

# HAILSTORM CHECKLIST

ALLIANZ RISK CONSULTING



Every tenth thunderstorm is accompanied by hail, which is a form of precipitation that occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into balls of ice. The hail falls when the thunderstorm's updraft can no longer support the weight of the ice or the updraft weakens. The stronger the updraft the larger the hailstone can grow. Hail is usually pea-sized to marble-sized, but large thunderstorms can produce large hail. The heaviest individual hailstones of about 2.2 lb were recorded in Gopalganj, Bangladesh on April 14, 1986. However, hailstones of 7.5 lb were reported from Hyderabad, India in 1939.

It is estimated that a 0.5 in. diameter hailstone falls at 20 mph. A large stone, however, can reach up to 135 mph. Damage can be expected by stones larger than 0.5 in.

When viewed from the air, it is evident that hail falls in paths known as hail swaths. They can range in size from 100,000 – 215,000 ft<sup>2</sup> to an area 10 miles wide and 100 miles long. Hailstorms usually last only a few minutes, but 15 to 30 minute durations have also been frequently observed.

Property damage caused by hail is not a new issue but one growing in importance due to more frequent

extreme weather conditions.

According to Swiss RE, 5 out of the top 20 most costly insurance losses of 2011 were hail related. Hail causes approximately \$1 billion in damage annually in the United States to houses, buildings, cars and crops. The costliest hail storm in US history caused an estimated \$2 billion in damage (Kansas City, MO, April 2001). The hail storm causing the largest loss in Europe occurred in 1984 in Munich resulting in a loss of approximately \$1.9 billion.

The potential damage which a hailstone can inflict is mainly proportional to the stone's size and the wind speed in which it falls. Clearly, a 1 in. diameter hailstone falling in high winds has a greater damage potential than a stone of the same size falling in light (or even updraft) winds. To a lesser extent, hailstone hardness and shape / fall orientation can also affect the degree of damage. Hail can fall with little warning, especially when storm clouds are close and rain is already falling heavily. When visibility permits, however, it is possible to discern certain features that are distinct to hailstorms. One of these is the so-called "hail shaft" (see photo), which indicates hail falling at a distance in a sharply defined swath. Another characteristic is hail clouds can sometimes take on an odd, greenish color.

## COMMON TYPES OF HAIL DAMAGE

- **Roofs:** Roofs are the most commonly damaged part of a building when hail storms hit. Hail damage to roofing can be difficult to detect and the longer you leave hail damage unrepaired, the more damage can occur as water leaks through the roof and into walls.
- **Roof mounted equipment:** Hail can cause damage to air conditioners, antennas, vents, cooling towers, heating units, company signs and other roof mounted equipment.
- **Skylights:** The glass or translucent plastic in skylights or the seal around the outside edge are most often damaged.
- **Solar panels:** Researchers from the California Institute of Technology worked with NASA to ascertain the effect of hail on photovoltaic solar panels. They discovered that panels incorporating clear silicon material were likely to be damaged by 1 in. diameter hailstones, while solar panels covered in acrylic were able to withstand simulated hailstones of up to 2 in. in diameter.
- **Windows & siding:** When hail falls at angles it can crack windows and siding on buildings. Exterior Insulating and Finish System (EIFS) wall coverings can also be damaged if hail has any significant horizontal force.
- **Automobiles:** Automobiles and aircraft are also extremely susceptible to hail damage, manifested in two main ways: dimpling of sheet metal and, in the case of larger hailstones, cracked or shattered windshields and sunroofs.
- **Property in the yard:** Equipment or goods located in the yard can be significantly damaged. Hail also causes damage to trees, plants and yards. Trees and tree branches can break and fall from the weight of hail and the winds that often accompany hail storms. When significant amounts of hail fall, then start melting on the ground, flooding and damage from standing water can occur.

- **Flooding:** Hail is often followed immediately by severe rainfall. There have been several recorded losses from significant flooding after large hail stones have blocked roof and yard drainage systems.

No roofing material is fully hail proof, but there are hail-resistant roofs. Underwriters Laboratories has developed a test standard (UL 2218, *Impact Resistance of Prepared Roof Covering Materials*) for roof impact resistance whereby materials are rated on their resistance to impacts from steel balls simulating hailstones of various sizes. The classifications for impact resistance are expressed as Class 1, 2, 3 or 4, which relate to a roof covering's ability to withstand impacts from 1¼, 1½, 1¾ and 2 in. diameter steel balls, respectively. Impact resistant roofing materials that are rated Class 4 provide the best resistance to damage.

