

INTEGRATED SEALANTS IN SOLAR

Reliability of Sealants Integrated with Solar Mounting Hardware

Although adhesives and sealants are small pieces of the solar module installation process, they play a big part in the quality, reliability and lifespans of modules. Despite this, their roles in crafting and installing modules is often not fully understood. To make the most of installations, it's critical for installers to understand how these materials can help complete successful projects that withstand extreme temperatures and conditions for decades.

Let's dive into what into what installers need to know about PV/solar adhesives and sealants before starting their next project.



WHY SEAL THE ROOF?

Waterproofing Any Penetrations

The primary purpose of sealants is to waterproof the roof, which is crucial for ensuring a clean install and a long-lasting bond. To produce a solid hold, create a dam with a bondline thick enough (at least 2 to 3 mm) to hold off water. Be careful not to make the bond too thick, otherwise it's susceptible to cohesion failures.

Load Transfer

Although bolts and hardware will be the primary load carrying component, adhesives and sealants play a role here. They can also contribute to dampening loads of wind to the hardware.

Protect from Movement/Seismic

Soft pliable sealants can absorb the stresses from vibration that can occur with seismic events or something similar. The sealant can act as a shock absorber for the solar panel system.

Manage Differences in Materials

It may seem obvious, but understanding the different materials to be bonded, or substrates, along with the roof and solar mounting systems, goes a long way in terms of identifying which adhesive is right for your project.

Cost

One way to lower installation costs is by having materials suppliers, such as H.B. Fuller, customize a package or installation process that integrates with an installer's procedure. With this method, the sealing process is incorporated into the overall process, speeding up installation and reducing labor hours, which in turn lowers installation costs.



UNDERSTAND THE SUBSTRATES

Some of the most common substrates include the following:

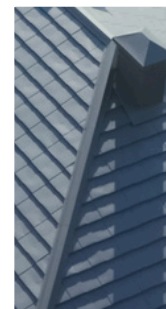
Asphalt- Large variety of shingles, pre-testing should occur. Oils can bleed out over time.

Metal- Aluminum, steel, galvanized steel, painted metals, etc. Easy to bond to, but not all the same.

EPDM- Commonly used in commercial roofs, high PE content, makes this a difficult material.

PVC (Poly Vinyl Chloride)- Full of plasticizers that will leach into the adhesive.

TPO- High PP content, like EPDM, this makes chemical bonding difficult.



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DIFFERENT ROOF MATERIALS REQUIRE DIFFERENT SOLUTIONS

Composite shingles will have many holes drilled through them to get to the rafters. Shingles will not self heal and a butyl sealant or some other adhesive or sealant is needed to protect from rain and snow.



Commercial roofs made of PVC/TPO/EPDM may require large amounts of material to seal the roof. These materials can be subject to different loads. Even self ballasting installations can be subject to movement with seismic events or in cold weather with ice that can form under the ballasts. A properly applied sealant can support the PV array under these conditions.



Some roof systems can be deceptive. A **tile roof** will use the materials under the tiles. This may be felt paper, tar paper or some other underlayment.



NOT ALL SEALANTS ARE THE SAME

It's important to understand the different adhesive types for solar panel installation on various substrates before choosing your solution. The table below shows how the three most common adhesives work on various roofing substrates.

