CBOS
Consumer, Building & Occupational Services
Promoting a fair marketplace

Electrical Standards and Safety

Advisory Note 4

Requirements for d.c. connectors

AS/NZS 5033:2014 Installation and safety requirements for photovoltaic (PV) array

Since July 2012 it has been a requirement within photovoltaic (PV) solar installations to only mate direct current (d.c.) connectors of the same type and from the same manufacturer.

AS/NZS 5033:2014 clause 4.3.7 Plugs, sockets and connectors states that:

Plugs, sockets and connectors shall -
(k) only be mated with those of the same type from the same manufacturer

Inspections of solar installations have revealed a high level of non-compliance to this requirement which is an indication of either:

1. A misunderstanding within the electrical industry of how to identify a mismatched d.c. connector, or
2. A lack of care to ensure compliance with the minimum safety standards.

Mismatched d.c. connectors are considered to be defective electrical work. They attract a Notice of Defective Electrical Work that requires rectification and payment of a reinspection fee, in addition, further action can be undertaken by Consumer Building and Occupational Services (CBOS) under section 25(1)(a) of the *Occupational Licensing Act 2005* (the Act).

CBOS have released this guide to assist all parties involved in installation, inspection and auditing of solar installations, to ensure compliance and safety requirements are met.

Why is it so important, what's the risk?

If mismatched d.c. connectors fail, they have the potential to cause major damage and a safety risk to occupants due to fire or smoke inhalation.

In 2019/2020, inspections conducted by the Electrical Safety Inspection Service, TechSafe, regularly identified mismatched d.c. connectors in solar installations. Investigations have identified the cause of these failures to be attributed to mismatched d.c. cable connectors. The connections had failed and the arcing of the d.c. cables started a fire within the PV systems.

Correctly matching d.c. connectors will improve safety by reducing fire risk.

Example of failed mismatched d.c. connector

How can you identify mismatched d.c. connectors?

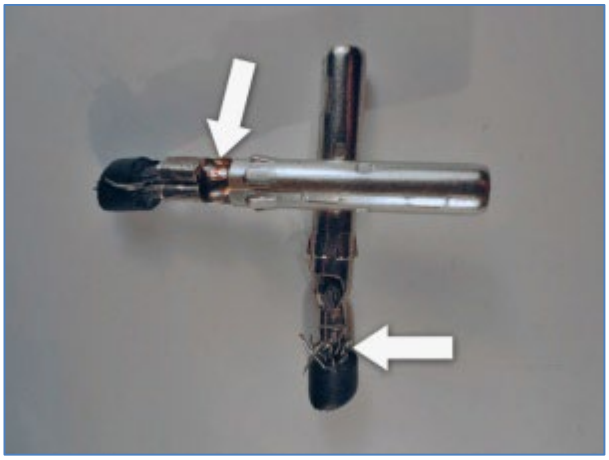
How can we ensure mismatched d.c. connectors are not mated together?

It can be difficult to identify the brands of connectors on the panel as they all look very similar. It is important to ask your supplier or check the panel spec sheet for the details of the connector.

For installers (Licensed Electrical Practitioners)

Ensure you use the same type of d.c. connector from the same manufacturer, and ensure the manufacturer-approved crimping tool is used for the connections.

Some failures have been caused by a poor cable crimp, either by a set of pliers or by a non-approved crimping tool. The right crimping tool will ensure the connection is crimped to the required pressure (Nm), as required by the manufacturer. This will ensure the connection is rated for the designed current carrying capacity.



Poorly crimped connection

Result of a poor crimp under the array

d.c. connectors carry significant energy, it is therefore very important to ensure crimping is properly performed. If there is a poor joint with a d.c. cable it may lead to arcing and as solar panels are energised by the sun it will keep arcing while the sun shines.

