Technical reference
Lightning protection of hazardous areas to ATEX/IECEx

Many industries, such as petrochemical, oil & gas and pharmaceutical, face the ongoing challenge of protecting people and property from the risk presented by potentially explosive atmospheres.

These atmospheres create hazardous areas, where flammable gases, powders, or dusts have the potential to mix with air at a ratio which would result in an explosion if ignited by a spark or other source of ignition (static charge, chemical reaction etc).

Clearly, lightning presents a significant threat to potentially explosive atmospheres, both through a direct strike, flash over and the risk of partial lightning currents entering the hazardous area via incoming/outgoing metallic services.

The employer or plant operator has responsibility for ensuring safety against potentially explosive atmospheres, and should therefore reference the relevant standards and directives - IEC/BS EN 62305 for lightning protection and ATEX (IECEx outside the EU) for protecting potentially explosive atmospheres - when establishing the requirement for lightning protection on site.

ATEX directives

Two ATEX directives have been published with the aim to protect employees, the public and the environment from accidents owing to explosive atmospheres. They require employers to eliminate or control risks from hazardous areas, to classify areas where explosive atmospheres may occur, and to ensure products suitable for use in those areas are applied.

From July 2006, all existing and new sites where hazardous areas are present must be ATEX compliant.

ATEX 137, Directive 1999/92/EC

This directive covers health and safety of employees at risk from explosive atmospheres. It requires employers to take necessary steps to prevent formation of explosive atmospheres, to avoid ignition in explosive atmospheres where they cannot be fully prevented, and to limit the effects of a explosion should such an event occur.

It further classifies the places where explosive atmospheres may occur into a number of zones (see Table 12).

ATEX Article 100A, Directive 94/9/EC

This directive covers equipment and protective systems for potentially explosive atmospheres and the health and safety requirements to which they must conform.

Table 12: Zonal classification of hazardous areas

Expectation of potentially explosive atmosphere/hazard arising	Zone reference	
	Gas	Dust
Hazard is continuously present, for long periods or frequently (> 1000 hours per year)	Zone 0	Zone 20
Hazard is likely to arise occasionally during normal operation (10-1000 hours per year)	Zone 1	Zone 21
Hazard is not likely to arise during normal operation, or is of short duration only (< 10 hours per year)	Zone 2	Zone 22
No hazard is present	SAFE AREA	

Table 13: Intrinsically Safe product classification

Symbol	Suitable for zones	Category	Standard
Ex ia	0, 1, 2, 20, 21 & 22	1	IEC 60079-11
Ex ib	1, 2, 21 & 22	2	IEC 60079-11

It applies both to equipment and systems used in potentially explosive atmospheres, and those sited outside these atmospheres which contribute to the level of safety in the hazardous area. Equipment is categorized in line with the protection level offered against the risk of producing a spark or source of ignition in a potentially explosive atmosphere.

Categories include:

- Applicable zone and equipment group for gases/vapours (II) or dusts (III)
- Protection level, per zone, according to risk from gases/vapours (Ga; Gb; Gc) or dusts (Da; Db; Dc)
- Form of protection (flameproof enclosure - Exd; Increased Safety - Exe; Intrinsically Safe - Exi etc)
- ILevel of protection to gas/vapour group or dust group (IIA; IIB; IIC)
- Restrictions in product usage (equipment without restriction; equipment with special condition - X; component - U)
- Temperature Class (T1-T6, spanning temperatures from 450 ºC down to 85 ºC)

Products classified as intrinsically safe (IS) are further categorized according to their applicable zone (see Table 13). Products are tested to ensure compliance with the requirements of ATEX, with approved products marked accordingly based on the classification system, including their ATEX certification number.

Lightning protection of hazardous areas in line with ATEX/IECEx

With hazardous areas at risk from the consequences of direct and indirect lightning, a comprehensive approach to lightning protection in line with IEC/BS EN 62305 should be considered. This should cover structural lightning protection, earthing and equipotential bonding, and transient overvoltage protection. The zonal approach to lightning protection, as established in IEC/BS EN 62305 is applicable for designing an LPS suitable for hazardous areas, considering the following points.