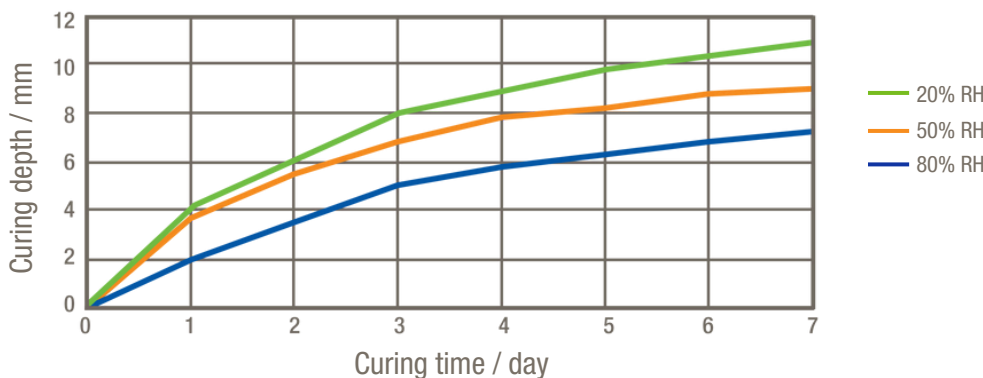
		Roofing Substrate					
		Asphalt	Metal	EPDM	Tar Paper	PVC	TPO
Adhesive	MS Polymer	✓	✓	✓	✓		✓
	Silicone		✓				
	Butyl or PIB	✓			✓		

✓ Indicates that the adhesive works well with the the specified substrate

UNDERSTAND THE CURE MECHANICS

Humidity has a bigger impact than heat.

Under the condition of the 23°C, the influence of different relative humidity on the curing depth



No matter where solar modules are placed throughout the country, they will be exposed to harsh conditions—both weather and system-related. That's why understanding various weather and project conditions plays a key role in successful installations.

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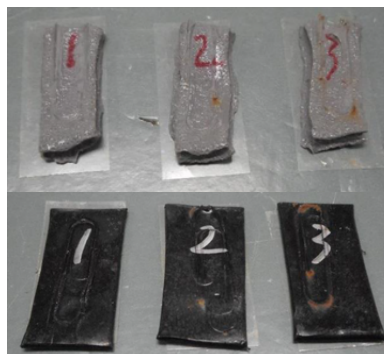
PUTTING ADHESIVES AND SEALANTS TO THE TEST

In recent years, to accelerate the time to install residential solar systems, installers have been exploring methods to streamline the entire process. One of the popular new concepts is to integrate the roof sealing process into the mounting hardware. This has streamlined the process nicely but has raised several concerns about the reliability of the seal and the ability to provide the waterproofing expectations of a home.

From a reliability perspective, three concerns need to be addressed: stability with exposure to UV, exposure to excess water and a loss of sealing properties over time.



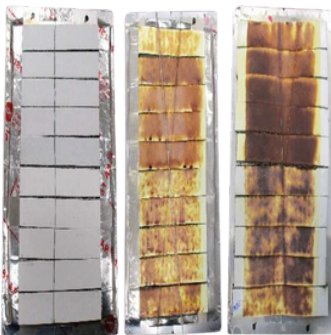
Brackets and flashing delivered to installer with sealant applied, remove release liner and attach to roof.



Sample	Initial Wt.	Initial Wt. in Water	Wt. After Exposure	Wt. Change
1	4.325	4.962	4.699	1.96%
2	4.332	4.771	4.712	1.33%
3	4.331	4.700	4.701	1.27%

These images show the samples after water immersion.

Pass/fail criteria is less than 5% change, per 2703A



The change in the color of the white backing for the tape after the UV aging exposure. The TPO and PVDF coated metal show the least amount of discoloration which would be consistent with the migration discussion shown with the peels. These images show the samples as they came out of the QUV chamber.



Cross sections of set ups showing how the compound traveled into the wood on the screw. Roof seal tape was difficult to see along the path that the screw went through.

When leaks were seen, they were from under the shingle but not through the wood.

ADHESIVES AND SEALANTS: HOLDING IT ALL TOGETHER

A greater grasp on applying adhesives, identifying the best substrates for projects, and accounting for extreme weather and conditions are all crucial pieces of a successful installation. Installers who make a point of thoroughly understanding how adhesives impact installations will better position themselves to install modules that are reliable, efficient and long-lasting.

To learn more about PV/Solar adhesives, visit www.hbfuller.com/solar.



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