

Lightning Protection System Survey Report

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By

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INTRODUCTION TO LIGHTNING PROTECTION SYSTEM AS PER IS / IEC 62305:

Lightening in simple terms is essentially heavy electric discharge from charged clouds to earth due to various reasons including but not limited to thunder storms.

- This heavy discharge is usually associated with extremely large current of small duration and extremely large voltage peaks mostly with respect to earth.
- The energy content in these discharges is very high.
- Further the current being very high, while flowing to and through earth, can produce dangerously high TOUCH and STEP potentials which can harm living beings.
- The flashovers or jumping of current can cause severe arcing resulting into fire.
- Heavy currents if not dissipated through alternate least resistance paths, can flow through metal structures of building or reinforcement of concrete and can cause severe damage to structure.
- Fall of structures can cause secondary damage to living beings.
- Due to conducted large voltages, severe damage to property and equipment may cause economic loss.
- Compliance to IS/IEC 62305 requires Risk assessment due to
 - a) Direct lightening strike on structure
 - b) Lightening strike on Electrical supply line inside the plant or outside.
 - c) Lightening strike on communication line inside the plant or outside.

The risk needs to be assessed for People, Plant and machinery and other costly / critical loads in the plant. The standard recommends that Plant management has to be involved in this assessment. The total risk is decided in each of the above category depending upon weather data and geographic location of the site which needs protection.

CLASS OF LIGHTNING PROTECTION SYSTEM:

Class of LPS denotes the classification of an LPS according to the lightning protection level for which it is designed. Four classes of LPS (I, II, III and IV) are defined as a set of construction rules, based on the corresponding LPL.

Recommended LPL for Typical Building as per IS / IEC 62305 as per table given below,

Application	Lightning Protection Level
Computer data centres, military applications, high rise hotels/hospitals, nuclear power stations, airports, essential services such as teleco	I
Low rise hospitals/hotels, ex-zones in the industry and chemical sector , fuel retail outlets/gas stations/compressor stations and similar installations	II
Schools, banks, residential buildings, temples, churches, mosques, community halls, etc	III

LIST OF IS STANDARDS AND CODES:

The entire electrical system shall be complying with the latest versions of I.S. codes and IEC guidelines as mentioned below,

Sr. No	IS No./ Year	Description
1	IS: 3043 - 1987	Code of practicing for earthing
2	IS/IEC 62305	Lightning Protection System
		B- Other Codes
3	SP30-1985	National Electrical Code 2016
4	NBC	National Building Code First Reprint 2016

EXECUTIVE SUMMARY:

1. The Lightning protection survey report is based on the assessment as per IEC 62305- Lightning Protection System standard.
2. The major findings in the existing lightning Protection system as per IS/IEC 62305 is discussed in detail in the site observation section of this report.
3. The major portion of plant is occupied by the production shed and , Administration building where LPS are installed.
4. Some locations like ETP, Pump House, Underground Tank 1 &2, Solvent store, Chemical Store, Tanker Decanting Platform, Equalization Tank, Security Gate-1 & Solvent Tank Farm are not covered under LPS at present.
5. We recommend an exercise to be done as per Lightning Protection System design perspective. This gives an idea of modification using existing LPS components (Lightning Arrester, Down Conductors & Earth pits etc).
6. After the analysis we will give BOQ to comply as per IEC 62305.

Site observations

1. The plant has large electrical setup. It is observed that Lightning arresters are installed on production shed, Administration building DG Stack (Both DG 1-2 & DG 3) & Boiler stack.
2. There are 19 Lightning arresters of conventional type. Out of these 5 lightning arresters found damaged. The detail observation is given in major finding section in this report below. The down conductors as per IS 62305 are required to be placed equally over the periphery of the plant and expected to be terminated to two earthen pits each with a junction box. --- This was not found in the plant as required. Further the location of air terminals has to be verified using "Rolling Sphere or Protection angle method" as per standards for complete and adequate coverage.
3. The major portion of plant is occupied by the production shed and , Administration building where LPS are installed – which has LPS as above.
4. Some locations like ETP, Pump House, Underground Tank 1 &2, Solvent store, Chemical Store, Tanker Decanting Platform, Equalization Tank, Security Gate-1 & Solvent Tank Farm are not covered under LPS at present.
5. The locations where lightning protection is required are as follows,

Sr No	Loaction	Height (mtr)
1	ETP (ETP Lab & Panel Room).	10
2	Security Gate 1	7
3	Pump House.	6
4	Underground Tank 1 & 2.	5
5	Solvent Store.	6
6	Chemical Store.	5
7	Tanker Decanting Platform.	5
8	Equalization Tank.	5
9	Solvent Tank Farm.	5

Some of the locations at heights as measured will have to be selected from above for installing Air terminals to cover / protect maximum area.

