Solar systems of Schweizer:
Factsheet – Use of Solrif® with high snow loads.

Summary
- Installing Solrif® framed photovoltaic modules on a roof can significantly change the snow's accumulation and sliding behavior compared to a conventional roof.
- Under severe winter weather conditions and in high snow load zones, the roof must be assessed by a local roofer during the planning phase with regard to snow loads. Compared to tiled roofs, the snow guard devices on PV roof integration systems often have to be reinforced or repositioned.
- The number and duration of the freeze-thaw cycles that occur are co-determining factors for the total snow accumulation and the icing and wetting of the snow on the roof.
- Special attention must be paid to the unimpeded drainage of the roof during dew periods.
- A high heat transfer at the roof surface can accelerate the melting process.

Standards

The current standards for pitched roofs refer to the effects on supporting structures and the requirements for safety devices. The special cases of partial or complete roof-integrated solar systems are not (yet) taken into account.

Important extract from the standards with the most important points concerning snow on pitched roofs are:
- The danger of a roof avalanche exists with every pitched roof.
- Snow retention devices are to be provided on roofs where, due to their position and inclination, snow slides onto used pedestrian paths, playgrounds, forecourts at house entrances or similar areas (e.g. SIA 232 Section 2.1.3).

As an example, chapter 5.6 of SIA 232 also defines the requirements for the safety devices. "Snow guard systems, safety systems, safety stairs and railings must be fastened in such a way that they can permanently fulfil their purpose and withstand the loads that arise. Snow guard supports must be capable of absorbing a tensile load of at least 2 kN per hook or support in the direction of the roof pitch and must be anchored in the supporting structure without hindering temperature-related length changes. Anchoring devices must comply with SN EN 517 or SN EN 795 and be fastened in accordance with the manufacturer's instructions."

Substructure: Load-bearing safety and serviceability

The transfer of roof loads such as dead load, snow loads, wind pressure and suction etc. through the layers of the substructure into the supporting structure of the roof or building must be ensured. The characteristic snow load on roofs as well as the line load for cantilevered components (snow overhang according to e.g. SIA 261) are defined e.g. in SIA Standard 261.

Slipping of snow

As the behavior of solar roofs with regard to snow and ice can change in comparison to conventional roofing, the statics must be checked and the (existing) snow retention measures adapted to the new situation before installing a solar system. For example, with partially snow-free solar systems, the snow typically slides off completely within a short period of time compared to a tiled roof, as the dark surfaces that absorb a lot of radiation heat up, melt the snow and then possibly let it slide off as a "roof avalanche".

Ice load hazard pattern:

Unfavorable freeze-thaw cycles cause high ice loads in the eaves area of pitched roofs. On the one hand, these ice loads are a strain on the eaves, on the other hand, breaking ice leads to personal injury and damage to property. Therefore, in areas with frequent freeze-thaw cycles and correspondingly high ice loads in the eaves area, reinforcements should be provided. However, to avoid personal injury and damage to property due to breaking ice, it is recommended to remove deposits at an early stage.

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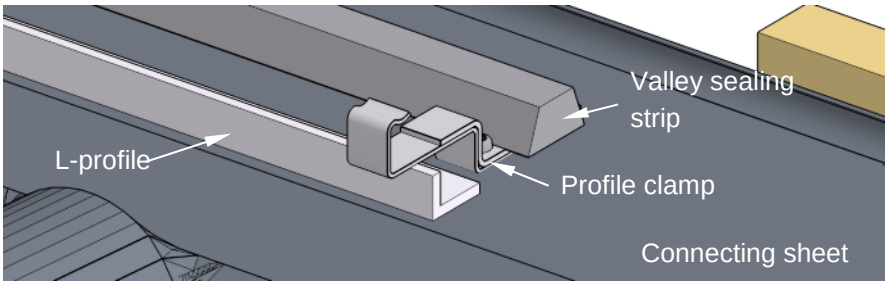
Design recommendations for increased snow loads

- It should be noted that in certain snow-rich and touristic regions, roof pitches are deliberately kept low, even in new buildings, so that the architecture matches the village landscape. Historically, this can be explained by preventing the snow from slipping off in order to additionally insulate residential buildings.
- For the installation of solar systems on existing roofs, the statics must be checked for snow retention.
- In an alpine environment, we recommend interrupting the module field with snow catchers after a maximum of four module rows in order to distribute the accumulations at regular intervals. If possible, accumulations of ice and snow should not be limited to the lowest edge. The accumulation of snow is again dependent on the pitch of the roof.
- In addition, the lowest row of mounting claps should be supported, for example with an "L-profile" or a wooden batten 17mm high. Under high snow loads, this will prevent deformation of the mounting clamps and contact of the clamps with the back sheet of the BIPV roof module.