FM Global has developed a test standard (Standard 4473, *Specification Test Standard for Impact Resistance Testing of Rigid Roofing Materials by Impacting with Freezer Ice Balls*) using ice balls with similar classifications for impact resistance.

In an effort to help you minimize the damage that may occur as a result of a hailstorm, Allianz Risk Consulting has developed the following checklist that should be completed before, during and after a hailstorm. This checklist is not intended to be all inclusive and should be used as a guide, taking into consideration your specific site conditions and processes.

Should you have any questions about hailstorms or want to discuss any aspect of risk management in greater detail, please feel free to contact your local engineer at Allianz Risk Consulting. For any insurance claims, please contact your insurance broker or Allianz Global Corporate & Specialty.

## PRE-HAILSTORM PLANNING

**The key to minimizing hailstorm damage is adequate preparation before the event.**

Hail storms may develop quickly, leaving limited time to react. If your site is located within a hail prone area and you have property susceptible to hail damage, the following should be completed:

- Develop a comprehensive, written hailstorm emergency plan to mitigate the exposures. The plan should include:
  - Assigning emergency organization roles and responsibilities.
  - Providing training at least annually.
  - Assembling emergency supplies and equipment, such as tools, portable hail covers, plastic tarps, mops, squeegees, emergency lighting, battery operated radio, tape for windows, lumber and nails, etc.
  - Planning for salvage and recovery, including maintaining a list of key vendors, contractors, and salvage services.
  - A business continuity plan for restoring operations after the event. The plan should be reviewed at least annually and updated as needed.
- Designate a person to monitor the status and location of the hailstorm, keeping management and maintenance personnel updated as needed. Allow sufficient time needed to implement the emergency procedures.
- Inspect and repair the roof for problems with:
  - Blocked or loose drains, gutters or downspouts.
  - Blisters in roof coverings, which are more susceptible to damage. They are more likely to form in warm weather. Blisters will often grow larger over time leaving the covering above the blister unattached to the roof. Damage results from hail breaking the blister, which allows water to penetrate the roof covering, resulting in leaks.
  - Uneven ballast distribution, which is subject to scouring from high winds leaving thin or bare spots over the underlying covering.
- Relocate important outdoor equipment, machinery and stock indoors or install protective shields.
- Install protective shields for rooftop equipment such as HVAC units. Look for devices that include hoodtype projections or screens that shield the fragile condenser coils. Be sure to consult the manufacturer prior to installing such devices to ensure that operating efficiencies or equipment warranties will not be affected.
- Install protective screens over skylights or specify impact resistant glass or translucent plastic.
- The following should be taken into account while planning new buildings:
  - Smooth roof coverings, including single-ply and built-up coverings, are more susceptible to hail damage than those with gravel, stone or paving block ballast. For built-up roof coverings, hail damage can be greatly reduced by providing slag or gravel surfacing adhered with a flood coat of hot asphalt.
  - Specify an impact resistant roof covering according to UL Test Standard 2218, FM Approval Standard 4473, or opt for a design using gravel, stone or paving block ballast for new construction or when reroofing. Class 3 or 4 products are recommended in hail-prone areas. In Europe, follow technical advice from DIN EN 13583 for roof coverings.
  - Light metal roofs can be dented or even penetrated by large hail stones. The lighter the gauge of metal used, the greater the susceptibility to damage. So heavy gauge metal should be preferred.
  - If fiber cement roof or wall coverings will be used in new construction or renovations, specify systems with a high impact resistance.
  - Specify windows with impact resistant glass (DIN EN 12600 in Europe) within vulnerable facades.
  - If EIFS wall coverings or translucent plastic wall sheets will be used in new construction or renovations, specify systems with a high impact resistance.
  - Solar panels should meet DIN EN 12975, part 2 or a minimum rating of Class 2 per FM Approvals Test Procedure, Test Method for Determining the Susceptibility to Hail Damage of Photovoltaic Modules.

- Outdoor equipment such as duct work, light-weight sheet metal housings, air conditioning fins, etc., should be designed to resist, without permanent deformation, the impact energy of a 2 in. diameter hail stone.

## DURING A HAILSTORM

- Continue to monitor weather reports for information on potential hail damage, access to property, utility outage, etc. Update management and maintenance accordingly.
- During power failure, turn off electrical switches to prevent reactivation before necessary checks are completed.

