



Protection of Building and allied structure by lightning

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ABSTRACT

The lightning is a natural hazard which is discharged as static electricity. The important point by considering damage point of view is return stroke. The current discharged by the return stroke is about 2kA to 200kA. This current flashes to the ground from the negative charged cells in the thunder cloud. There is less chances of strokes from positive charge to the ground. The rising time of the negative charged flash is in the order of 10µs and that of decay time less than 100µs. The multi stroke may be 10 strokes together. The estimated potential of the charged flash is approximately. The cloud potential may be 100MV.

KEYWORDS : Lightning conductor, protection angle, lightning area

Lightning effects: As the current is discharged to the resistance path of the earth electrode, it raises the potential of the protective system with respect to the earth. This high potential gradient earth electrode is dangerous to the human beings. If the lightning current is discharged through internal installation of the whole electrical system resulting flashover may be possible to the whole structure. As the magnitude of the current is high for short duration resulting the thermal effect on the protection system cannot be neglected. Similarly when the lightning stroke discharged to single conductor/parallel conductor, the effect of mechanical stress on the bends and fittings are also considered. The power of return stroke of 10MW/meter may damage to the fabric of the building.

Lightning conductor and protection: The function of the lightning conductor is to discharge lightning stroke to the earth therefore protect the vulnerable part of the structure of the building. The range of attraction of lightning conductor to lightning stroke is not constant but it depends upon vertical and horizontal configuration of the conductor.

Need of protection: The structure which consists of highly explosive factories, stores, large number of peoples congregates, essential public service related, historic places or cultural importance requires lightning protection.

Protection: The effective lightning collection area of the structure for a building depends upon type, size and shape of the building. It is calculated at the edge of the corner of the building. If a rectangular building having length L, height H and width W meter, the length of the collecting area becomes (L + 2H) and width is (W + 2H). Similarly if the radius of corner of the building having H meter, the collected area for that building is

$$A = (L * W) + 2 (L * H) + 2 (W * H) + \Pi h^2$$

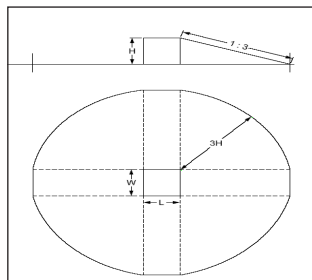


Fig. 1 Lightning collected area for the rectangular structure

The probable numbers of lightning stroke per year is given by

$$N_t = A * N_g * 10^{-6}$$

Where N_g is lightning flash density, per km²/year

(5)**Protection angle:** The lightning protection angle depends upon lightning stroke and its calculation is not accurate. As the protection angle decreases, the protection by the lightning conductor increases. The protection angle for any simple structure having vertical or horizontal termination network is taken as 45°.

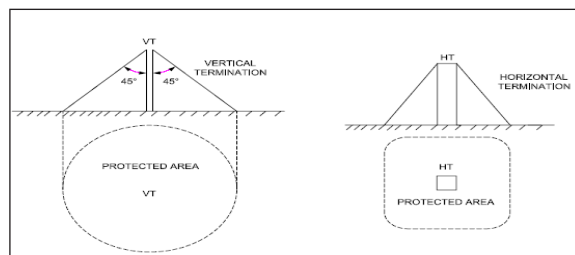


Fig. 2 Lightning protection by vertical and horizontal air termination

Shape and size of conductor material below ground for lightning protection

Material, shape	Minimum shape
Round copper wire	8 mm dia.
Copper strip	32 mm * 6 mm
Round GI wire	10 mm dia.
GI strip	32 mm * 6 mm

Shape and size of conductor material above ground for lightning protection

Material, shape	Minimum shape
Stranded copper wire	50 mm ²
Stranded copper wire	6 mm dia.
Copper strip	20 mm * 3 mm
Round galvanized iron wire	8 mm dia.
GI strip	20 mm * 3 mm
Round aluminum strip	9 mm dia.
Aluminum strip	25 mm * 3.15 mm

REFERENCES

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