

Guide to Best Practice - Connections and Connectors

Ensuring the best performance of REC solar panels

REC panels have been designed for easy installation and minimal maintenance, however the connections between panels can often be the weakest link in an installation. Here the electrical circuit is left exposed until the connectors are attached and over time, any weakness can be exposed by the elements. Therefore the correct handling of connectors can help prolong the lifetime and efficiency of the installation.

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
- ⚠ If connectors remain open or modules are stored outside, modules must be protected against foreign materials and the elements e.g., water, snow, dirt or other contamination

Connector types for (1000V)

As part of continued product improvement, the connectors used by REC have changed over time. When connected properly, all connector types will provide long lasting and secure connections. The four different types of connector used by REC since 2010 are:



Table.1
The connector types found on REC Solar panels since 2010 (1000V)

Connector Type	Usage
	Radox <ul style="list-style-type: none"> • REC production until 02/2013 • Used with H&S junction box
	Hosiden <ul style="list-style-type: none"> • MC4 connectable type • REC production until 03/2013
	Tonglin <ul style="list-style-type: none"> • MC4 connectable type • 10/2016 to present
	Stäubli MC4 <ul style="list-style-type: none"> • REC production from 02/2013 to present

Connector types for (1500V)

As part of continued product improvement, the connectors used by REC have changed over time. When connected properly, all connector types will provide long lasting and secure connections. The types of connector used by REC since 2010 are:

Table.1
The connector types found on REC Solar panels since 2010 (1500V)

Connector Type	Usage
	Tonglin <ul style="list-style-type: none"> • MC4 connectable type • 10/2016 to present
	Stäubli MC4 EVO2 <ul style="list-style-type: none"> • REC production from 02/2013 to present

Connecting and disconnecting (1000V)

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

Connecting Hosiden, MC4 and Tonglin connectors:

- 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.1: Connection of MC4 type connector (Multi-Contact MC4, Hosiden or Tonglin)

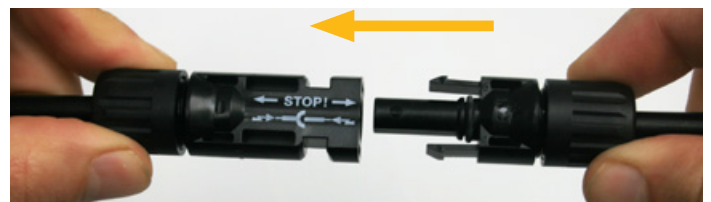


Fig. 2: MC4 type connector fully closed (Multi-Contact MC4 or Hosiden)



Disconnecting Hosiden, MC4 and Tonglin connectors:

- Press the latches together either by hand (Fig. 3) or with the correct tool (available from the manufacturer or other good supplier) (Fig. 4)
- Pull the connectors apart

These 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. 3: Disconnecting an MC4 type connector by hand (Multi-Contact or Hosiden)



Fig. 4: Disconnecting an MC4 type connector with tool (Multi-Contact or Hosiden)



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



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

Fig. 5: Connection of Radox connectors showing ~2 mm gap



Fig. 6: 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

Connecting and disconnecting (1500V)

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

Connecting MC4 Evo2 and Tonglin connectors:

- Align latches of the male plug with receptacles of the female socket

Fig. 7: Connection of MC4 Evo2 and Tonglin connectors



- Insert the plug into the socket until a firm click is heard
- Check the connectors have engaged correctly by gently pulling them apart

Disconnecting MC4 Evo2 and Tonglin connectors:

- Press the latches together with the correct tool (available from the manufacturer or other good supplier) (Fig. 8)
- Pull the connectors apart

Fig. 8: Disconnecting MC4 Evo2 and Tonglin connectors



Cutting of cables and re-crimping connectors

Some regions have specific regulations regarding the compatibility of connectors. Installers are responsible for ensuring the compliancy of the system with local regulations. Additionally, these connectors must fulfill all technical specifications of the factory-mounted connector and be certified according to the required standards for each region or country.

REC panels are supplied with Stäubli MC4 connectors as standard. To ensure connector compatibility and reduce the potential for damage to the solar modules and wider installation, **REC only permits mated connectors from the same manufacturer and of the same connector type.**

The mounting of the connector must be carried out by a qualified and certified expert. All changes to the original state of the module should be limited and only be done in exceptional circumstances. If connectors ever need replacing, it is critical that replacements are correctly installed according to the manufacturer's instructions. The REC product warranty is not voided by changing the connector. Any type of failure or malfunction due to inadequate or incorrect mounting of the connector is excluded from REC's product warranty.

