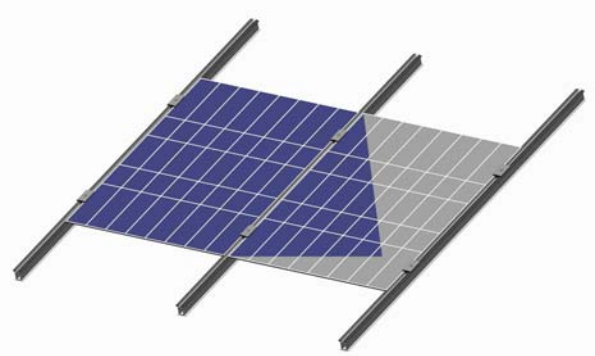
Proof test Plandach5



Information on system tests

Schletter Plandach5© is a new system for the mounting of laminate modules and framed modules as a complete roof covering in combination with an industrial roofing membrane.

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Concerning the application we can point to the following references:

- **In the autumn of 2005 the system was put to a long time test on the Schletter-premises. The results were published correspondingly.**

- **Within the framework of an all-over system test promoted by the Federal Department of Trade and Industry the system Plandach5 at the an was put to a thorough water impermeability test by Cordes wood construction company. Below please find an excerpt of the test report with the results concerning the water impermeability.**

  First of all a little summing-up of the text:

- **The Plandach 5 system proved to be impermeable in the following cases**
  - **see paragraph 1 of the following test report**

- **A conventional comparison-roof covered with concrete tiles proved to be impermeable, but showed weaknesses in case of low roof inclinations (18 degrees) - see chapter 2 of the following test report.**

- **A roof integration system by one of our competitors (who cannot be mentioned here), which uses the module layer as a sealing layer, turned out to be absolutely unsuitable in all cases due to penetrating water. - see paragraph 3 of the following test report.**

Final report

Cooperation project within the framework of the program
„Innovation competence in medium-sized companies“
of the Federal Department of Economy and Technology (BMWi)

“Technological design of a planning of big roofs of a wood-constructed and energetically innovative dimensioning of big roofs with special consideration of photovoltaics“

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from the irrigation tests for roof - integration models

1 System Schletter Plandach 5

Irrigation test with the Novotan-Schletter-system

The second irrigation test was carried out with a roof plate that was sealed with a layer of Novotan (a special kind of quality roofing membrane). This solution reflects the present state of development. The structure of this wooden construction element is the same as in the test before. The fundamental difference is in the creation of the insulating layer. The solar modules are not used for the complete drain-off of the rainfall and therefore do not work as a first layer of sealing. This function is transferred to the insulating roofing membrane under the modules, which has to be laid professionally and impermeably.

Picture: Test element with Novotan layer

As already described above, the Novotan membrane is laid onto the elements, stapled at the edges and clamped in the middle area using Schletter rails. The upper edges on the sides are welded accurately. In the middle of the test element an element connection line is arranged, at the same time the Novoton membrane covering is arranged in an overlapping manner, in order to be able to examine this critical spot.

Illustration 1: Welding of the element connection of the Novotan membrane

The Schletter rails are fastened on sealing rubbers to the upper covering material using special sealing screws, thereby the perforations in the sealing membrane that are inevitably caused by the screws are protected and sealed.

Illustration 2: Fixed Schletter rails

As the solar modules do not have any sealing function anymore, the test element is irrigated without this additional protection.

Illustration 3: Second irrigation test

Results of the second irrigation test

Measures of element:	2.05m x 3.75m
Roof element type:	Foil roof Novotan direkt TF080
Roof inclination:	18°
Direction of irrigation:	vertical from above
Duration of test:	33 minutes
Water pressure:	2.2 bar
Start level of water meter:	3.900 cbm
End level of water meter:	4.641 cbm
Quantity of water:	0.741 cbm
Drawn quantity of water:	22.5 l/min
Equivalent quantitiy of irrigation:	2.9 l/min per m²
Beginning of test:	13:10
End of test:	13:43
Quantity of collected water:	**0.0 ml**

The sealing membrane turned out to be absolutely water tight and also under the Schletter rails the perforation spots of the screws remained dry. Therefore, this combination is suitable for the photovoltaic integration roof.

Irrigation test with Stamisol-roofing membrane

As an alternative to the comparatively expensive Novotan-roofing membranes, the breathable roofing membrane Stamisol DW was examined. This is an especially acrylate-covered polyester membrane, which is designed for the application on roofs with an inclination of at least 5° or more, and without any additional roof cover ing. Compared to the Novotan roofing membrane, the Stamisol roofing membrane is extremely breathable (sd=1.1). The product is durably resistant to ultraviolet rays and also withstands temperatures from -40℃ to +80℃.
The mounting construction was the same as in other tests and was covered with the Stamisol roofing membrane applying the same procedure as in case of the Novotan roofing membrane. The roofing membrane was laid onto the boarding surface, glued at the edges and pressed with Schletter rails to the plates made of wooden material.

