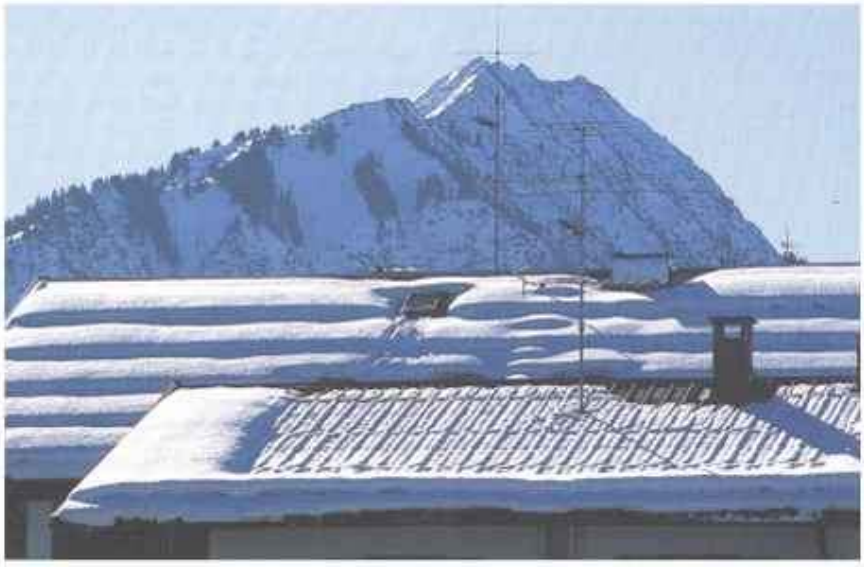
Dimensioning of snow guard brackets on metal roofs

Georg Rees

In the past years and above all at the end of last year's winter, it once again became obvious that damages to lock seam roofings, profile roofings or roofings with trapezoidal corrugations occurred because of missing snow guard brackets or snow guard brackets of too low capacity, size or strength. In most cases, the individual snow guard brackets were installed too far from each other (installation on every second seam only) or simply in too few snow retention system rows. Even small spaces such as dormer windows, pent roofs, mansards etc. were not protected at the eaves. Due to this, snow can come off the smooth surface of the roof and, partly also together with the snow load of the principal roof, plunge down. Personal injury or damage to property are pre-programmed in such cases.

In order to provide for a safe installation of a snow retention system on appropriate roofs – all according to natural conditions -, some basic thoughts have to be given to this topic.



Correct installation of several snow retention system rows on the roof. The snow load spreads. In the foreground, the snow has largely melt away due to insufficient heat isolation.

The snow load

For every building project, static calculations are necessary for the dimensioning of the roofing in order to exactly calculate the incurred loads such as wind and snow load, roof weight etc. In order to get the respective values, table 3 (design loads according to DIN 1055 part 5) "Snow and ice load" has to be referred to.

Here, Germany is divided up into different zones from I to IV into a snow load zone map. By means of table 3.23 (Schneider), the normal snow load in kN/m^2 can be determined from the snow load zone for the respective place and sea-level.

Example for the two towns of Goslar and Braunlage/Harz, 25 km distant:

Goslar - Snow load zone III, 320 m above sea-level

0,8 kN/m^2 = 80 kg/m^2

Braunlage/Harz - Snow load zone IV, 600 m above sea-level

2,6 kN/m^2 = 260 kg/m^2

Above all, wind transports of snow and possibly extremely high snow levels with subsequent rainfall have to be considered. In winter 98/99, for example, it occurred several times that the snow load was up to 60% higher than indicated in DIN 1055 part 5. Also ice loads can shift towards the eaves, for example on non-ventilated roofs or on badly isolated old buildings.

The holding force of different types of snow guard brackets

The form of different snow retention systems has an influence on the holding force of the mountings. Differences also exist between clamp holders for standing seam roofs and those for industrially pre-profiled metal lengths such as, e.g., Rib Roof, Kal-Zip, etc. The distance between the individual mountings should, if possible, lie between 400 and 600 mm, by no means, however, exceed 800 mm. The screws should be tightened with at least 30 Nm.