Structural lightning protection

For locations with potentially explosive atmospheres, as defined by IEC/BS EN 62305 the appropriate Class of LPS required shall be dictated by the risk assessment process in IEC/BS EN 62305-2.

An isolated LPS is required since the structure includes combustible materials and/or presents a risk of explosion, with minimum separation distances adhered to between the LPS and structural metallic parts to remove any risk of sparking. Additionally, catenary conductors raised high above the structure should be considered, where these are to protect locations where combustibles are present, such as gas/oil storage tanks.

Earthing & equipotential bonding

The earth termination system should meet the requirements set out in IEC/BS EN 62305-3 a single, integrated earth termination system combining lightning protection, power and telecommunications systems. It should provide low electrical resistance (less than 10 Ohms) and be appropriately bonded to ensure no metallic part is at a different potential with respect to another. Where incoming or outgoing services cannot be bonded directly to earth, these should be protected by a suitable SPD.

Following the zonal approach in IEC/BS EN 62305, services passing from LPZ 0 to LPZ 1 should be protected against partial lightning currents using a lightning current/equipotential bonding SPD (tested to 10/350 µs waveform), as well as transient overvoltages (SPD tested to 8/20 µs waveform).

Electronic systems protection

Electrical and electronic equipment/systems need to be protected against transient overvoltages, since damage to components could lead to risk of sparks or fire. Equipment/systems sited in a safe area which do not contribute to safety in a potentially explosive atmosphere can be protected against transient overvoltages using appropriate standard SPDs, as defined by IEC/BS EN 62305.

However, equipment/systems sited in potentially explosive atmospheres (Zone 1, 2) or contributing to safety within these atmospheres require an SPD suitably tested and approved by ATEX. All SPDs installed on site should form a coordinated set to ensure protection levels are maintained and effective throughout.

Protection of intrinsically safe (IS) circuits

Intrinsic Safety (IS) is a concept for protecting hazardous areas from dangerous sparking, whereby sparks from electrical equipment and circuitry are prevented through the use of IS barriers. These barriers limit the available electrical energy that could cause an explosion to below ignition threshold.

IS Barriers however are not surge protectors but are field instruments which are themselves at risk from transient overvoltages. IS circuits therefore need to be protected from transient overvoltages by a suitable (ATEX approved) SPD. Protection should be applied at the boundary between the hazardous and non-hazardous area (see Figure 15), with an isolated screen SPD installed within the hazardous area (Zone 1, 2).

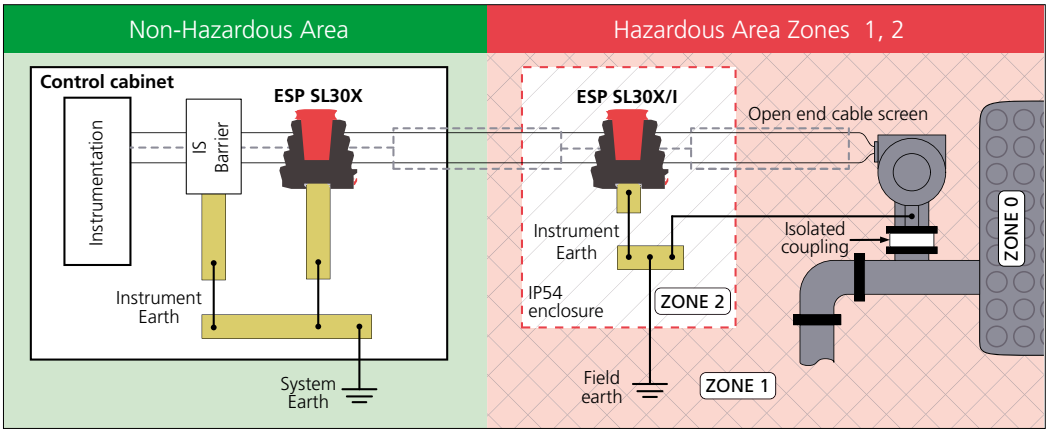

Figure 15: The installed SPD (here the ESP SL30X Series) provides protection for the instrumentation as well as providing protection for the IS Barrier. The isolated screen version (ESP SL30X/I) should be used in Zone 1, 2.