# A9 Snow Removal

## A9.1 Introduction

One of the most detrimental climatological conditions to metal buildings is snow and ice buildup on the roof. Snow buildup to any significant depth greatly increases loads on the roof. While much of the snow will tend to slide off steeper roofs, (over 4:12 slope), much will remain that falls on a cold surface or previously covered surface. It is common to prevent snow slide by having devices placed on the roof in strategic locations. Snow will tend to slide more readily on a warm roof, caused either from sunshine or heat loss through the roof. Relatively little snow will slide off low slope roofs.

## A9.2 Drainage

Gutters, downspouts and interior roof drains allow for the controlled removal of water from a roof system. They must be kept open and free flowing to work. During cold temperature conditions, gutters, downspouts and drains can freeze solid allowing for ice build-up on the roof. This ice build-up causes additional water back-up on the roof deck. These circumstances create extreme loading conditions on the roof system and building. Freezing conditions are particularly likely on the north side of a building and in shaded areas of a building.

One simple precaution is to have heat tape installed in gutters and downspouts. This will help maintain open and flowing gutters and downspouts. However, in extremely low temperature conditions, heat tapes may not be 100% effective and should be checked regularly.

## A9.3 When to Remove Snow

Defining a specific depth of snow that a building has been designed to support is not possible because the density of snow is variable and dependent upon weather conditions both during and after a snowfall, as well as affected by the total depth of snow at a location. With the variability of snow density, it is possible for conditions to exist that exceed the designs specified by the building codes. Snow density also changes as the snow melts. Not all water drains off the roof as the underlying snow absorbs some water from the melted snow above. This leads to ice build-up on the roof as the temperature varies from day to night.

Fresh snowfall may weigh as little as 10 to 12 pounds per cubic foot (pcf) but the density will greatly increase as it compacts and becomes heavier with water. Typical densities on a roof will range from 16 pcf to 30 pcf depending on snow depth. When there is snow on the roof of a building and rainy conditions occur, excessive loads can develop rapidly. Snow acts as a sponge in these conditions and loads can approach the weight of water, 62.4 pcf or 5.2 pounds per square foot (psf) per inch of depth. Rarely will a cubic foot of snow and ice equal the weight of water due to the expansion that takes place as water freezes. However, these conditions must be monitored with extreme caution.

Snow will build up in areas around firewalls, parapet walls, valleys, dormers and on lower roof levels where a step in the roof occurs. All modern building codes require design for snow build-up conditions so that the structural systems in these areas can support the additional loads. However, due to the variability of snow density, as noted above, it is possible for conditions to exist that exceed the designs specified by the building codes.

While it is not possible to accurately determine a specific depth of snow that is considered a safe maximum, an approximation can be made. The first step is for the building owner to obtain information as to the snow load the building has been designed to carry. For example, a building designed for a 30 psf snow load can be at design load with just 18 inches of snow at a density of 20 pcf and could be overloaded with less than a foot of snow under wet conditions. Clearing snow from the roof is, of course, the only way to relieve this. It is recommended by Factory Mutual (Ref. B2.44) that roofs be cleared of snow when half of the safe maximum snow depth is reached. The maximum snow depth can be estimated based on the design snow load and the density of the snow and/or ice buildup.

## A9.4 Snow/Ice Removal Procedure

Following are some suggestions that generally apply, however, it is recommended that the building manufacturer or a structural engineer be consulted before snow removal is initiated.

1) Remove all hanging icicles from eaves and gutters. These will be quite heavy and if snow hangs up on them during removal, it can only increase this load. Care must be exercised to not damage the building and to not endanger pedestrians.

2) Always provide proper safety precautions when working on the roof. If possible, remove snow without getting up on the roof. Using draglines through the snow, working from the endwalls, can sometimes accomplish this.

3) Place ladders at the end of the building so sliding snow will not dislodge them.

4) Never send just one person on a roof to remove snow.

5) Remove snow in a pattern that does not cause an unbalanced loading condition. Avoid large differences in snow depth between adjacent areas of the roof. Do not remove all of the snow from small areas and then move on to another area. Instead, remove the snow in layers from all over the roof. This gradually decreases the load.

6) Remove drifted areas first, down to a level with other snow. If an area has drifts four feet deep and the main roof is two feet deep, trim off the drifts to two feet before proceeding.

7) Remove snow from the eave towards the ridge, sliding the snow off the roof over the gutter.

8) Remove the snow from the middle one-third of each bay for the full width of the building, beginning with the most snow packed bay. Complete snow removal on the remainder of the building.

9) On gable buildings, remove snow on both sides of the ridge at the same time.

10) Never use metal shovels on any type of roof. Do not use picks, axes or other sharp tools to break up ice on the roof. It is quite easy to damage roofing materials with these tools.

11) Do not remove snow to less than a 3" depth over roof sheets. Care must be taken to eliminate hitting panel fasteners, snow guards, etc. If an ice layer is next to a panel, it should be left, if not extraordinarily thick.

12) Care must be taken in removal of ice and snow around ventilator bases, pipe flashings, and HVAC units, due to the ease of damaging neoprene boots, pipes, conduits, etc.

13) Be cautious of snow or ice breaking away and sliding down the roof, even on low slope roof buildings.

14) Use extreme care when working along the edge of the roof.

15) Watch for extreme deflections and listen for unusual noises when snow and ice build-up conditions exist.