

Cross-connection of PV connectors – a fact check

Connectors | Solar PV connectors provider Stäubli discusses the risks of cross-mating PV connectors, examines the pitfalls of individual testing and details the international standards all solar PV professionals should know.

Damage to photovoltaic systems caused by cross-mating of different PV connector brands is a recurring issue, and one that holds the potential to pose significant problems for solar installations, as this article will explain. Often there are reports from testing institutes about tests regarding the combinations of PV connectors from different manufacturers, which lead to a false interpretation of compatibility. In this context, it's useful to know the difference between type approval certificates and individual testing. Far more, it is also important to be aware of the consequences from both a technical and legal perspective.

Test institutes are regularly commissioned to test combinations of PV connectors from different manufacturers. Such kinds of tests are solely being done based on the requirements of the commissioning customer. Based on those individual test reports it's misleading to conclude a safe and long-term operation regarding the combination of PV connectors from different manufacturers in a PV system based on such individual test reports.

Test reports from individual testing

One-time analysis for individual testing of the combination of PV connectors of different manufacturers are performed on individual samples. The customer decides at the time of application what is to be tested and how. A test report from such individual testing describes the actual state of the existing sample, without taking into account the production processes, the handling of raw material or the manufacturer's quality management. These individual tests are not comparable with a type approval certificate, which is far more comprehensive, repeated at regular intervals and verified by spot-checks and factory inspections. With such

individual tests as a basis, no statement can be made about the long-term safety of a product combination.

A PV connector is designed and manufactured to guarantee uninterrupted operation for more than 25 years. These smallest PV components are transmitting very high currents and high voltages, which also means that the contact elements have to ensure constant low contact resistance, even in challenging environmental influences. This means that plug and socket in the connection have to be capable of withstanding high solar irradiation, temperatures ranging from below -40°C and in excess of 100°C , heavy rains and thunderstorms, winds and snow.

And in installations at high elevations, they also have to meet the requirements for clearances because of lower air pressure. The quality of a long-lasting connection depends on other factors including, but not limited to, the functionality of the contact technology on the inside of the plug and socket, the mutual influence of different plastic or metal alloy

materials, the manufacturing process and the monitoring of consistent quality.

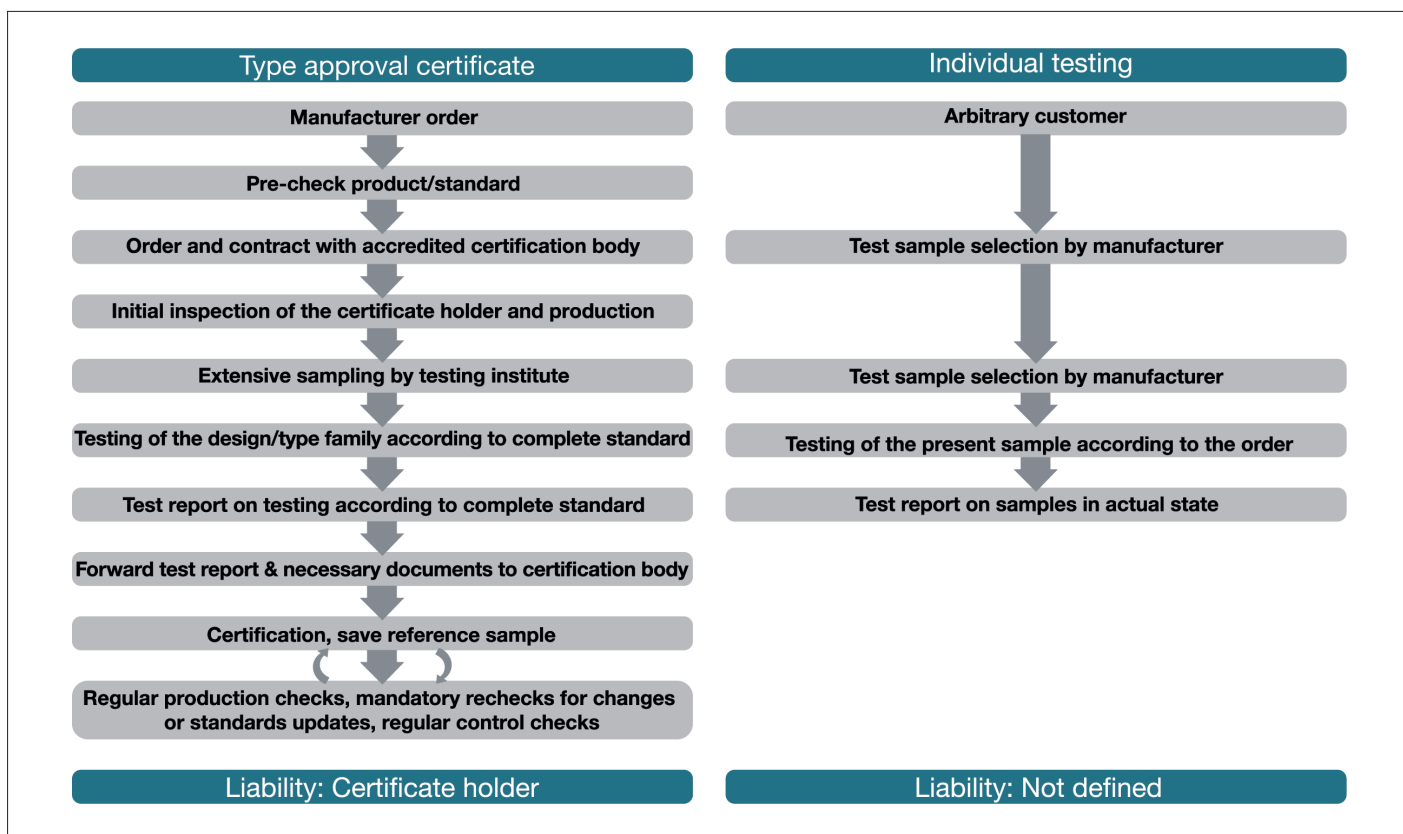
All these points must be considered during the development of connectors and the final type tests. Therefore, it is dangerous to conclude from the results of individual testing based on particular samples that PV connectors from different manufacturers can be safely combined in a PV system and operated safely over the long term.