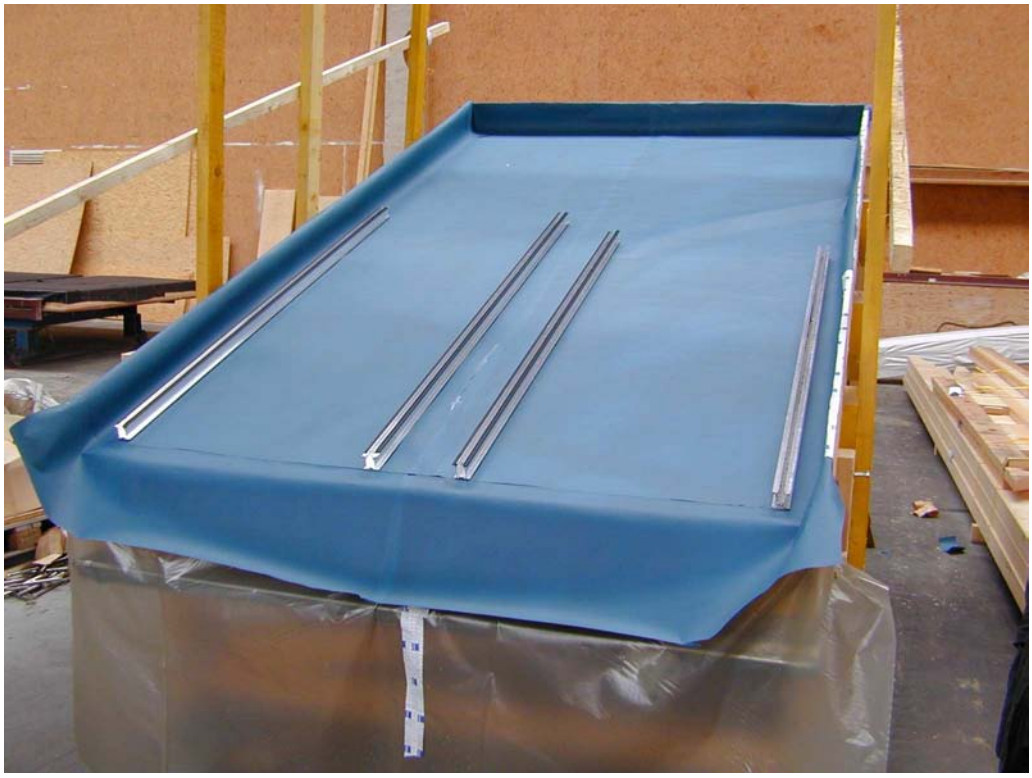

Illustration 3: Element with Stamisol roofing-membrane

In the middle of the test arrangement again an element connection was simulated, onto which two overlapping roofing membrane layers were glued. For this purpose a special glue produced by Starnisol was used. For the gluing the membranes must be free of dust and grease. Moreover, they have to be dry.

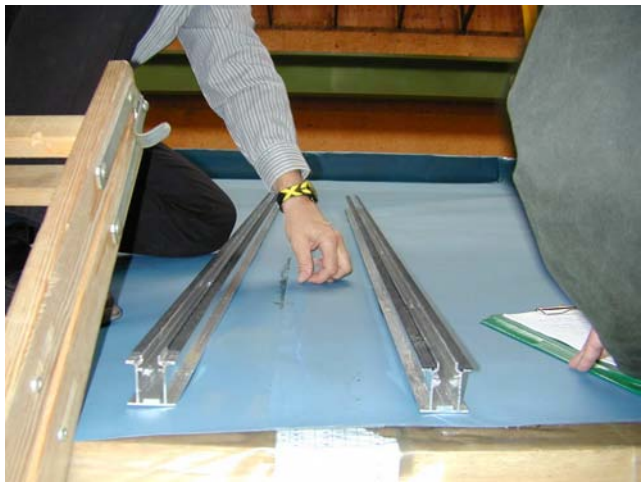

Illustration 4: Gluing of the Stamisol-membrane

In order to simulate the most unfavourable case of arrangement, at the dripping edge of the test rack a strip of roofing membrane is arranged against the water running direction.

