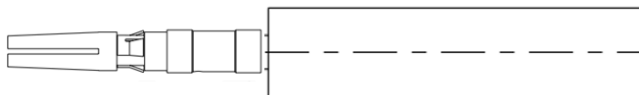
Only Cables released from TE Connectivity are permitted to use with SOLARLOK Components!

When assembling the connectors, the following sequence must be followed:

- 1) Stripping the Wire (see Application Spec. 114-94061-1) (see Figure.6)  
Using the appropriate wire stripping tool, strip the wire 9 mm ± 1 mm without damaging the strands.

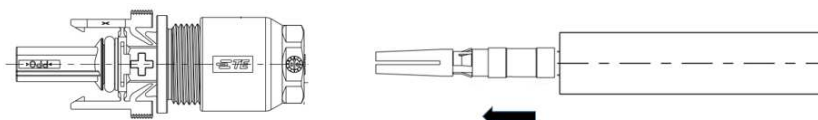

**Figure 6**

- 2) Making a crimping contact connection with suitable Tool-cross-section opening.  
Insert the stripped wire into the wire crimp barrel until it stops.  
Insert the contact with the cable into the crimp locator until it stops.  
While holding the wire in place, squeeze the tool handles together until ratchet releases.


**Figure 7**

Detailed information regarding the making of the crimping connections of the contacts SOLARLOK can be found in the specification of use 114-94061-1.

- 3) Insert the contacts until an audible click sound is heard and then give a slight pull back (a maximum of 5-10 N force) to check whether the contact has clicked into place.
  - a) The terminal engagement Force is max 25 N.
  - b) The connector housing can be reassembled a maximum of 1 times.
  - c) The contact can be reassembled a maximum of 1 times.


**Figure 8** Final assembly: Insertion of contact with crimped connection

- 4) Use a slotted torque wrench (PN 523229-1) to tighten the cable screw nut (see figure 9).



**Figure 9** Tightening of the cable screw lock (Initial tightening torque is  $1.0^{+0,2}$  Nm)



*In case of replacement of cables or components or of assembling / disassembling of the cable entry gland, new pinch rings and seals have to be used. If a visible deformation appears at the clamping area of the cable, the cable end needs to be trimmed to remove the deformed area.*

- 5) Label the connector with the connector warning label “Do not disconnect under load!”



**Figure 10** Placement of a warning label



*Unplugged terminal points must be protected against moisture, dust and any environmental pollution. Only clean and dry plugged terminal points fulfill their respective pollution class. (Dust covers are available, see Figure 11)*

These protective dust plugs serve for the protection against environmental contaminants. Their use is not allowed for operation on the panel or connector (protection level IP 44).

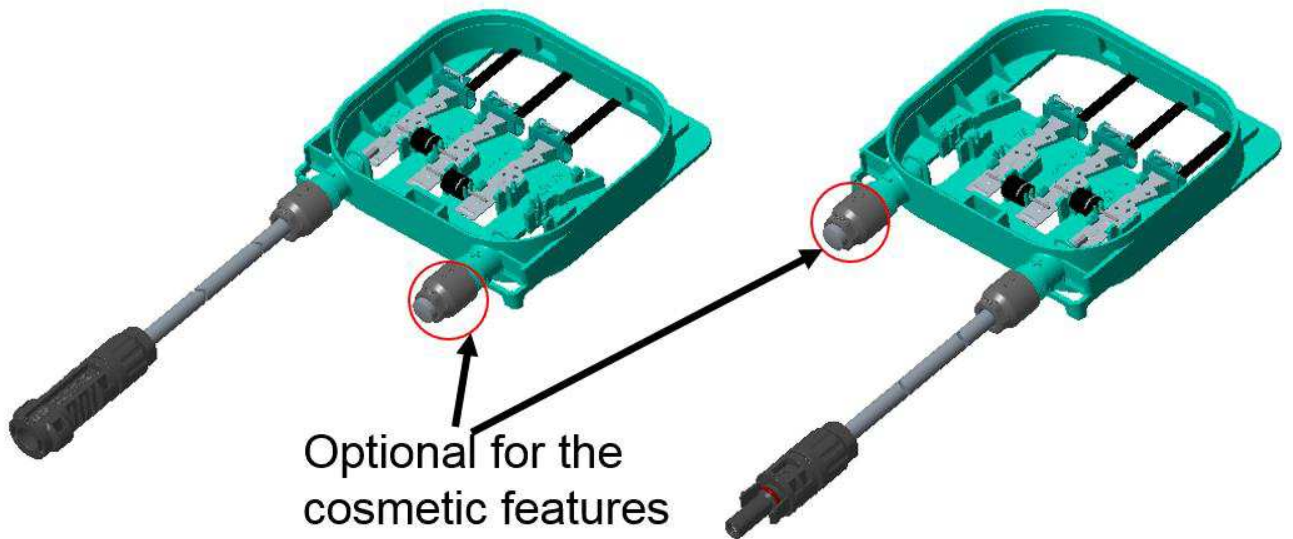


Dust cap PN 1987424-1 for socket connectors

Dust cap PN 1987423-1 for socket connectors (with loss protection)