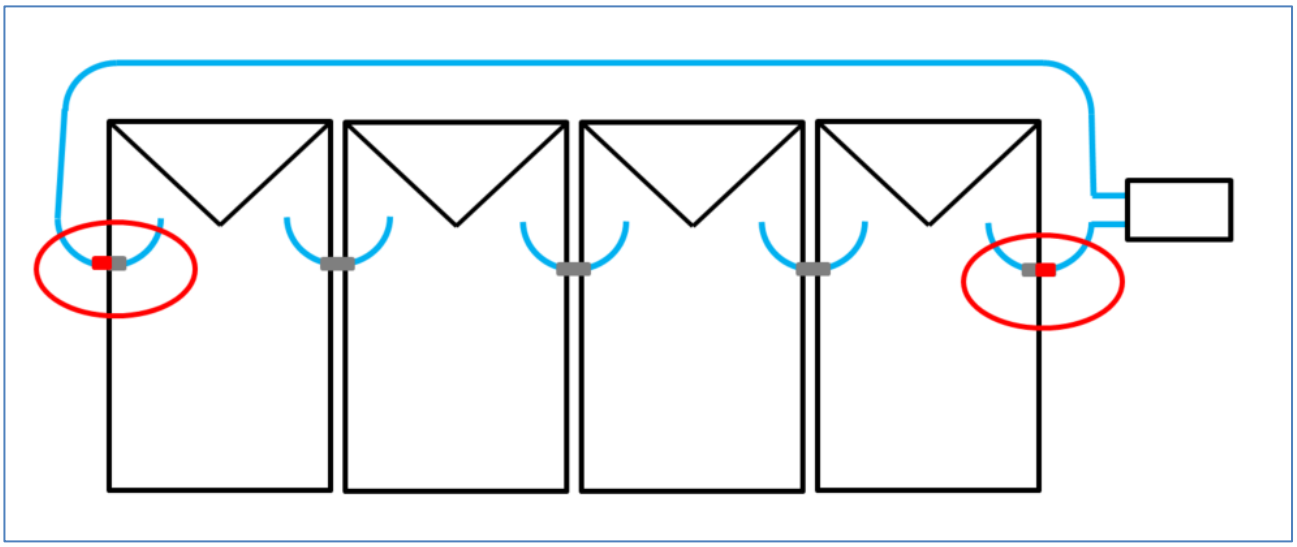
If your panel has different connectors than what you carry in your van, ask your supplier for some spare matching connectors. Don't risk it!

What Electrical Inspectors are looking for

Ideally, an inspector will find matching connectors from one PV panel to the next which have been fitted and supplied by the PV panel manufacturer.

Therefore an inspector is looking for the d.c. connectors that have been crimped and fitted to the cables by the installer. They will be located at the start of the return d.c. cable from the end of the PV array, or from a top PV array to a lower PV array, between split PV arrays, and at the d.c. isolator (see Figure 1 on the following page).

Note: d.c. connectors at the inverter are also checked.



Examples of locations where d.c. connectors have a greater risk of being mismatched.

There is no need to remove PV modules as the inspector should not dismantle the PV array to conduct an inspection.

d.c. connectors

Some tips on identifying different d.c. connectors:

1. Look at the 'O' ring on the male or positive connector. Some have different colours, some have two 'O' rings. If the 'O' ring on your panel doesn't match the connector you are fitting, then it is probably a mismatched connector.
2. Look at the screw nut on the cable gland at the end of the connector. The shape varies from brand to brand, this may be an indicator of a mismatched connector.
3. Look at the contour of the body mouldings. Manufacturers use the same design on both the positive and negative connectors, this is easily recognisable as a mismatched connector.

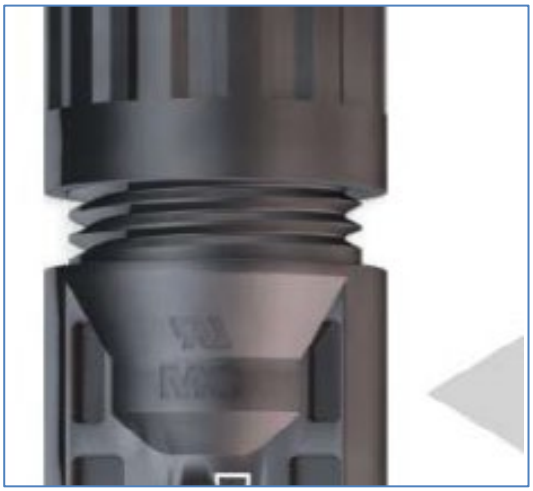
4. If in doubt, verify the connector by looking at the small manufacturers logo or symbol on the connector body, if they match you can be sure they are from the same manufacturer.

It is a clear requirement in the standard that only connectors of the same type from the same manufacturer can be mated together. Therefore it is the responsibility of the licensed person to ensure all connectors comply with this requirement.