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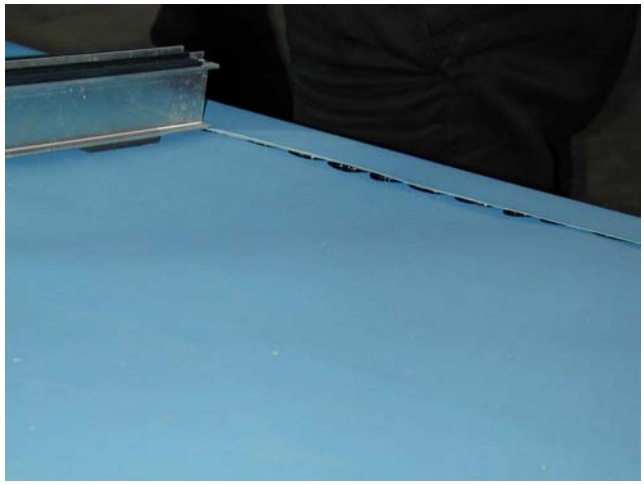

Illustration 5: The dripping strip is glued by using a Stamisol glue-cartridge

Results of the third irrigation test

Measurements of element:	2.05m x 3.75m
Roof element type:	Foil roof Stamisol DW „strong“
Roof inclination:	18°
Direction of irrigation:	vertical from above
Duration of test:	40 minutes
Water pressure:	2.3 bar
Start level water meter:	4.642 cbm
End level water meter:	5.512 cbm
Quantity of water:	0.870 cbm
Drawn quantity of water:	21.8 l/min
Equivalent quantity of irrigation:	2.8 l/min je m²
Test start:	10:35
Test end:	11:15
Collected quantity of water:	**0,0 ml**

The Stamisol-roofing membrane also turned out to be absolutely water-proof. The perforation spots of the screws also remained dry in this test. Concerning the criterion of water tightness, this roofing membrane also seemed to be suitable for the integrated roof.
Several tearing tests of the glued membrane connections have shown the gluing connections have a far too little tearing resistance, and the membrane cannot be used in this configuration, because bendings in the sealing layer have to be absorbed by the firmness of the material of the roofing membrane.

2 Reference roof with tiles

Irrigation of a tile-covered model with 30° inclina tion

First, the reference model covered with concrete tiles produced by Eternit, was irrigated.
Roof inclination of the element in the first series of tests: 30°
Direction and duration of the irrigation:
- 15 minutes vertical from above
- 20 minutes orthogonal to the covering
- 15 minutes parallel to the covering from below

Test start: 10:05
The total quantity of water of 1.527 m³ in a test period of 50 minutes results in an average irrigation quantity of 31 liters per minute for the element surface area of 7 m², and therefore is above the average of 21 liters per m² and minute. The water pressure was 2.4 bar.

Illustration 6: different directions of irrigation of the 30° inclinated reference surface area.

In the end it was stated that no water had penetrated the covering, both the rain water drain and the collector bucket remained free of water.

Irrigation of a tile-covered roof with an inclination of 18°

Subsequently the roof inclination of the model was changed to 18° for the second series of tests. The direction of the irrigation was parallel to the covering from below. After 15 minutes (Test start 11:20) the regular test time was over. Due to the proven water impermeability of the covering more favourable directions of irrigation were not applied.
0.437 m³ were mounted, which results in a medium irrigation quantity of 29 l per minute for a 15 minutes test time and 7 m² element surface. The water pressure was 2.5 bar.
The quantity of water collected below the covering after 15 minutes was 50 ml.

After the end of the test the roof surface area was irrigated by hand with a water hose for about 2 minutes (see illustration above), in order to find out, how the covering reacted to extreme conditions. The quantity of water collected of about 100 ml was quite remarkable in view of the short duration.

3 Integration roof of a competitor

Concluding remarks by the Schletter company:

The Cordes company also tested a „conventional“ roof integration system, where the module layer is supposed to form a sealing layer.
As an overview of the results of these tests, the following quotes are supposed to give an impression, and there will be no further comment from our side.

Quote from the system report by the Cordes company:

Excerpt 1 from the test results:

Test start: 14:10
After 7 minutes the test had to be cancelled **due to the penetrating quantities of water.**
In this span of time several 10 l-buckets were filled.
Total quantity of water used: 0.173 m³

Excerpt 2 from the test results:

The findings gained in these seven minutes in combination with the assembly difficulties made evident that the attempt to modify the XXX-System to such an extent that it can be used for an in-roof mounting **is pointless.**

Excerpt 3 from the test results:

Conclusion of the first irrigation test:
The considered solution (Application of the XXX XXX-system with modified sealings) was abandoned. **It turned out to be impossible to achieve an impermeability of the first sealing layer equal to the impermeability of a tile covering**. Moreover, it turned out that the mounting of the photovoltaic modules is made difficult in a counterproductive manner by the additional sealings that have to be installed.