

Lightning Protection System for Hazardous Area Plants

as per IS/IEC 62305

One of the focal points in the IS/IEC 62305 is, to decide Lightning Protection System (hereafter LPS) based on the Contents inside the structure. A structure can be of building made of RCC or metal columns or combination of metal & RCC, Metallic tanks etc.

Fundamentally External LPS is divided into 2 major sub-headings

Isolated LPS (in correct technical terms, as per IS/IEC 62305-3, External LPS isolated from the structure to be protected) . By definition it is, LPS with an air termination system and down conductor system positioned in such a way that the path of the lightning current has no contact with the structure to be protected. An important point to note here is- earthing system is not isolated from the structure that needs protection, again emphasising the need for “global earthing” system, which means, a common earthing system for the ‘WHOLE PLANT”.

Non- Isolated LPS (in correct technical terms, as per IS/IEC 62305-3, External LPS “not “isolated from the structure to be protected). By definition, it is, LPS with an air- terminal system and down conductor system positioned in such a way that the path of the lightning current can be in contact with the structure to be protected.

An external LPS is intended to intercept direct lightning flashes to the structure, including flashes to the side of the structure and conduct the lightning current from the point of strike to ground without causing thermal or mechanical damage or dangerous sparking which may trigger fire or explosions.

Most of the applications do not warrant isolated LPS. Examples include, thermal power plants, steel plants, cement plants, etc. , either for the whole plant or need isolated LPS only for a small portion of the plant (viz., where naphtha is used as a fuel).

However, an isolated LPS should be considered when the thermal & explosive effects at the point of strike, or on the conductors carrying the lightning current, may cause damage to the structure or its contents.

Given below are few examples where isolated external LPS has to be used:

- 1 Structures containing solid explosive materials.
- 2 Structures containing hazardous areas (Zone 0, 1, 2 and Zone 20, 21 & 22).
- 3 Susceptibility of the contents (inside the building) warrants the reduction of the radiated electromagnetic field associated with the lightning current pulse in the down-conductor).
- 4 Consideration of the architectural design of the buildings.
- 5 Heritage buildings (ex. Taj Mahal).

Whereas, an isolated LPS is convenient where it is predicted that changes in the structure, its contents or its use will require modifications to the LPS.

Depending upon type of plant & its application, some are all of the 4 risks to be considered.

R1: Risk of loss of human Life.

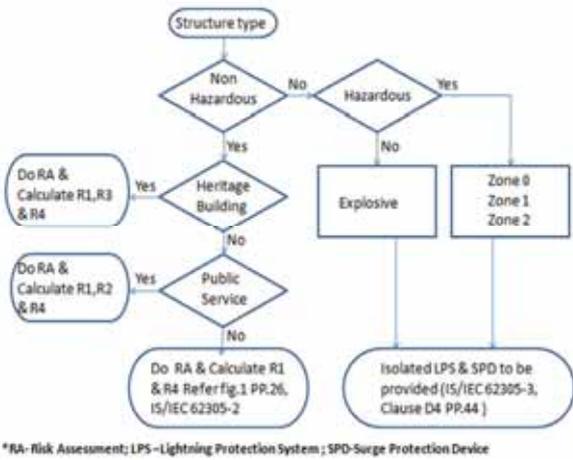
R2: Risk of loss of Public services.

R3: Risk of loss of cultural heritage.

R4: Risk of loss of Economics.

For all the process industries only losses R1 & R4 are applicable. (Ex. Thermal power plants, cement plants, sugar plants, steel plants, paper plants, pharmaceutical plants etc..)

Attached Figure 1- Flow chart helps in determining the kind of losses associated with each type of plant.



A quick comparison or ready reckoner between Isolated & non- isolated LPS. .

| Non- Isolated lightning Protection System | Isolated Lightning Protection System |
|---|---|
| Applicable to Non-Hazardous Area | Applicable to Hazardous Area |
| Application: Most of the applications- Ex. Thermal Power Plant, Cement Plant, Sugar plant, Textile mills, Commercial buildings, Residential apartments etc. | Application: Limited to Petrochemicals, Refineries, Fertilizer plants, Oil Exploration etc. |
| Risk Assessment- Required.- to know whether building under evaluation needs External LPS & if required, what is the LPL level (I to IV) | Needs External LPS & SPDs for the equipment. No need to perform Risk Assessment. More stringent protection depends upon the category Zone 0 or 1 or 2. For Ex, Zone 0 is more stringent than Zone 1 and Zone 1 is more stringent than Zone 2. |
| LPS shall be installed on the building- i.e Air terminal & down conductor based on LPL I to IV | LPS shall be 1 m away from the hazardous building. i.e Air terminal & down conductor |

| | |
|---|--|
| Earthing- Structural or ring earthing. | Earthing- Structural or ring earthing. i.e Earthing shall not be isolated from the building. |
| Easy to maintain :LPS on the building | In extreme cases, if LPS is installed on the building, very difficult to maintain as the requirement is stringent because any loose connection will result in spark which will initiate fire hazard. |
| Requirement of SPD- Surge Protection Device depends on Risk Assessment requirement. | SPD is must. Ex-proof SPD has to be installed in Zone 0. |

In general, Storage tanks containing liquids that can produce flammable vapours or used to store flammable gases are essentially self protecting if the continuous metallic contained is not less than 5 mm of steel or 7 mm of aluminium require no additional protection provided that the temperature rise of the inner surface at the point of strike does not constitute a danger. As it is practically very difficult to find out the same, it is preferable to have isolated LPS for the tank farm as the investment on LPS is very meagre.

