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# **SOLRIF Photovoltaic- Roof Integration System**

Ernst Schweizer AG  
Metallbau  
Photovoltaic Systems  
September 2009 / COF

*Technical Documentation for Framing Laminates*

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## Technical Documentation for Framing Laminates

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### 1. General Information

These instructions describe how to frame PV-Laminates with SOLRIF to create watertight units. These instructions have been created to aid dealers and installers who would like to frame their PV-Laminates with SOLRIF on their own.

#### Required Work

The average work required to frame 100 modules is:

Preparation and setting up the working area:	60 min.
Gluing, framing and cleaning pro module:	6 min.
Stocking, quality controls and packaging pro module:	3 min.

#### Average Work Required

#### Manpower

For an average sized laminate (~0.8 to 1.6 m<sup>2</sup>) it is recommended that 2 people work together to frame the laminates. If one wants to frame a large number of laminates it would be more efficient to have a team of 4 people to do the job. To increase efficiency it would further help to prepare the frames as described later on in these instructions.

#### Required Manpower

#### Tools

- Slotted Screwdriver (M4)
- 1-2 Allen keys (SW2)
- 1-2 Metering unit(s) for the silicone. At least one of them should be able to supply a constantly controlled amount of silicone (e.g.: a pneumatic silicone gun<sup>1</sup>)

#### Required Tools

#### Material

- PV-Laminate
- SOLRIF Building kit for PV-Laminates (see Appendix B: List of Material)
- Silicone provided in a container that is compatible with the dosing pistol, approx. 30 ml silicone is required for every meter laminate circumference<sup>2</sup>.
- Plastic spatula and soap water to clean the laminates.
- Framework to store the modules so they can dry out. If no framework is available, the modules can also be stacked on top of each other with some spacer in-between the modules (e.g. foam with a thickness greater than the height of the outlet in the back). It is recommend not stacking more than 10 modules on top of each other.

#### Required Material

<sup>1</sup> The dosing pistol P 620 COX 600ml from Otto Chemie has proven to work satisfactory (see Appendix A)

<sup>2</sup> Schweizer and different PV-laminates manufacturers recommend Novasil®SP5737 Silicon for the fixation and the sealing. An alternative would be the product FD-plast F transparent from Karoplast and the product Karo-Primer 120 for a pre-treatment of the aluminium frames.

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### **2. Required Working Environment for Framing Laminates**

It is recommended having a working area big enough for the assembly and clean:

- Around 4 m<sup>2</sup> work surface for the pre-assembled framing pieces

#### **Pre-assembly**

- Assembly area with a 18 mm wide, 40 – 50 mm deep and long enough channel to erect the frame in order to:
  - fill in the joints with silicone glue
  - frame the laminates

#### **Assembly**

The assembly area should be free from any metallic surfaces and corners to minimize any damaging of the PV-Laminates.

If no such area can be provided a simple solution would be to clamp two wooden slates (48 x 48 mm) to the table.

- The storing area that is required for the curing of the framed modules is roughly 15% of the module area or the manufacturing capacity of a day. The framed laminates have to be stored to dry. This period depends on the silicone used (minimum 6 hours).

#### **Hardening and storage**

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### **3. How to Frame a Laminate**

1st worker: framing pre-assembly:

Clean with isopropanol, pre-treat, assembly the angles in the right and left profiles, and insert the EPDM joint in the top profile.

2nd worker: siliconing:

Fill in the grooves of the profiles with silicone.

3rd and 4th workers: assembling frame and laminate

Place the laminate in the grooves of the prepared frame, assembly the other profiles. If necessary, remove the waste silicone and store the framed laminate (Detailed instructions will be provided below).

With this work-sharing technique every of the three working steps require roughly the same amount of time and there are only minimal waiting periods for every worker.

With only 2 people available for the job the first step is to prepare the profiles together. Then one person applies the silicone to the frame while the other person brings the laminate to the table. Together they then fit the laminate into the frame and finish framing the laminate. The "runner" then takes the framed module away so it can cure and on his way back he brings a new laminate. In the meantime the first worker prepares a new frame and applies the silicone.

- PV-Laminates mainly consist of hardened glass. They are very sensitive at the corners and have to be treated with great care. During the storage period and packaging of the framed modules it is important to make sure that the glass doesn't bear on any metal. Further the foil layer on the backside of the laminate should under no circumstance get damaged.
- One should make sure that there aren't any silicone residues on the front side of the laminates, as they would negatively affect the performance of the laminate. The maximum allowed amount of silicone on the front side in the border area is 1 – 2 mm.
- One must further pay attention to the orientation of the laminates before framing them. They should all be oriented in the same direction so that the outlets on the back are all located in the same area. Otherwise problems could arise while connecting the modules.

#### **Procedure for a 4 Man Team**

#### **Procedure for a 2 Man Team**

#### **Rules to be followed while using PV-Laminates**

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### Pre-assembly

1. Pre-assembly of the top profile  
The EPDM joint is bathed in soap water and insert in the groove without tension (Photo 1). Control that the inserted EPDM joint is not deformed (stretching). Finally, cut the joint at the correct length.
2. Cleaning  
For an optimal bond of the silicone, the profiles have to be freed from any processing remainders and fat. Additionally it is recommended that before the pre-assembly the grooves and the ends of all profiles are dipped with OTTO Cleanprimer (Photo 2) and then wiped with a clean piece of cloth. If you are using FD-plast F the manufacturer recommends a treatment of all aluminium gluing areas with Primer 120.

#### **Be careful with the coated profiles!**

Clean only the grooves and the contact surfaces. Some cleaning products could damage the coating.