Great attention has to be paid to the surface of the metal roofing. With colour, foil or another coating, the sliding effect of the mounting is much higher than with non-coated metals. The inside of guard brackets must not be coated. Because of the clamp (nip) pressure, a greasy layer arises which clearly reduces the holding force.

With barrel roofs, not only the snow load should be taken into consideration, but also the overfeed effect, according to the degree of barrelling. Above all, this is important in case of small snow levels, as a compact, thick snow layer is much more stable in itself.

Summary of statements

The determination of the snow load must not only be effected on the basis of given standards, but also thoughts as regards an increase of the design load are necessary.

The holding force of the different snow retention systems has to be considered when it comes to calculating the necessary snow

retention system rows situated over each other.
A coating of the roof surface increases the sliding effect of the snow retention systems; one has to reckon with a smaller holding force.
For barrel roofs, a closer division of the snow retention systems rows is necessary in order to avoid an overfeed effect of the snow masses.
Snow stops are necessary to hold back snow masses between the retention tubes and the roofing.

	Roof Pitch		
Snowload	10 °	20 °	30 °
0,75 kN/m²	60 mountings	100 mountings	150 mounings
1,00 kN/m²	70 mountings	140 mountings	210 mountings
1,50 kN/m²	100 mountings	210 mountings	310 mountings
2,00 kN/m²	140 mountings	280 mountings	410 mountings

Determination of the necessary number of snow guard brackets, dependent on snow load and roof pitch.

Examples for the installation of snow guard brackets on a metal roof

The length of the eaves is 50 m, the sheaf length is 10 m and the distance between the seams is 600 mm. The number of snow guard brackets indicated below is a minimum number and has to be increased in case of limiting cases. In this calculation, the roofage is the real roofing and not the base area.

Example 1: snow weight 0,75 kN/m^2, roof pitch 10°: according to the table, at least 60 snow retention brackets are necessary. If the length of the eaves of 50,0 m is divided through the distance between the seams of 0,6 m, the number of 83 seams or the equivalent number of snow guard brackets is obtained. One row of snow guard brackets at the eaves is sufficient.

Example 2: snow weight 1,00 kN/m^2, roof pitch 20°: according to the table, at least 140 snow guard brackets are necessary. If the length of the eaves of 50,0 m is divided through the distance between the seams of 0,6 m, the number of 83 seams or the equivalent number of snow guard brackets is obtained. With an increased factor of safety, two rows with a total of 166 gutter board mountings are recommended.

Example 3: snow weight 1,50 kN/m^2, roof pitch 30°: according to the table, at least 310 snow guard brackets are necessary. If the length of the eaves of 50,0 m is divided through the distance between the seams of 0,6 m, the number of 83 seams or the equivalent number of gutter board mountings is obtained. With an increased factor of safety, four rows with a total of 332 snow retention brackets is recommended.

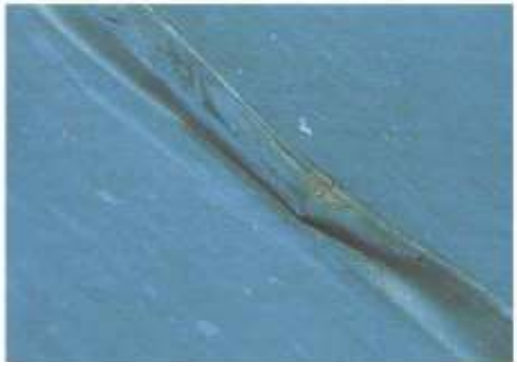
Logically, these examples are also valid for the number of snow guard brackets on profile roofs or roofs with trapezoidal corrugations. At the eaves, the distance of the individual snow retention system rows should be smaller than towards the ridge, because snow builds up as ice at the eaves under temperature influence and thus more weight lies on the eaves.

(Status as of April 1999).

…serious damage is the result.

The snow levels on a roof shown on these two photos are to be expected only rarely in the lowland plains of North Germany. In mountainous or even alpine regions, however, these levels have to be reckoned with.

If effective snow retention systems are missing here…



If the number of snow guard brackets is not sufficient, this is what standing seams look like after a snow-intensive winter.