## AFTER A HAILSTORM

- Organize and prepare emergency crews for salvage and cleaning operations.
- If safe to do so, conduct an immediate damage assessment, paying particular attention to the following:
  - Structural damage to the building (in case of hail and water accumulations on roofs)
  - Roof coverings
  - Roof mounted equipment
  - Yard storage or equipment
  - Fire protection equipment (mainly in case of structural building damage)
- Notify utility companies of any outages or damage to equipment.
- Call in key personnel and notify contractors to begin major repairs. Make sure facility safety procedures are fully implemented before work commences. This includes controlling ignition sources such as smoking and hot work. Follow all hot work permit procedures.
- Initiate salvage operations to perform the following:
  - Promptly cover any compromised exterior building elements, such as damaged roof coverings, doors, windows, etc., with plastic tarps to prevent water entry.
  - Relocate damaged stock and equipment to dry areas.
  - Promptly clear any debris and ice/hailstone blockages from roof and yard drains, gutters, drain pipes, gutters, catch basins, etc.
- Review the effectiveness of the hailstorm emergency plan and revise as needed.

## VEHICLE STORAGE YARDS

For vehicles, hail has turned out to be far and away the most significant natural hazard in the last few years. Damage to vehicles can be expected from hail stones with a diameter larger than 0.5 in. The extent of damage is mainly influenced by the following factors:

- Mass and size of the hail stones
- Duration of the hailstorm
- Speed of impact
- Storm / wind velocity (due to the lateral acceleration)

- Angle of impact
- Point of impact (i.e. glass, vertical, horizontal, sloped, curved part etc.)
- Construction of the outer panels and accessories (model)
- Material and thickness of the bodywork

The financial loss can be considerable (approx. \$6000 – 15,000 per vehicle)

## MEASURES TO LIMIT HAIL DAMAGE TO VEHICLES

- Aligning:** Past experience shows that aligning the storage yards to the main hail path direction (not the main weather direction), so that the rear end faces into it, can significantly mitigate the loss, particularly when hail does not fall just vertically. This should be considered when building new storage compounds or rearranging them.
- Hail protection mats:** Mats should have several layers (three layers: non-rip backing, padding and anti-slip layers) to provide good cushioning qualities. Make sure that softening agents in the anti-slip layer do not attack the paintwork. Be aware that these mats don't offer complete protection against severe hailstorms. Even hail that falls more vertically can cause damage if the mat does not cover enough of the bodywork, depending on how the vehicles are positioned in relation to the hail path.



- Roll-up hail nets:** Hail nets with a roll-up functionality are by far the most widespread kind of hail net protection for vehicles during storage. Be aware that the nets are not constructed to support significant snow loads. To ensure effectiveness when the hail is accompanied by strong winds (horizontal hail impact), nets should be extended to the side of the structure. Hail nets built with an arched design are relatively new on the market. The nets empty themselves with utmost precision and in a controlled fashion into the downward sloping parts of the arches. By building them in blocks, hail protection from all angles is possible.
- Permanent hail nets:** Used at locations where the likelihood of heavy snowfall is extremely low. The basic construction is essentially the same as that of the roll-up hail nets.

□ **Protective roofing:** Consists of steel posts, beams, supports and braces in the roof as well as frames that can hold elements made of hot-dip galvanized expanded metal. This construction is designed to intercept hail stones with a diameter of 10 mm (0.4 in.) or more. Protection against hail coming from the side can be achieved by building them as low as possible and adding side extensions.



- **Multi-storey car parks:** Usually not considered due to the high installation cost. Lack of space, the high price of land or climatic conditions such as frequent hail, high exposure to storms or the risk of flooding can, however, make multi-storey car parks an attractive proposition.
- **Pre-planning:** A hailstorm emergency plan for automotive companies should include the relocation of new cars from unprotected yard areas into shielded areas (e.g. empty multi-storey car parks, empty warehouses, show rooms, etc.) as well as the placing of hail protection mats onto cars, if available.

□ **Lightweight buildings:** Usually having a width of up to 100 m (328 ft), while there is practically no limit in length. Be aware that a microclimate sometimes develops in the building causing condensation. This can be avoided by utilizing industrial air dryers or air extraction devices.

If needed, please contact your insurance broker or Allianz Global Corporate & Specialty for assistance in reporting a claim.