

# High-quality connections for PV modules



Quality creates cohesion



SEALING & BONDING

# Quality creates cohesion ... for 140 years!



2021 is a very special year for OTTO!

We can look back on a company history lasting 140 years.

Founded in Berlin in 1881 by Hermann Otto as a window putty manufacturer, the company has been producing silicone sealants since the early 1960s. Adhesives based on polyurethanes, silane-terminated polymers (hybrid) and acrylates round off the product range. The sealants and adhesives are developed in OTTO's own laboratories and marketed under the brand names of OTTOCOLL® (sealants), OTTOCOLL® (adhesives) and Novasil® (industrial applications). A broad range of special products facilitates solutions to complex problems.

As a manufacturer, OTTO is synonymous with top expertise in sealing and adhesive technology in industry and trade across all sectors. With its products, most of which are premium, OTTO has done more than just secure market leadership in its sector; it is also considered a driver of innovation in many fields due to its quality and performance.

A close partnership with its customers provides the precondition for OTTO satisfying the needs of discerning customers. OTTO is appreciated as a socially committed, reliable employer by its around 480 employees. Modern production plants and an attractive administration building provide the perfect working atmosphere from both a profession and social point of view, and create the best conditions for employees who are both satisfied and motivated.

The new OTTO logistics and training centre was inaugurated in the autumn of 2015. With its spacious training rooms, the OTTO training centre offers enough space for up to 40 participants.

OTTO is expanding its production capacities by building a new production plant. Following a construction period lasting just 18 months, the first stage of construction's fully automatic production line was commissioned on schedule in late summer 2020.

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The information in the present document corresponds to the status quo on going to print, (refer to the index on the outside back cover).  
With a new edition this edition becomes invalid.

Due to the many possible influences during and after application, the customer always has to carry out trials first.  
Please observe the respective technical data sheet! This information is available on the Internet at [www.otto-chemie.com](http://www.otto-chemie.com).  
Errors and typographical errors are excepted.

# Bonding of module frames



Photovoltaic modules are permanently exposed to harsh environmental conditions. Sun light (UV rays), temperature changes, snow, frost, rain, humidity and wind loads are constantly affecting the materials used. As a result selection of perfect products to fit these conditions is a crucial and determining factor for module makers.

## The OTTO solution

Laminated solar-cell units need high-performance adhesives to suit demanding requirements of the finished products whether on roof-tops or in solar-parks. OTTO's range of products has been developed accordingly and has proven its reliability for many years already.

The key-characteristics of the OTTO products are defined by several 'Musts':

- ✓ Fail-safe long-term connection of components and substrates
- ✓ Stabilization of modules and increased stiffness of elements
- ✓ Perimeter edge-protection
- ✓ Compensation of different thermal properties of materials
- ✓ Moisture protection

# Bonding of back-rails



Traditional modules and their fastening racks resp. fixation systems have been amended by additional profiles at the panel's reverse side as soon as it comes to frameless constructions for example in solar parks. To ease and facilitate installation of finished panels module makers are improving their fastening system by bonding supporting rails to their modules at the back-end of the production line. Thus corrosion can be avoided as silicone-based adhesives may serve as sole fastening mechanism and take over changing loads from temperature, wind, rain, sand, ice and snow even under worst conditions.

## The OTTO solution

As one of Europe's leading compounders, OTTO is determined to develop products based on real experience from several decades of extensive practice in the field of silicones. Products which are initiated by OTTO's R+D division in cooperation with trusted customers seem new to the public, but have passed an intense phase of pre-testing prior to launch. Development of especially designed back-rail attachment adhesives for manufacturers of standardized as well as oversized modules considers permanently changing loads and repeatedly harsh climate influences.

Looking at the back-rail attachment, a combination of fast reacting two-part silicones with the know-how from mixing & dosing equipment manufacturers is the result.