The international standards

There are established standards in the PV industry; product standards such as IEC 62852:2014 + A1:2020 or UL6703, and installation standards IEC 62548 or IEC 60364-7-712. Type approval certifications are carried out based on these existing standards. These established standards were written for connectors of the same type or type family from one manufacturer. They refer to the tested connection of socket and plug within a type family and not to the respective individual parts of a connector. Therefore, they are not suitable to make a statement about the



Avoid cross-mating of PV connectors from different manufacturers and only couple same brand connectors



safety of combinations of PV connectors from different manufacturers.

This fact also applies that if two manufacturers designate their connectors as compatible on the condition that they inform each other of safety-relevant changes to the product. Even the smallest modifications can have a significant impact on the long-term function of the connection. For example, a chemical incompatibility or differing thermal expansion parameters of the metal contact can lead to contact corrosion after some time. Under such circumstances, not only are the project and the PV system at risk, but also people and the surrounding infrastructure and environment. The question then arises as to who is responsible for such damage. The manufacturers of connectors are not liable if they exclude the combination with third-party products. The PV system is implemented by the installer, which is why they can be held responsible in most cases.

Type approval certificate

A type approval certificate verifies the tested safety and quality of an entire type series. Besides the safety tests, a broad range of additional aspects is inspected and considered, such as the production process, the handling of the raw materials, and also the quality management of the respective manufacturer.

This extensive testing is repeated regularly and performed on large sample quantities that are usually selected by the expert of the testing institute. This procedure ensures a consistent quality of the products. The relevant applicable testing standards describe the minimum requirements for the safety of PV connectors, from which indications for liability can also be derived in the event of damage. Based on these existing standards the notified bodies or accredited certification institutes are signaling the tested and certified safety and quality of a type series of products for long-lasting operation in a PV plant.

A test report for individual testing is not the same as a type approval certificate, and deriving compatibility from it is deceptive. No statements regarding the safety of products and product families can be made based on the test report from individual testing. Only the status of the existing sample at the time of the respective individual testing can be evaluated. In the event of damage, product liability is not regulated, and responsibility usually lies with the installing party. Both the manufacturer and the testing institute have noted a disclaimer.

The currently valid product safety standards and installation standards of the IEC prohibit cross-connection. There are also international studies and a large number of claims showing that cross-

Table showing the difference between type approval certificate and individual testing

mating different connector brands hugely increases the technical, but also the legal risk of a PV system.

Relying on individual testing reports to legitimize the cross-mating of PV connectors of different manufacturers can lead to significant risks such as loss of safety to the environment, life, and limb, as well as loss of performance with critical consequences regarding the project and financial success.

References

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