**Figure 11**

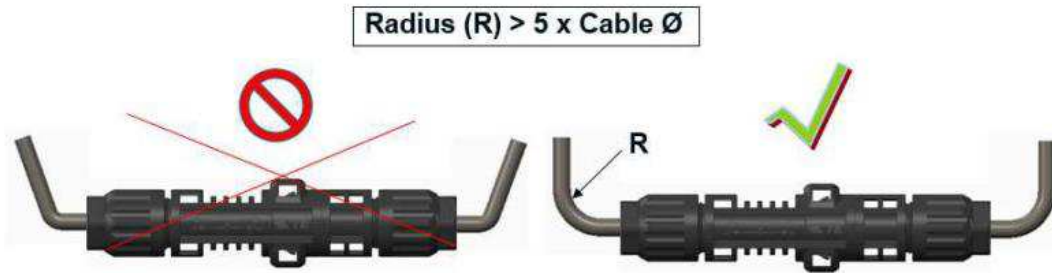
### OTHER VARIANTS OF THIS JUNCTION BOX SERIES



*Figure 12*

### 3.8. Cable Routing and Strain Relief

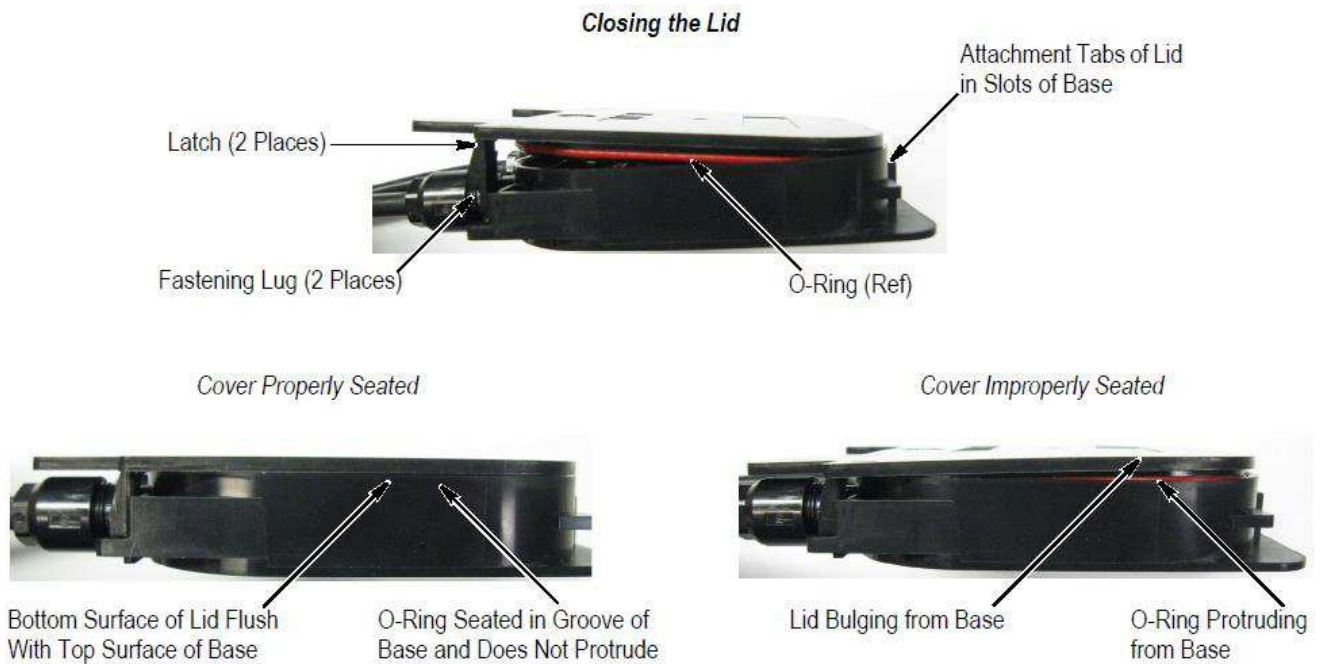
Cables must not bend, stretched, crushed, or confined in any way. The cables must not be bent in the direct exit of the cable screw joint. A minimum bend radius of greater than 5 times the diameter of the largest cable must be maintained. The cable must be routed so that tensile stress on the connections is prevented.