# Bonding of junction boxes



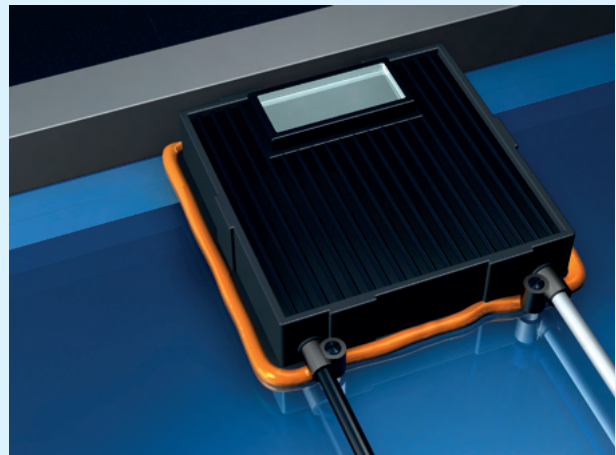
Out of experience one of the crucial parts of ready-to-use modules is defined by the spot where transformed sunlight becomes electrical energy which needs to be transferred off the modules to external points such as cables and inverters.

Usually junction-boxes are the places to combine string-wires with clamps, diodes resp. transmitting cables. Because of that fact well-known suppliers of J-boxes are highly attentive to the way their boxes are connected to backsheets resp. glass. That is why they regard bonding by means of silicones superior to other methods.

## The OTTO solution

The use of OTTO's silicone-based adhesives leads to a permanently reliable bonding interface between J-box and backsheets resp. glass.

Due to extensive research efforts formulations are not just taken off the rack but truly designed, re-designed resp. altered according to specific requirements of components, their raw materials and process peripherals.



# Potting of junction boxes



Electrical contacts and connections inside J-boxes rely on design resp. tightness of the box itself. Open areas between laminated package and J-box may not only serve as exit for string-wires but also as entry-point for humidity. Leakage might lead to short circuits resp. failure of module or – in worst of cases – to destruction of the unit.

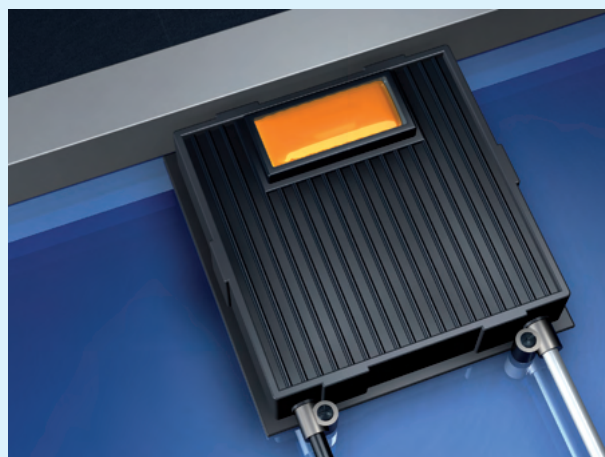
Moisture protection combined with flame resistance and di-electric properties of encapsulant therefore is a supporting means of longterm failsafe operation of J-boxes.

## The OTTO solution

Development of OTTO's silicone-based potting agents/encapsulants took place over years and is mainly influenced by true and practical experience reported by module makers, J-box manufacturers and solar inverters producer.

Superior elasticity of pottant results in low modulus reducing mechanical stress to the J-box interior.

Perfect adaption of fluid-properties to highly sophisticated and partially complicated shapes of state-of-the-art J-boxes allow bubble-free filling.



# Our silicone-based Novasil® adhesives for PV modules

Silicones – alkoxy	S49	S645	S800	S-SP 5737
Components	2K	2K	1K	1K
Mixing ratio	10:1	10:1	ready to use	ready to use

## Viscosity at 23 °C

Stable	☑	☑	☑	☑
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## End state

Hard – Shore A >60	✗	✗	✗	✗
Elastic – Shore A 25–60	☑	☑	☑	☑
Soft elastic – Shore A <25	✗	✗	✗	✗

## Features

Thermal conductivity <0,3 W/mK	☑	☑	☑	☑
Temperature resistance up to 180°C	☑	✗	☑	☑