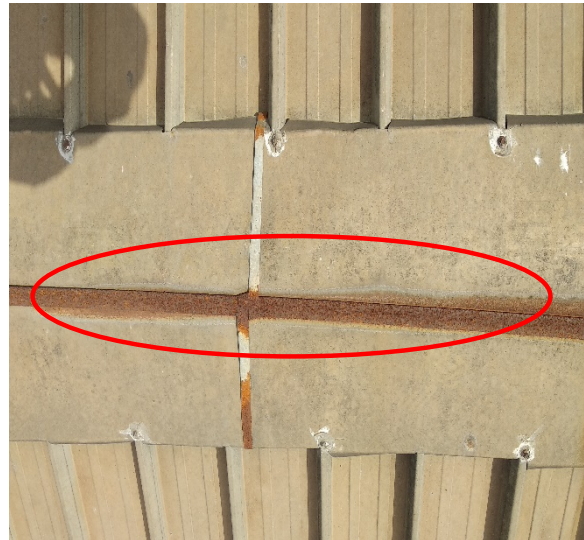
6. The existing down conductors & earthen pits for LPS are not appropriate as per IS 62305 There should be 16 down conductors for the existing LPS installed on shed and administration building. There should be two dedicated earthen pit for each down conductor.
7. Lightning Protection System Design Parameter as follows:
 - Lightning Protection Level (LPL) : II
 - Radius of Rolling Sphere : 30 Meter
 - Protection Angle : Will vary with respect to height
 - Mesh Size : 10 X 10 Meter
 - Distance between down conductor : 10 Meter.

It is observed that five(LA- 6,11,13,14, & 15) Lightning Arresster do not have 4 compleat spikes and Central final Spike. (As per the shared LA Layout)



Earthing GI strip is in contact with the metallic shed and wall. Earthing strip should be provided with support insulators

GI strip are found in corroded. This leads to reduce the conductivity of strip.



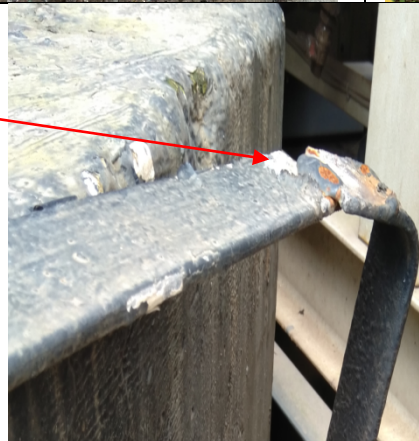
Height of the adjacent structures is more than the existing LA(LA – 3, LA-4)



Existing earthpits for LA are maintained properly.
(As per the shed Earth resistance test report)
It is required to trace the dedicated earthpit for
respective arrester.



Improper welding
joint is found at
Boiler stack LA
earthing strip.
It should be welded
as the joint shown in
next picture



Data Collected from Site:

Data collection for LPS Survey - Industry		
Sr. No	Data Required	Data
1	Survey existing LPS installed if any - right brief description of the same - Number of air terminals etc.	Number of LA = 19 [Shead & main building = 16 DG stacks = 2 Boiler Stack = 1]. Type = Conventional
2	Name of the organization	Watson Pharma Pvt.Ltd
3	Activity - Engineering / Chemical / Paper / Textile / Other	Pharmaceutical Company
4	Electrical Input is at LT / HT / EHT level	33KV
5	How many electrical connections enter the premises	Outdoor HT Panel - 2 Nos,
6	How many telephone lines / OFC etc enter the premises?	-
7	Contract demand KVA	2500KVA
8	Kwh consumption per month	10,00,000KWH
9	Details of any other type of energy used in plant - LPG/PNG/Diesel/ Coal/ Firewood etc -	1250kVA (3 Nos)
10	If yes for above - approximate qty storage at any point of time	2 Storage tanks (25 K.L & 1 K.L)
11	Monthly consumption of such energy - qty	144319 KWH
12	Is captive electricity generation used in plant	No
13	If yes for above - what is the capacity	No Captive Generation
14	Is roof top or ground Solar PV used in the plant?	No
15	If yes for above - what is the capacity?	No PV installation
16	Detail address	Plot No. A3 to A6, Phase I-A, Verna Industrial Estate, Verna, Salcette, Goa- 403722
17	Google location available / not available	-
18	Max Number of staff present ant time	500
19	Number of shifts per day	3 shift + 1 General shift
20	Is staff residential colony in same premises?	No
21	Rainy / Stormy months in year	3 (June, July & August)
22	Type of Rain - Normal / Heavy / Total rain fall	Heavy Rain
23	Total Plot area	L 220m W 120 m
24	Number of Isolated buildings	10
25	Area of footprint and height of each building	Dimension of shead - 164m X 83m X 25m (Dimension details of other buildings are not available)
26	Height of tallest structure in the plot and it's relative location on the plan.	Boiler Stack = 45m

