



WITH YOU ALWAYS

RE-Konnect

Risk Engineering Bulletin

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Editor's Note

As fascinating as a lightning strike can be, it is one of the most leading causes of fires in industries and homes around the world. Lightning is capricious, random and unpredictable event. This year lightning caused 93 deaths and numerous fires only in the first two days of monsoons in India! As the monsoons are in full swing accompanied by the thunderstorms it's the perfect time to get familiar with dangers of lightning. In this very first issue of Re-Konnect, we provide you a brief overview of how devastating a lightning strike can be and what kind of protections you can employ to counter the same. The idea is to get you familiar with various aspects related to lightning which can be further explored through the references provided.

Disasters

Lightning Fire at Nabha (Patiala) Factory

Recently in mid March lightning caused huge fire in a factory which manufactures agriculture harvesters in Nabha, Patiala. One of the shed of the factory was hit by lightning which immediately caught fire. The fire soon spread to nearby area where a LPG cylinder was kept. When the fire reached cylinder, it exploded destroying the factory compound and further spreading the fire. The walls in and around the factory collapsed and trapped the workers inside the premises. Fire tender from a nearby place took more than two hours to reach the site. Much of the damage was done by that time. All the workers inside sustained serious burn injuries and conditions of three were critical.

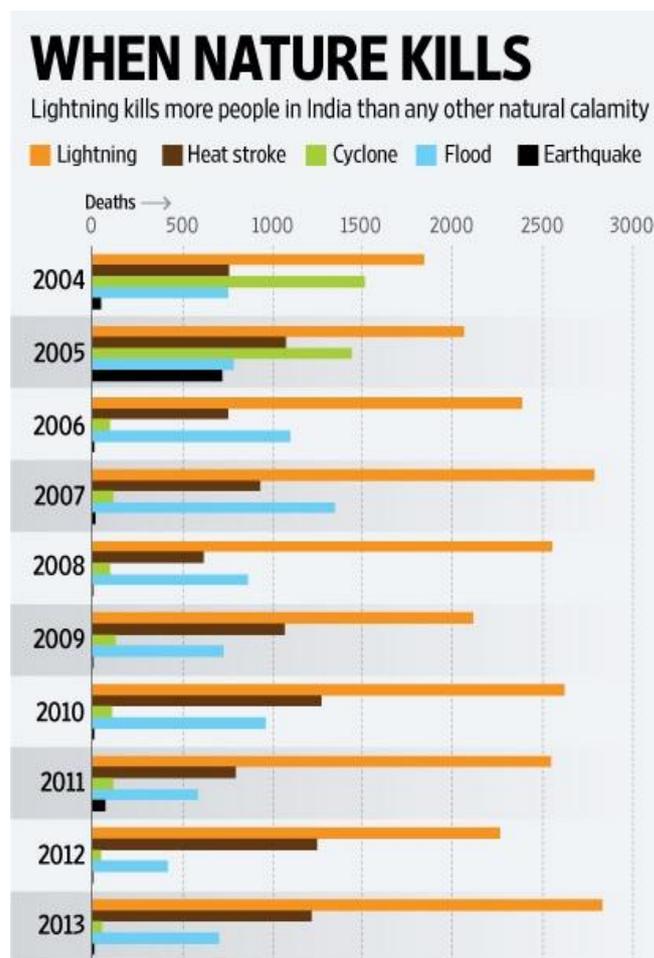


Lightning Caused \$25 Million Fire in Manufacturing Plant

In an early morning of July 2009 in Arkansas, a fire broke out in a one-story machinery parts manufacturing plant covering 23,226 square meters. Fire was caused by lightning. Lightning had struck a roof vent and started a fire in the storage area. The site had no workers when the fire broke out. The site did not have any automatic detection system or suppression system for fire. A security guard in a nearby facility detected the fire nearly 3½ hours after the lightning strike and called the fire department to report smoke in the area. By the time fire-fighters arrived, the factory was heavily involved in flames. The delayed discovery, as well as the high-rack storage, made fighting the fire difficult. Damage to the structure was estimated at \$15 million, and damage to its contents was estimated at \$10 million. The large monetary loss was due to damage to large number of machines and warehouse full of finished product.

Did You Know?