**Figure 13**

### 3.9. Closing the Lid

The lid of the junction box must be attached to the base and then closed properly having the following requirements:

1. The two attachment tabs of the lid must be inserted into the recesses of the base. The attachment tabs must be properly seated so that the lid can freely rotate closed
2. When closed, the two latches of the lid must lock into the fastening lugs of the base (there will be an audible “click”). The bottom surface of the lid must be flush with the top surface of the base. The lid must be flat (not bulging). The O-ring of the lid must sit in the groove around the perimeter of the base. No part of the O-ring can protrude from the base.


**Figure 14**

**NOTE** When closing the lid, the entire perimeter of the lid must be pressed down to ensure that the O-ring enters the groove around the base.

**CAUTION** To ensure proper sealing of the junction box and avoid damage to the components inside of the junction box, the O-ring of the lid must be properly fitted in the groove around the base and the lid must be tightly fitted to the base when the lid is closed.

### 3.10. Opening the Lid

**IMPORTANT:** Only authorized and trained personnel should open the lid of the junction box.



*To avoid personal injury or death, the lid of the junction box must NEVER be opened while the junction box is under electrical load. Components inside the junction box may be electrically charged and capable of causing severe injury or death. EXTREME CAUTION must be taken when opening the lid of the junction box.*

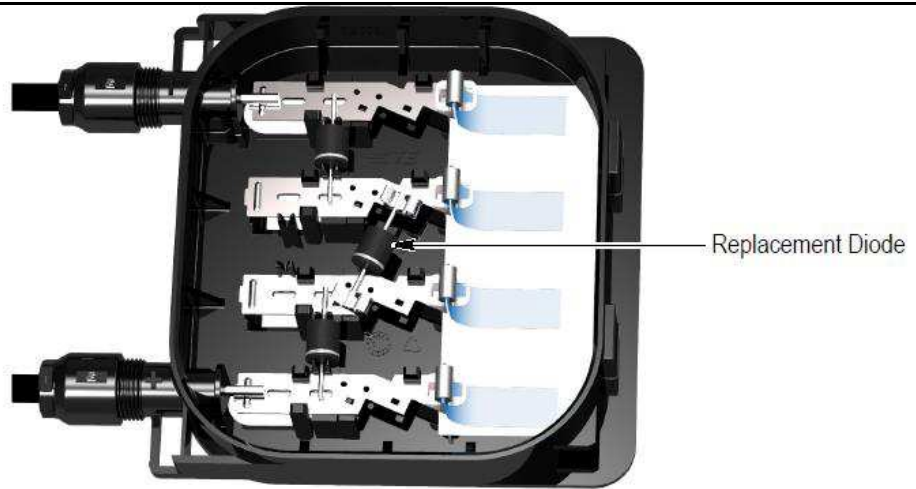
To open the lid of the junction box, the tip of a screwdriver having a 3 to 5-mm flat blade must be inserted into the release pocket of the lid, and then the attachment tab must be pried free while simultaneously slightly lifting the front of lid. See Figure 15.



**Figure 15**

### 3.11. Diode Replacement

A damaged diode can be replaced by a replacement diode. It is highly recommended to replace all 3 diodes; however, it is permissible to replace 1 or 2 diodes only. Different types of diodes must not be installed in the same junction box. A junction box with one replacement diode is shown in Figure 16.



**Figure 16**

### 3.12. Maintenance and Repair

## 4. QUALIFICATIONS

SOLARLOK Z-Rail junction box.

## 5. TOOLING AND MATERIALS

### 5.1. Tooling

- The foil clip pliers is used to spread the open end of the foil clip for installation. Refer to Figure 17.
- The repair tool kit is used to install replacement diodes into the junction box. The repair tool kit consists of a repair tool, 3 replacement diodes, and 6 spring clips. The repair tool installs one replacement diode at a time. Refer to Figure 17.