3. Pre-assembly of the side profiles  
Insert the angles of the right and left top angles in the side profiles and screw with an Allen wrench (Photo 3).
4. Pre-Assembly of the bottom U profile  
It is recommended to fasten loosely the groove stones to the countersunk screws in the bottom profile (Photo 4). The ends of the protection film of the adhesive band have to be a bit removed to ease its complete removing during the assembly.



Photo 1



Photo 2



Photo 3



Photo 4

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### **Silicone**

1. Fill in all the grooves of the profiles with a dosing of around 15 ml/m, manually or with an air pistol (Photo 5), or with a dosing machine (Photo 6).
2. Fill in the ends of profiles with silicone (Photo 7).



*Photo 5*



*Photo 6*



*Photo 7*

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### Frame assembly

1. Place the top transverse profile and the side profile assembled with an angle. Press the profiles together and screw the angle (Photo 8).

Place the laminate in the pre-assembled frame of 2 profiles (Photo 9). The positioning should be the most possibly direct and without a inclination, therefore the silicone stay regularly distributed and is not accumulated on one side.

**Important control: verify the presence of a continuous waste bead in the corners! The waste will be later removed with a spatula.**

2. Place the side profile with an angle (Photo 10). With a pneumatic press set around 0,8 bar, press the second side profile against the laminate at the angle. Screw the angle with an Allen key.  
**Important control: verify the presence of a continuous waste bead in the corners! The waste will be later removed with a spatula.**
3. Assembly the bottom transverse profile (Photo 11). Insert the groove stones in the vertical profiles. Remove a bit the protection film and screw lightly the ends. When the position is correct, the protection film can be completely removed and the profile pressed against the laminate.
4. Screw the 2 groove stones with a screwdriver and press again cautionary the profile against the laminate.
5. Remove the waste of silicone on the front face of the laminate with for example a plastic spatula and soap water.
6. It is recommended to stretch quickly and gently a continuous silicone joint at the interface between the frame and the back side of the laminate. This joint will not be re-touched after its application (Photo 12).



Photo 8



Photo 9



Photo 10



Photo 11



Photo 12

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### Storage, hardening, controls and packaging

1. The framed laminates have to be stored during a period conformed to the hardening period of the used silicone with a minimum of 12 hours. A shelf for 10 maximum laminates can be built. A convenient solution is a storage trolley with dimensions of the framed laminates (Photo 13).
2. The laminates should not be directly stacked with the connection boxes. Some spacers in-between the modules (observe the height of the connection box) in wood or plastic (see Photo 13 below) can be used.  
**During the hardening, the frames should not be loaded!**
3. Please observe the hardening duration and the storage temperature!  
For Novasil® SP 5737, the recommended hardening period is 24 hours for 2-3mm thickness. For SOLRIF frames, a period of 12 hours is recommended for the hardening of silicone. With FD-plast F from Karo-Chemie, the minimum hardening period is 6 hours.
4. The **waste of silicone and deteriorations** has to be controlled on **all** framed laminates after the hardening period.
5. The framed laminates should be carefully packed before they can be delivered to the customer (Photo 14). The packaging of the framed laminates can eventually be re-used.

Points to observe:

- The modules have to be transported upright with the upper profile on the bottom.
- Lateral loading that can result in bending of the modules has to be prevented.
- The power outlets in the back are not allowed to directly lie or touch other modules as this would create local stress fields in the glass that could be too great for it to handle. Therefore always slide some packaging material in-between two modules.
- Protect all glass corners



Photo 13



Photo 14

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### **Appendix A: Source of Supply for Silicone**

#### **Glue / joint Novasil® SP5737**

(Alternative of FD-plast F from Karochemie AG)

**Used for the framing of PV laminates with SOLRIF**

OTTO Chemie GmbH  
Krankenhausstrasse 14  
DE-83413 Fridolfingen

Phone: +49 (0) 8684 908 0  
Fax: +49 (0) 8684 908 529

**Reference for  
Novasil®**

Karochemie AG  
Sihlbruggstrasse 144  
CH-6341 Baar

Phone: +41 (0) 41 760 12 12  
Fax: +41 (0) 41 760 13 20

**Reference for  
Karo Plast**

#### **Abstract of the technical sheet from the 21.01.2008:**

Connection Alkoxy RTV-1 Glue and joint in silicone  
Sealed and elastic glue developed for photovoltaic laminates and solar collectors: gluing from metallic frames and connection boxes and bottom sheet. Glue used for general industrial applications.

Novasil® SP 5737 has good adhesive properties on numerous materials. The surfaces have to be cleaned before application and should present no contamination for a good adherence.

**Technical data  
Novasil®**

#### **Abstract of the inspection report from Heidelberger Kompakta (5.10.1999) (Translation from German to English)**

... It was shown that the glass surface, without the usage of any primer, provides an optimal surface for the bonding of the sealant. The aluminium frame on the other hand can only achieve this bonding when used in combination with Primer 120. A bonding of FD-plast F onto the back surface of the glass (assumption: tedlar film) wasn't possible even after cleaning it with isopropanol and treating it with Primer 120 ...

**Inspection Report  
Karo plast**

With the use of Novasil® SP 5737 or with the alternative FD-plast F, we recommend always to pre-treat the aluminium profiles with OTTO Cleanprimer or alternatively Primer 120.

**Recommendation**

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### **Appendix B: List of Material included in a Framing kit**

Pos.	Article Nr.	Quantity	Description	Drawing-Nr.
10	03058	1	Solrif Frame top profile	4-33934
20	03059	1	Solrif Frame left profile	4-33935
30	03063	1	Solrif Frame right profile	4-33936
40	03831	1	Solrif Frame bottom profile	4-33937
50	33939	2	Solrif Groovestones	4-33939
60	60018	2	Panhead-ScREW A2 VSM 13328 M4x6	
70	33938	2	Solrif complete Angles	4-33938