	Data Required	Data
27	Total constructed area in sq ft / sq mtr	Apprx 20,000sq.mtr; out of which Area of shead = 13612sq.mtr (from layout of shead)
28	Type of construction for plant - RCC / Fabricated	RCC & Metallic Shed
29	Type of construction for office - RCC / Fabricated	RCC
30	Is huge unused ground space available in plant?	No
31	If yes / does it require protection from lightening?	-
32	Is latest Detail site plan and approved construction plan available? If yes collect copy. Also collect AUTOCAD file if available. Check whether the same can be made available	Yes
33	Is sectional elevation view of construction available showing different heights with location - if yes collect autocad file.	Yes
34	If 25 and 26 are not available - rough dimensional sketches should be prepared at site. This should include floor area and maximum height of each isolated construction. There relative position - seperation from each other	Done
36	Physically inspect existing electrical earthing system	Done
37	Check condition of present earthpits, Photograph if possible	Checked
38	Collect latest earthpit test report	The dedicated earthpit of respective LA should be traced
39	survey existing LPS installed if any - right brief description of the same - Number of air terminals etc.	As per the given Plot Plan of mettalic shead number of down conductors = 16
40	Check feasibility of running down conductors, peripheral conductors	Yes it is feasible

DESIGN PARAMETER FOR LIGHTNING PROTECTION SYSTEM:

- 1. Interception of direct strikes – Air Termination System
- 2. Conduction of lightning current safely towards earth - Down conductor System
- 3. Dispersion of the current into the earth - Effective earth-termination system

1.1 Air Termination system

Air-termination system is a part of an external LPS using metallic elements such as rods, mesh conductors or catenary wires intended to intercept lightning flashes. The probability of penetration by a lightning current on a structure is considerably decreased by the presence of a properly designed air-termination system. Air termination systems can be composed of any combination of the following elements:

- 1. Vertical rods (offers certain angle of protection)
- 2. Catenary wires
- 3. Meshed / Grid conductors.

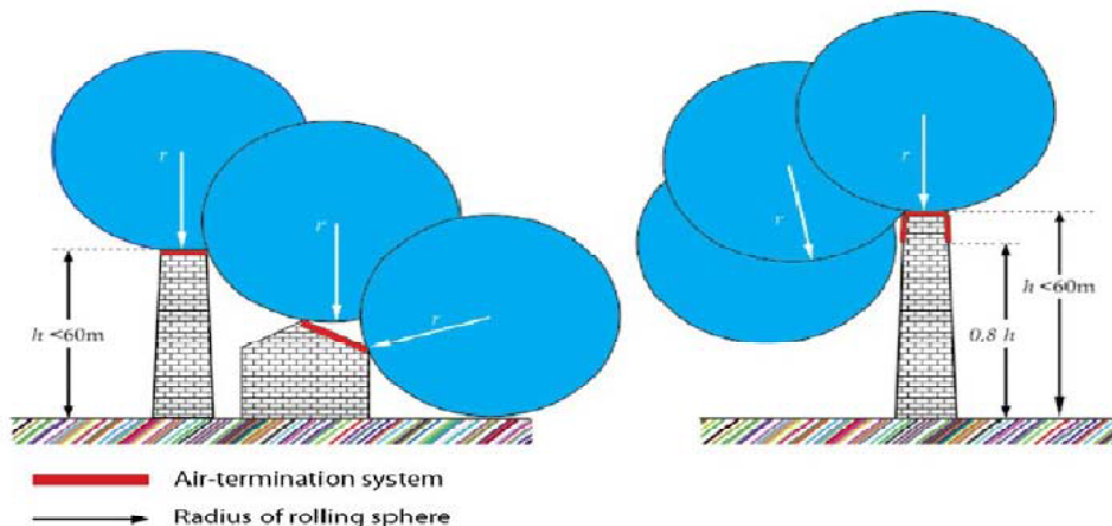
Air-termination components installed on a structure shall be located at corners, exposed points and edges (especially on the upper level of any facades) in accordance with one or more of the following methods:

- A. Rolling Sphere Method
- B. Protective Angle Method
- C. Mesh Method

Roof mounted electrical/electronic equipment (for example, chillers, antennas, cameras and bill boards) need vertical air-termination to avoid direct flashover.

