

## Guide to Best Practice - Connections and Connectors

### Ensuring the best performance of REC Peak Energy solar panels

Connecting panels can often be the weakest link in a solar installation. It is here where the electrical circuit is left exposed until the connectors are correctly attached. Over time, any weakness will be exposed by the elements. REC Peak Energy panels have been designed for easy installation and minimal maintenance, however there are a number of factors to watch out for when installing a system to ensure an effective and durable source of power.

#### Safety when working with connectors




Safety is paramount when working with electrical connectors. Ensure these rules are followed at all times:

- ⚠ Do not work on live or load-carrying parts
- ⚠ Connections must not be disconnected under load
- ⚠ Protection from electric shock must be assured by the end product and its user
- ⚠ Isolate the system from the grid before carrying out any maintenance or repair work

#### Connector types

Over the course of its lifetime, REC has used three different types of connector on REC Peak Energy Series solar panels. These are:

Table.1  
The connector types found on REC Peak Energy Series panels

Connector Type	Usage
	<b>Radox</b> <ul style="list-style-type: none"> <li>• REC production until 02/2013</li> <li>• Used with H&amp;S junction box</li> </ul>
	<b>Hosiden</b> <ul style="list-style-type: none"> <li>• MC4 connectable type</li> <li>• REC production until 03/2013</li> </ul>
	<b>Multi Contact MC4</b> <ul style="list-style-type: none"> <li>• REC production from 02/2013 to present</li> </ul>

Changes in connector type have been made as part of continued product improvement. When connected properly, all connector types will provide long lasting and secure connections.

#### Connecting and disconnecting

All connectors must be securely joined to each other according to the following instructions:

##### To connect Radox connectors:

- Hold connectors by the grip areas on connector hoods
- Slide the male plug completely into the female socket connector. The gap left should be about 2 mm
- Screw the plug into the socket until the gap is closed completely and locked. The direction in which to lock the connector is labeled on the connector hood
- Check that the connectors have engaged properly by gently pulling the connectors apart



Fig. 1: Connection of Radox connectors showing ~2 mm gap

⚠ **Note: Do not twist the connectors further as this can break the internal ribs in the connector cap**



Fig. 2: Radox connector fully closed

##### To disconnect Radox connectors:

- Hold the connectors at the grip areas on the connector hood and unscrew until a gap of ~ 2 mm is visible
- Pull the plug and socket completely apart

## To connect Hosiden & MC4

- Align latches of the male plug with receptacles of the female socket
- Insert the plug into the socket until a firm click is heard
- Check the connectors have engaged correctly by gently pulling them apart

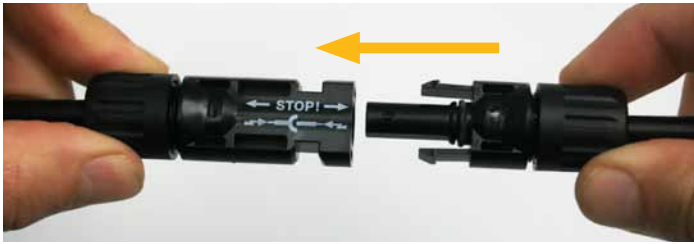


Fig. 3: Connection of MC4 type connector (Multi-Contact MC4 or Hosiden)



Fig. 4: MC4 type connector fully closed (Multi-Contact MC4 or Hosiden)

## To disconnect Hosiden & MC4:

- Press the latches together either by hand (Fig. 5) or with the correct tool (i.e., Multi-Contact tool PV-MS or the Hosiden connector tool) (Fig. 6)
- Pull the connectors apart

Hosiden and MC4 connectors can be further secured by a specific locking system available from the manufacturer. This prevents the connector being opened except with a specially designed tool.



Fig. 5: Disconnecting an MC4 type connector by hand (Multi-Contact or Hosiden)



Fig. 6: Disconnecting an MC4 type connector with tool (Multi-Contact or Hosiden)

## Cutting of cables and re-crimping connectors

Some regions have specific regulations regarding the compatibility of connectors. To make adherence to such legislation as easy as possible, current REC production panels are supplied pre-installed with Multi-Contact MC4 connectors as standard. REC explicitly excludes the cutting of cables and replacement of connectors. If this causes an issue for a particular site, contact REC ([www.recgroup.com](http://www.recgroup.com)) for further advice.

If connectors are ever replaced, it is critical that replacements are correctly installed according to the manufacturer's instructions. Any failures caused by incorrect or insufficient crimping can invalidate the warranty and insurance policies as well as presenting a risk for potential panel defects.

## Cable bending

The cables used by REC have a minimum bend radius of 30 mm. This means the diameter of the complete bend in the cable may not be less than 60 mm from the inside of the bend to the facing inside bend as shown in Fig. 7.