- Measures due to ice load: Due to possible snow overhang or ice loads, the distance between the lowest module edge and the eaves should be at least 30 cm. The linear load resulting from snow or ice overhang must not be transferred to module edges. Combined systems with collectors and PV require even more stringent measures due to the rapid warming and associated slipping of the snow. Experience shows that a separation with snow traps between collectors and Solrif® modules is highly recommended.
- Above 2400 Pa snow load, two battens of 60 mm (120 mm in total) must be additionally mounted below the BIPV modules, especially with 3.2 mm glass thickness. These battens must be installed with a minimum distance of 20 mm above and below the junction box to ensure that the Solrif® system allows for individual module replacement.

Standards

The recommendation is based on:

- EN 1991-1-3 Eurocode 1 - Actions on structures - Part 1-3: General actions, snow loads
- VKF (Swiss Cantonal Association for Fire Insurance)
- SIA 232/ SIA 261: The standards for pitched roofs (SIA 232/1:2011) and SIA Standard 261 Actions on Structures define both the forces of snow on pitched roofs and the safety measures to be taken. (SIA: Swiss society of Engineers and Architects)

Specific information for Switzerland

In general, we limit the application limit for Solrif® to 5100 Pa due to snow loads. Solrif® can also be used above this limit if special measures are taken with regard to the sliding of the snow or the snow guard and substructure.

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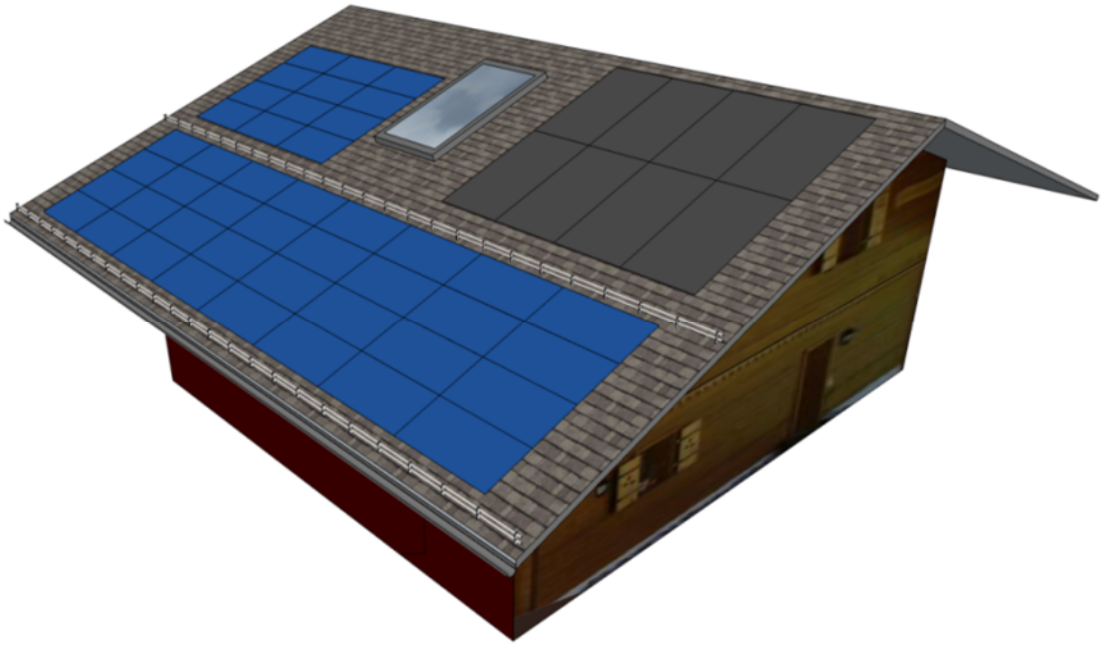

Example of the arrangement of snow catchers in snowy regions for PV and solar thermal combined systems.

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