Examples of different d.c. connectors

Red 'O' ring

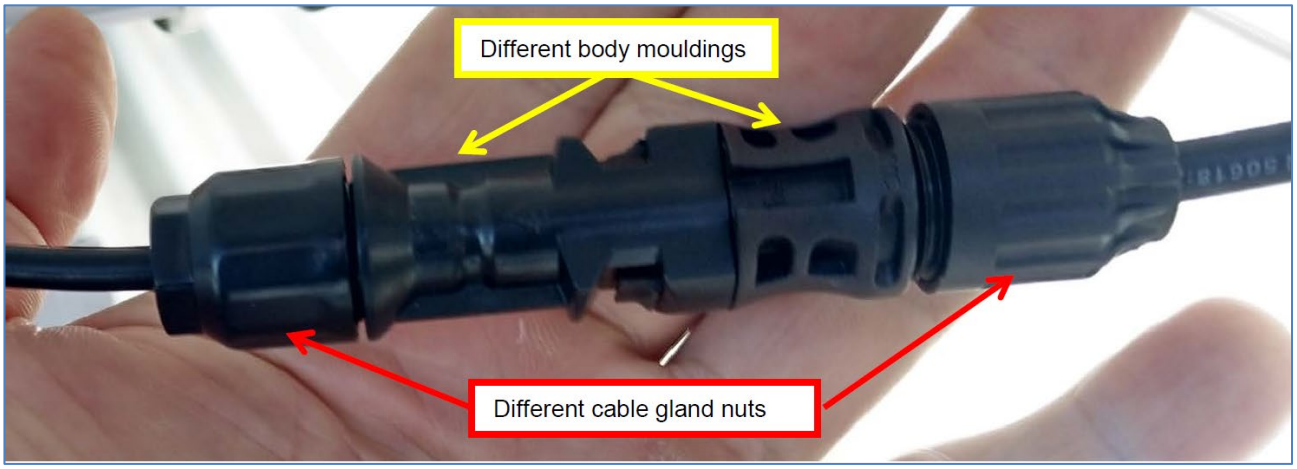
Black 'O' ring



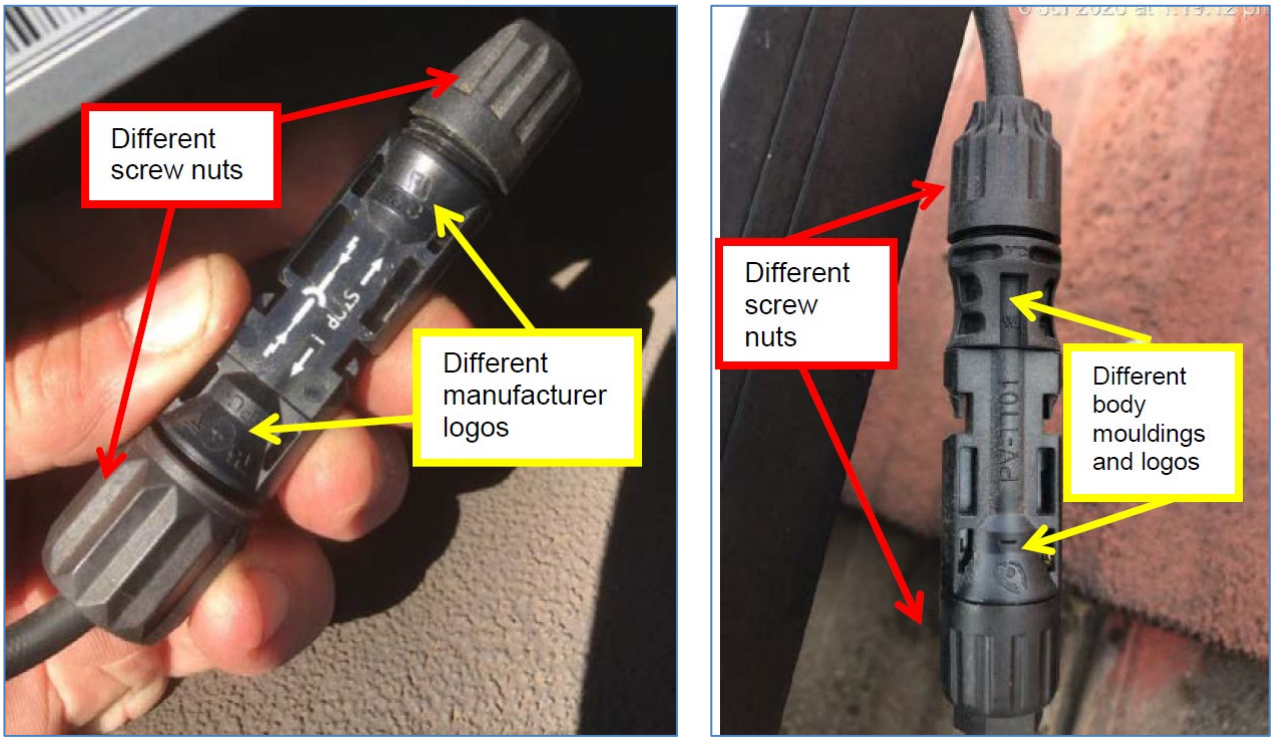
MC4 brand

'TUV' logo