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.9.

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. Anything less than the minimum bend radius can weaken the cable insulation and allow moisture to penetrate and corrode the insulation and cable.

Further good practice is to ensure that the cable exits the junction box in as straight a line as possible, before a bend and ensure cables are free from any external load (Fig. 10). 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, or cause stress on the junction box casing.

Fig. 9: Examples of incorrect and correct bend of cable on exiting junction box

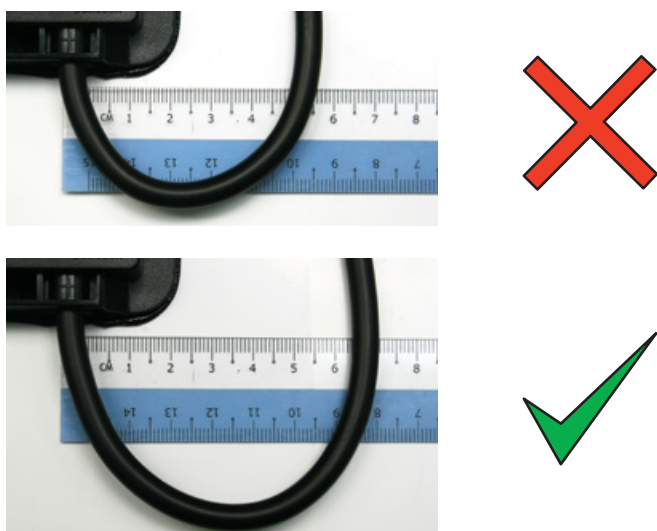


Fig. 10: Example of cable exiting the junction box at an extreme angle



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 not 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 (Fig. 11). Fastening the connector itself may damage the protection afforded by the connector shell.

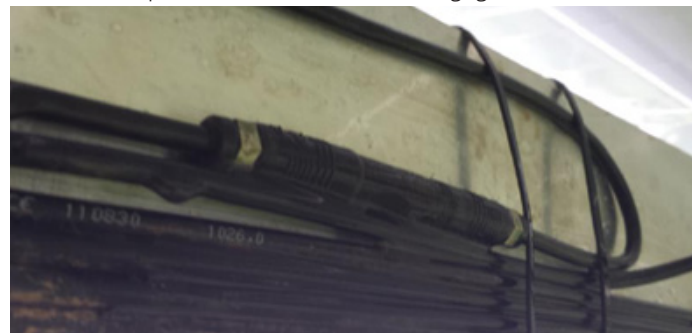
Ensure sufficient air circulation around connectors

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 at least IP67, moisture can still build up between the mounting structure and connector.

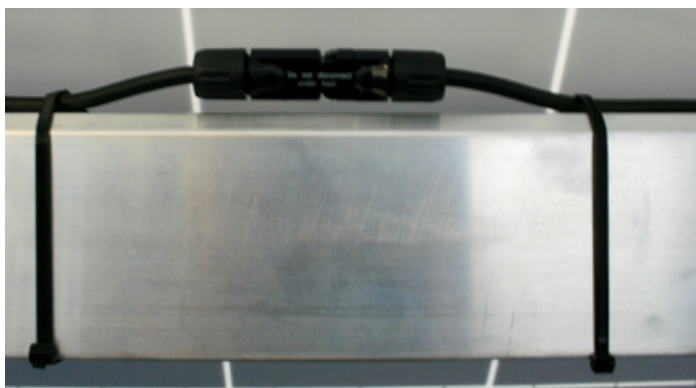
Fig. 11 shows a connector secured tight to the mounting structure. While the panel above protects the connection from rain; humid air, mist or condensation can cause

Fig. 11: Fastening of the connector tight to the mounting structure can cause moisture build up between connector and rail, damaging the connection



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. 12: Best practice installation of a connector with it placed away from the mounting rail allowing air circulation and water to drain away.



Placement of the connector away from the surface helps ensure sufficient air circulation around the connector, and means any water can drain away and allow the connector to dry effectively and avoid the risk of damage as in Fig. 11.

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 Installation Manual are observed at all times.