- A lightning bolt reaches about 30,000 degrees Celsius — roughly five times hotter than the surface of the sun!
- During 2007-2011, U.S. local fire departments responded to an estimated average of 22,600 fires per year that were started by lightning
- These fires caused \$451 million in direct property damage per year
- In a peer reviewed article which studied 242 tank fires, about 80 or almost a third of the total fire incidents were caused by lightning.
- A lightning strike to a floating roof tank containing naphtha on October 24, 1995 in Gilacap, Indonesia resulted in fires and property damages of 38 million dollars in January, 2002 dollars
- Lightning kills about 2,000 people a year, so stay inside during lightning storms



This image of a lightning storm was captured by a pilot from 37,000 feet above the Pacific Ocean. The photo soon went viral on internet.



Picture was taken from the roof of a 56 storey building opposite the Burj Khalifa, during a thunderstorm.

Loss Prevention

Lightning and Surge Protection

The primary reason for a lightning protection system is to route that electrical energy to a less destructive path to ground – instead of travelling through the building's electrical wiring, water piping, structure, or Low-Voltage (LV) cabling paths where it could create significant chaos inside the building. A lightning protection system does not completely eliminate the damage that can be caused to a structure, but it can certainly decrease the damage by routing the energy directly to ground instead of giving it free reign of the building.

The basic principle for protection of an installation against the risk of lightning strikes is to prevent the disturbing energy from reaching sensitive equipment. To achieve this, it is necessary to capture the lightning current and channel it to earth via the most direct path (avoiding the vicinity of sensitive equipment); perform equipotential bonding of the installation; minimize induced and indirect effects by installing Surge Protection Devices (SPDs) and/or filters. A surge is a fast, short duration electrical transient (spike) in the electric potential of a circuit.

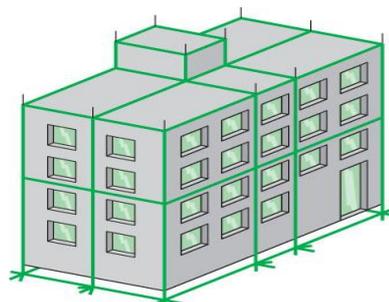
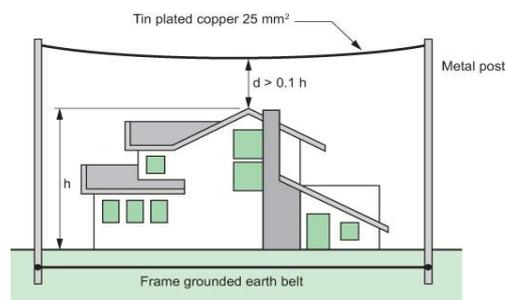
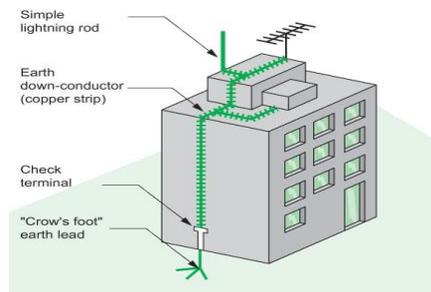
The system for protecting a building against the effects of lightning must include:

- Protection of structures against direct lightning strokes;
- Protection of electrical installations against direct and indirect lightning strokes.

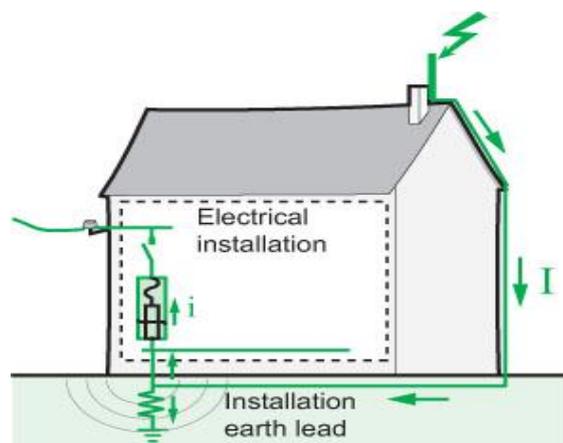
Protection of structures

Three types of protections are used:

1. **The lightning rod:** The lightning rod is a metallic capture tip placed at the top of the building. It is earthed by one or more conductors (often copper strips)
2. **Lightning rod with taut wires:** These wires are stretched above the structure to be protected. They are used to protect special structures: rocket launching areas, military applications and protection of high-voltage overhead lines.
3. **Lightning conductors with meshed cage (Farady Cage):** This protection involves placing numerous down conductors/tapes symmetrically all around the building. This type of lightning protection system is used for highly exposed buildings housing very sensitive installations such as computer rooms.