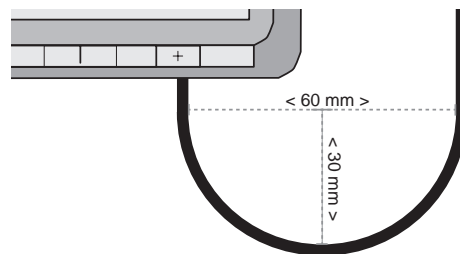


Fig. 7: Minimum bend radius of 30 mm

This protects the cable and insulation from undue stress. Bending the cable compresses the insulation on the inside and stretches the material on the outside of the bend. Any curvature less than the minimum bend radius can weaken the cable insulation and allow moisture to penetrate and corrode the insulation and cable.

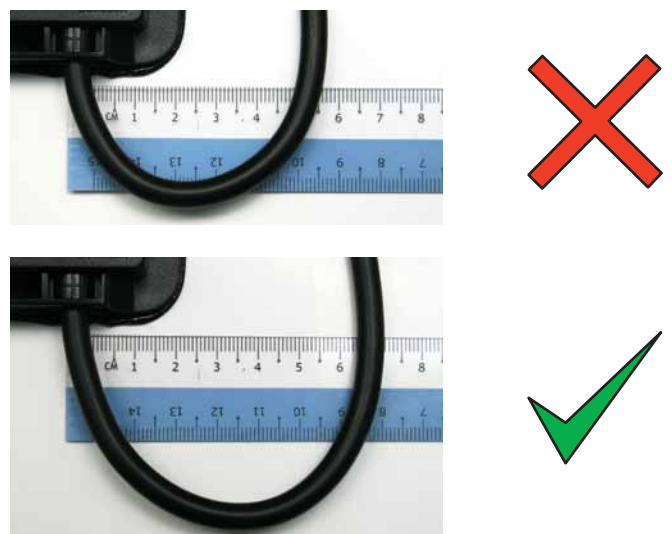


Fig. 8: Examples of incorrect and correct bend of cable on exiting junction box

Further good practice is to ensure that the cable exits the junction box in as straight a line as possible, before a bend (Fig. 8). Cables exiting the junction box at extreme angles apply force to the surrounding construction; this can create small fissures in the casing and allow the ingress of water and dirt into the junction box material.

## Cable management

Protect cables from any damage through friction or stress. Using a cable raceway or conduit is a good method of providing this protection.

To ensure longevity, connectors must be protected from humidity as much as possible:

- Shield connectors by placing them directly beneath the panel so water cannot fall on the connection
- Ensure cables and connectors do not hang loose or that they are moved around by wind
- When securing cables, ensure they are held firm, but do not overtighten, as this may deform the insulation.

Best practice is to secure the cable ~ 20 mm either side of the connectors. Fastening the connector itself may damage the protection afforded by the connector shell.

## Ensure sufficient air circulation around connectors

Keeping humidity away from electronic connections is also important. Solar panel connectors must not be left to stand in permanent or regularly occurring pools of water. Likewise, after rainfall, connectors should be given the opportunity to dry completely. Although the connectors used by REC are rated to IP67, moisture can build up between the mounting structure and connector.

Fig. 9 shows a connector secured tight to the mounting structure. While the panel above protects the connection from rain; humid air, mist or condensation can cause moisture to accumulate between the connector and the mounting rail. This layer of moisture is caught between the connector and rail and can slowly work into the connector through capillary action. Here it can erode the metallic connection.



Fig. 9: Fastening of the connector tight to the mounting structure can cause moisture build up between connector and rail, damaging the connection

Ensuring sufficient air circulation around the connector, as in Fig. 10, means it can dry effectively and avoids the risk of damage.



Fig. 10: Best practice installation of a connector allows air circulation around the connector body with connector secured either side

## Use of extra isolation and lubricants

If connectors ever require replacement, and the use of lubricants is desired, follow the instructions supplied by the connector manufacturer.

As the panels are rated to IP67, there is no requirement to add extra protection to the connection, for example heat shrink, grease or tape.

## Application of chemicals

REC does not permit the use of chemicals on the connectors or contacts. Use of such can lead to degradation of the plastic or rubber casing. Treating connectors in this way will invalidate the warranty.

## Summary

With cables and connectors forming a source of weakness in the system, it is imperative that these are protected as far as possible. To avoid any drops in performance or at worst any risk to life, following the best practice guidelines above will ensure a safe and durable bond between panels and other components.

Note: These Guidelines to Best Practice are intended to help ensure a safe connection between solar panels and between other balance of system components. REC accepts no responsibility for any damage caused by improper or incorrect use of connectors. The Warranty on the product is only valid if the instructions in the REC Peak Energy Series Installation Manual are observed at all times.



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REC is a leading global provider of solar energy solutions. With more than 15 years of experience, we offer sustainable, high performing products, services and investments for the solar industry. Together with our partners, we create value by providing solutions that better meet the world's growing energy needs. REC is headquartered in Norway and listed on the Oslo Stock Exchange (ticker: RECSOL). Our 1,600 employees worldwide generated revenues of USD 647 million in 2013.

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