## Certifications

UL 94 HB	☑	☑	☑	☑
ETAG 002	✗	☑	✗	✗

## Applications

Glass frame bonding of hot water collectors	☑	✗	✗	☑
Elastic bonding of frames to PV-modules	☑	✗	☑	☑
Adhesion and sealing of junction boxes	☑	✗	☑	☑
Bonding of back-rails	✗	☑	✗	✗

## Characteristics

Non-corrosive	☑	☑	☑	☑
Reduced cycle times	☑	✗	✗	✗
Excellent weathering, ageing and UV-resistance	☑	☑	☑	☑
Excellent primerless adhesion on numerous substrates - even when exposed to water	☑	☑	✗	✗
Very good adhesion on many plastics	✗	✗	☑	☑
Very good temperature resistance	☑	✗	✗	✗
Low odour	☑	☑	☑	☑
High adhesion strength	☑	☑	☑	☑



# Our Novasil<sup>®</sup> potting compounds for PV modules

<b>Silicones – alkoxy</b>	<b>S 822</b>	<b>S 824</b>	<b>S 651</b>
Components	2K	2K	2K
Mixing ratio	9,5:1	10:1	10:1

## Viscosity at 23 °C

Very flowable < 10.000 mPas	☑	☑	☑
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## End state

Hard – Shore A > 60	✘	✘	✘
Elastic – Shore A 25–60	✘	✘	☑
Soft elastic – Shore A < 25	☑	☑	✘

## Features

Thermal conductivity <0,3 W/mK	☑	☑	☑
Temperature resistance up to 180 °C	☑	☑	☑

## Certifications

UL 94 HB	☑	☑	✘
UL 94 V-0	✘	✘	☑

## Applications

Potting of junction boxes	☑	☑	☑
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## Characteristics

Non-corrosive	☑	☑	☑
Excellent flowability	☑	☑	☑
Cures at room temperature	☑	☑	☑
Good mechanical resilience	✘	✘	☑
Low odour	☑	☑	☑

# Benefit from knowledge and experience

**High quality and highly specialised sealants and adhesives make OTTO an important partner for many industries.**

Photovoltaic systems are long term investments. Their return on investment is generated through Energy savings. Therefore, every single component that makes up the system must function with the highest quality throughout the entire period of operation.

Adhesives and sealants used for photovoltaic modules are exposed to extreme conditions. They have to withstand and compensate fluctuations in temperature of up to 100 °C, endure and remain resistant to moisture, damage and mechanical deformation.

Not only can you expect always consistently high product quality and quick and reliable delivery from OTTO, but also the greatest possible flexibility, many years of experience and extensive expert knowledge when it comes to developing tailor-made solutions.

The earlier you contact us, the better we can meet your needs. From the first product design to setting up production, we are at your side to help and advise.



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## Application consultation

Which sealant and adhesive suits your task best? Our application consultation defines a profile of requirements together with you, helping you to find exactly the right product from our product range.

## Prototype consultation

Are you planning a new product? The earlier you speak with us, the better we can grasp your ideas. And perhaps even you optimise your product idea when it comes to the design and costs. We are also happy to give you sample sealants and adhesives to use for prototype tests.

## Individual product solutions

If we do not have the sealant or adhesive to meet your ideas, then we will work on implementing one. We will first clarify together with you the exact requirements, such as the physical and chemical loads, the materials used, the specific properties of the point of bonding, aesthetic requirements and production sequences. Then we will develop exactly the solution that suits your product.

## Process consultation

The integration of sealants and adhesives into the production process is another focus of our range of consultation. No matter whether semi-automatic or fully automatic, we are happy to advise you in choosing the processing machines and optimise the processing times to ensure a fluid production process.

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# 140 YEARS

## COLLABORATIVE WORK

**OTTO and Industry**

You have specific requirements, we have individual solutions.

Learn more about 140 years of OTTO: [www.otto-chemie.com/en/140-years](http://www.otto-chemie.com/en/140-years)



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