In the same way, it is a good idea to provide isolated LPS for floating roof tanks as otherwise, it is very difficult to maintain extremely stringent requirements of the design of seals and shunts and their relative location apart from arranging bonding conductors so that they can't form a re-entrant loop.

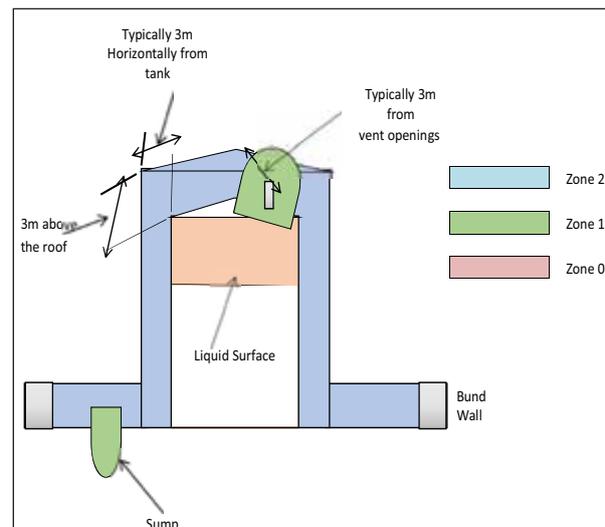
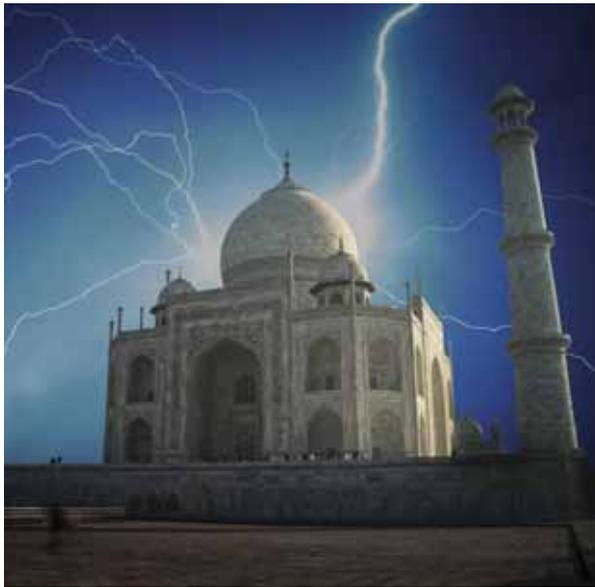


Figure- hazardous area classification of tanks.

Normally there is a doubt among Instrumentation Engineers that when Barriers or isolators are used, whether there is still a need to provide SPDs. In fact, SPDs are needed to protect barriers or isolators.



The purpose of barrier or isolator is to reduce the energy to less than 1 W in case of a short circuit which is a safety requirement. In fact, ignition of a potentially explosive atmosphere can be prevented by limiting the available electrical energy to levels below which ignition takes place. Whereas in case of lightning or switching surges the energy produced is very high and hence the need of SPD is justified even to protect the barriers or isolators apart from the other loads (ex. Analog input cards, analog output cards, Digital input cards, digital output cards etc.)

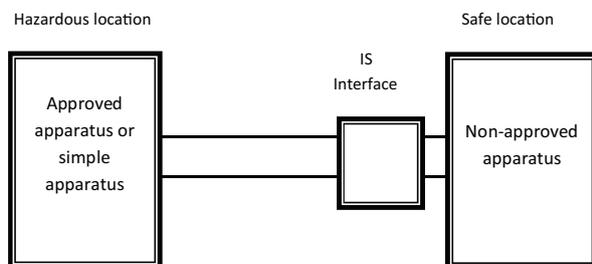


Figure –An Intrinsically safe loop

The important installation practice to be followed is that SPD's shall be the first point of receiving the signal followed by IS barriers or isolators. More specifically SPDs and IS barriers or isolators shall not be interlaced once after the other.

Conclusion

If the classification of hazardous area is known before doing the lightning protection survey, it is actually easy to implement Isolated LPS than the non- isolated LPS, which needs risk assessment and determining the level of protection (LPL I to IV), apart from the practical difficulties encountered at the time of actual installation. ■

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