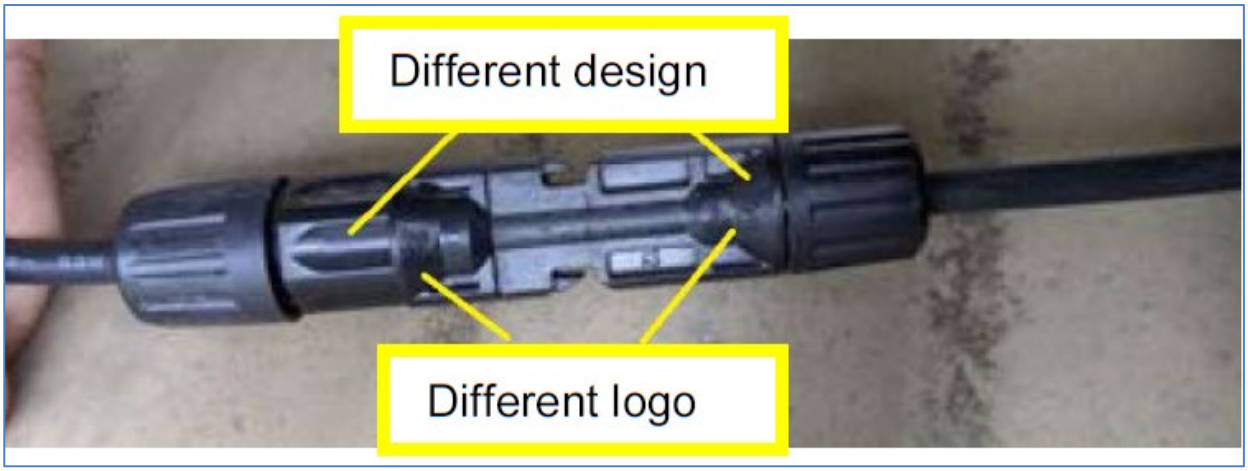
Examples of mismatched d.c. connectors



Example of d.c. connector showing mismatching body mouldings and cable gland nuts