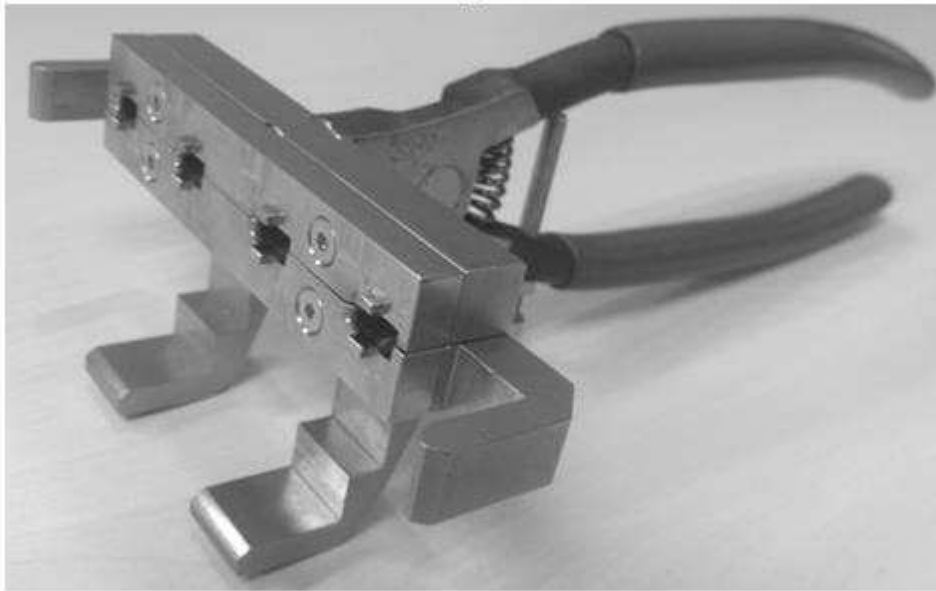
**Figure 17**



*Only diodes of the same type designation are permitted for use in one and the same*

*junction box. In case of field rework to replace the diodes, only to use the same type diode indicated in customer drawings.*

- The 4 in 1 tool is used to install the foil clips 4pcs on the Z-rail contact rail at the same time. Refer to Figure 18. For the installation instruction, pls refer to 411-137001



**Figure 18**

## 5.2. Materials

### A. Cleaning

- Soft clean cloth moistened with isopropyl alcohol

### B. Assembly

- Gloves and eye protection
- Momentive Performance Materials (MG) SS4179 Clear Silicone Primer, or equivalent, is used as an option to prepare the attachment area of the junction box
- The following silicone sealants or adhesive can be used to secure the junction box to the solar panel:

#### NOTE



*Only the sealants and adhesives listed are approved for use; otherwise, any others must be tested and verified for suitability by the customer.*

DOW CORNING Solar PV-804 Neutral Sealant White/Black  
Double-Sided Adhesive Tape 1740620-[ ]

The tape is typically provided in cartridges; refer to the instructions included with the tape for recommended applicator.



- Spatula or brush can be used to apply the silicone sealant
- 1-kg [2-lb] metal weight used to aid in mounting the junction box to the solar panel

## 6. VISUAL AID

The illustration below shows a typical application of this product. This illustration should be used by production personnel to ensure a correctly applied product. Applications which DO NOT appear correct should be inspected using the information in the preceding pages of this specification and in the instructional material shipped with the product or tooling.

FOIL CLAMP TYPE JUNCTION BOX

Note: Solar Panel Not Shown



WELDED TYPE JUNCTION BOX



Figure 19

## 7. Components approved in TUV Rheinland certification

TUV certificate	Components	Manufacturer	Type/model	Technical data	Mark(s) of conformity
Z-rail Box Per IEC62790:20 14	Cable	TE Connectivity	SLKC1A4	4.0mm <sup>2</sup>	R 50504538 R 50504540
		TE Connectivity	SLKC0A4	4.0mm <sup>2</sup>	R 50504538 R 50504540
		TE Connectivity	SLKC1A4	4.0mm <sup>2</sup>	R 50504531 R 50504536
		TE Connectivity	SLKC0A4	4.0mm <sup>2</sup>	R 50504531 R 50504536
	Connecor	TE Connectivity	PV4-Syx	1000V	R 60148776
		TE Connectivity	PV4-S1yx	1500V	R 60148776
		TE Connectivity	1394462-3 1394462-4	1000V	Only allowed to be used with connectorized version

					box(see figure 3)
		Stäubli Electrical Connectors AG	PV-KST4/xy-UR Male PV-KBT4/xy-UR Female	1000V	R 60127190
		Stäubli Electrical Connectors AG	PV-KST4-EVO 2/xy-UR Male PV-KBT4-EVO 2/xy-UR Female	1500V	R 60127169
		Amphenol	UTXCMabcd and UTXCFabcd	1500V	R 50340393
	Adhesive	Dow Corning	PV 804	neutral	
	Backsheet	ZTT	ZTT-TPT	1000V	R 50302136
		ZTT	ZTT-KPO350	1500V	R 50302136
			Glass		

Table 3

## Annex A

### Documentation Change Record

Version	Clause	Page	Change Description
D2	3.6 C	5	Update the content of Mounting
	7	14	According to TUV requirement, add the list of product components approved in TUV Rheinland certification
E	7	17	According to TUV requirement, add the list of product components approved in TUV Rheinland certification
E1	3.7	7	Added min insertion depth of foil in picture 3 and re-edited all document