50% of the lightning current discharged by the building protection system rises back into the earthing networks of the electrical installation: the potential rise of the frames very frequently exceeds the insulation withstand capability of the conductors in the various networks (LV, telecommunications, video cable, etc.). Moreover, the flow of current through the down-conductors generates induced overvoltages in the electrical installation. As a consequence, the building protection system does not protect the electrical installation: it is therefore compulsory to provide for an electrical installation protection system.



Protection of Electrical Installation:

The main objective of the electrical installation protection system is to limit over voltages to values that are acceptable for the equipment. The electrical installation protection system consists of: one or more SPDs depending on the building configuration and the equipotential bonding: metallic mesh of exposed conductive parts.

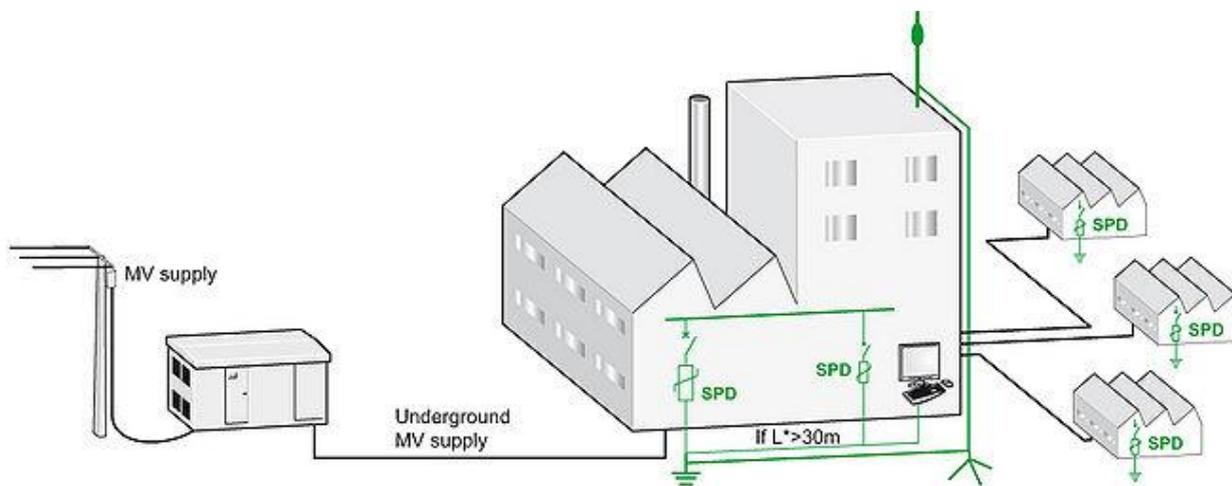
The procedure to protect the electrical and electronic systems of a building is as follows.

Search for information

- Identify all sensitive loads and their location in the building.
- Identify the electrical and electronic systems and their respective points of entry into the building.
- Check whether a lightning protection system is present on the building or in the vicinity.
- Become acquainted with the regulations applicable to the building's location.
- Assess the risk of lightning strike according to the geographic location, type of power supply, lightning strike density, etc.

Solution implementation

- Install bonding conductors on frames by a mesh.
- Install a SPD in the LV incoming switchboard.
- Install an additional SPD in each sub-distribution board located in the vicinity of sensitive equipment



Guidelines

Following codes and standards should be referred for lightning protection:

- **IS 2309 (1989):** *Code of practice for the protection of buildings and allied structures against lightning (second revision)*
- **SP 30 (2011):** *National Electrical Code 2011*
- **NFPA 780:** *Standards for Installation of Lightning Protection System*
- **FM Global Datasheet 5-11:** *Lightning and Surge Protection for Electrical Systems*
- **FM Global Datasheet 5-10:** *Protective Grounding for Electric Power Systems and Equipment*
- **API 2003:** *Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents*

Engage

Answer the following questions to win Amazon coupons worth Rs 500 each. Send the answers to editor.bulletin@tata-aig.com. 10 prizes will be given and winners will be announced in next issue.

Q. A 765 kV line is being laid from a power station to a nearby city. Which lightning protection system among the three mentioned should be employed to protect the lines?

Q. The distance between two electrical installations is less than 30 meters. Do you require two SPDs or a single one is enough?

Q. You are outside, it starts to rain and there is no structural shelter nearby. Which of the following is the safest place to be in when there is an immediate lightning danger?

- a) Under a tree with big trunk
- b) Inside a car with windows rolled up
- c) Remain outside with umbrella overhead

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