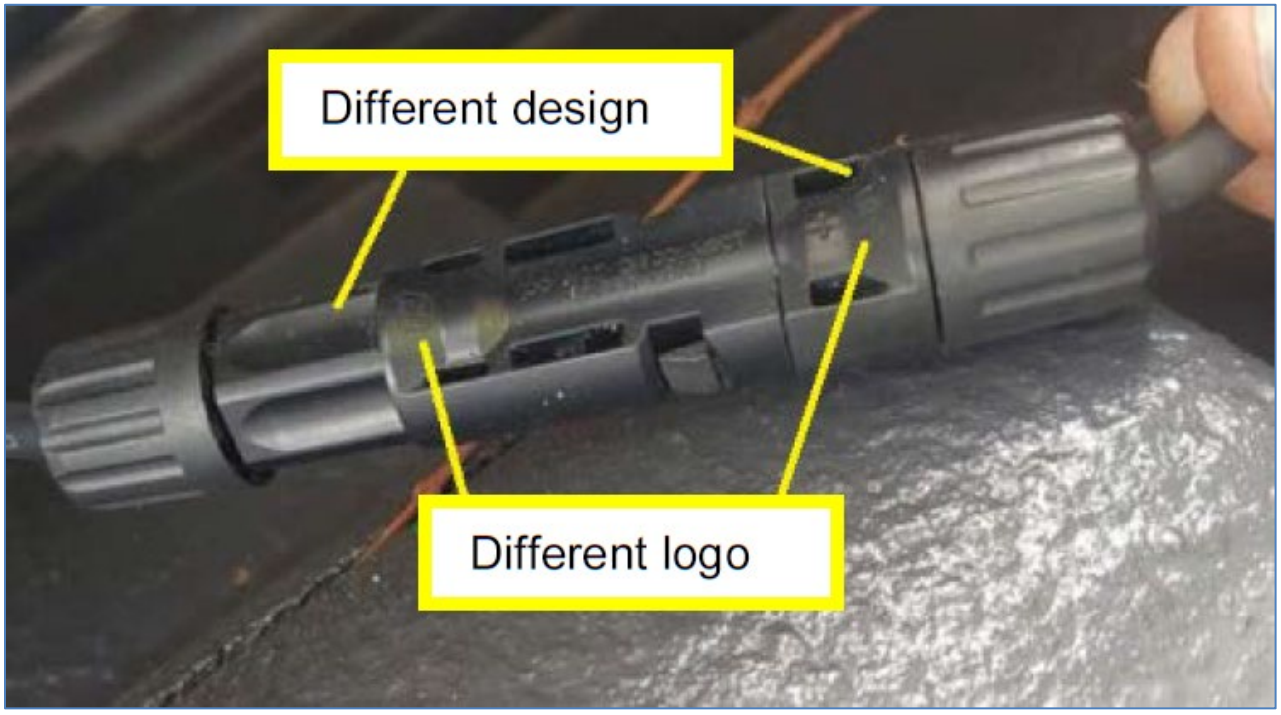


Example of d.c. connectors with mismatching screw nuts, manufacturer logos and body mouldings



Example of d.c. Connector with different design and logo

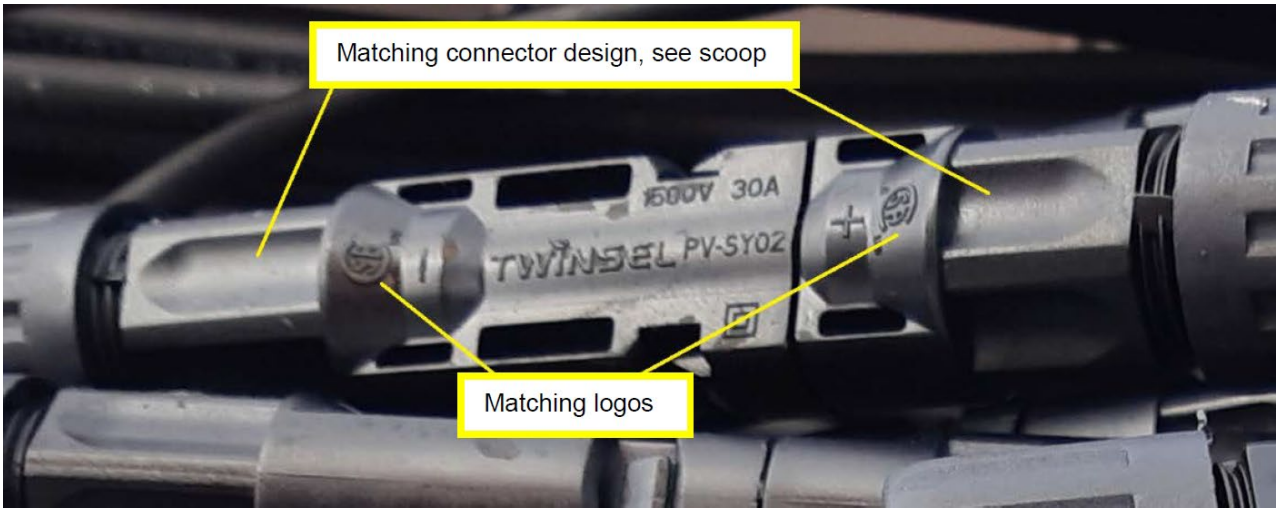
Examples of mismatched d.c. connectors (Continued)



Example of d.c. connector showing mismatching design and logo

Example of d.c. connector showing mismatching manufacturer logos

Example of a compliant, matching d.c. connector



Example showing a compliant d.c. connector

Exception to the rule

The only exception to this requirement is where a single manufacturer has designed, tested and declared that a specific type of connector they manufacture is compatible to be connected to another specific connector they manufacture.

Manufacturer's instructions must be followed when mating these two connectors. Specifications may state maximum voltage of 1000 V d.c. in one version whilst another has a maximum voltage of 1500 V d.c. Therefore when used together the application must not exceed the lowest rated voltage of the connectors.

Document Development History

Version	Application Date	Sections amended
1.0	November 2020	Original release

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