A. Rolling Sphere Method:

The rolling sphere method is a simple means of identifying areas of a structure that need protection taking into account the possibility of side strikes to the structure. The basic concept of applying rolling sphere to a structure is illustrated in figure below.



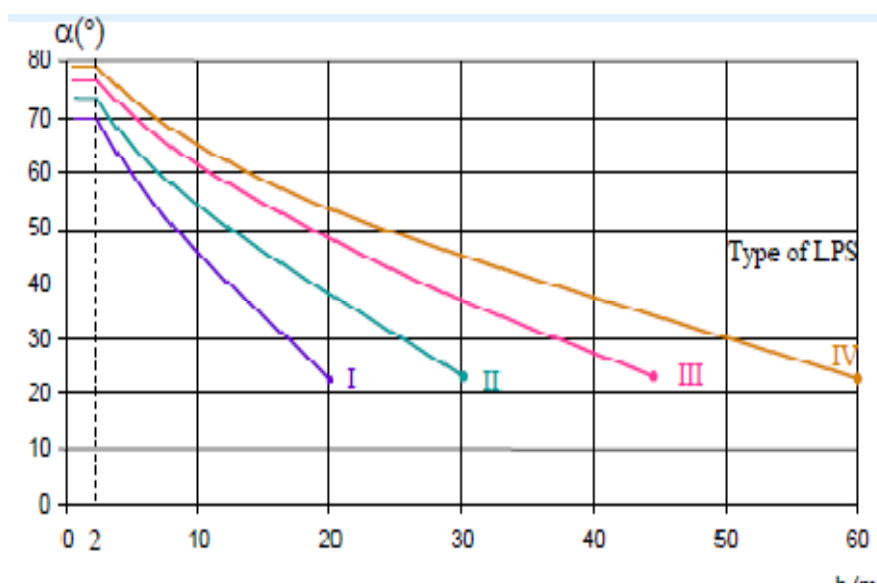
There is different radius of rolling sphere that correspond to relevant class of LPS as below,

Class of LPS	Rolling Sphere Radius (meter)
I	20
II	30
III	45
IV	60

This method is suitable for defining zones of protection for all types of structures, particularly those of complex geometry.

B. Protective Angle Method

The protection angle method is suitable for simple shaped buildings but it is subject to limits of air-termination height. This method is a mathematical simplification of the rolling sphere method. The protective angle is an angle created between the tip of the vertical rod and line projected down to the surface on which the rod sits.



C. Mesh Method

The mesh method is a suitable form of protection where plane / pitches roof surfaces are to be protected.

Class of LPS	Mesh Size (meter)
I	5 X 5
II	10 X 10
III	15 X 15
IV	20 X 20

2.2 Down Conductor System

Down-conductor system is a part of an external LPS intended to conduct lightning current from the air-termination system to the earth-termination system. Down-conductors shall be installed so that, as far as practicable, they form a direct continuation of the air-termination conductors. It shall be installed straight and vertical such that they provide the shortest and most direct path to earth. The formation of sharp bends and loops shall be avoided. Typical values of the distance between down-conductors are given in Table as per IS/ IEC 62305.

Class of LPS	Typical distance (meter)
I	10
II	10
III	15
IV	20

2.3 Earth Termination System

Earth-termination system is a part of an external LPS which is intended to conduct and disperse lightning current into the earth.

2. Natural Components / Steel Roof Structure

When metallic roofs are being considered as a natural air termination arrangement, Standard gave guidance on the minimum thickness and type of material under Consideration

Class of LPS	Material	Thickness 1(mm)	Thickness 2 (mm)
I to IV	Lead	-	2
	Steel(Stainless Galvanized)	4	0.5
	Titanium	4	0.5
	Copper	5	0.5
	Aluminium	7	0.65
	Zinc	-	0.7

Where,

(1) Thickness t prevents puncture, hot spot or ignition.

(2) Thickness t' only for metal sheets if it is not important to prevent puncture, hot spot or ignition problems.

“We recommend an exercise to be done as per Lightning Protection System design perspective. This gives an idea of modification using existing LPS components (Lightning Arrester, Down Conductors & Earth pits etc)”