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Recharging stationary and traction batteries and creating potentially explosive areas

Introduction

The aim of this article is to address the problem of potentially explosive areas being created at the stationary and traction batteries, namely the UPS and UPS battery packs and the pallet trucks.
Although most companies do not have operations that need to handle flammable liquids / gases or electrostatic or explosive dust, the typical case of battery charging is a widespread situation; even this activity can create a potentially explosive atmosphere.
During the article, we analyze the generic problem of zoning, then illustrating a methodology for evaluating battery charging areas, based on specific standards in this area.

Legislative obligations

ATEX zoning has always been a delicate business problem, which is overlooked on many aspects of safety at work and involves most of the activities and employers. ATEX zoning is in fact an issue that affects all employers and businesses, regardless of their work activity. In fact, Legislative Decree 81/2008 requires, in the specific Title dedicated to this issue, that each company must compile a "Explosion Protection Document".

The possible formation of a potentially explosive area comes from various and partly widespread industrial activities:

- charging of traction batteries;
- charging stationary batteries;
- use, handling, distribution or storage of flammable substances (gases or liquids);
- use of machinery and work equipment that manipulate or produce flammable substances or explosive or electrostatic powders (paper dusts, wood powders, powders of polymeric origin, cereals and flours, etc.);
- thermal power plants;
- purification plants.

In the specific "Title XI Explosive Atmospheric Protection", Legislative Decree 81/2008 requires the Employer to avoid the formation of such areas, eliminating the risk if there is a possibility, or to assess the actual formation of Explosive atmospheres through the preparation of a specific "Explosion Protection Document", Article 294 of Legislative Decree 81/2008, which must contain effective zoning of these areas, in case the deletion of the source of Possible danger is not possible for productive purposes.

Zoning

This Explosion Protection Document should be the starting point for assessing, on the basis of zoning, application and presence in the company of many procedural and technical aspects:

- the adequacy of the electrical and mechanical equipment installed within the identified areas; equipment must be labeled according to the specific ATEX Directive 2014/34/EU by the respective manufacturers, depending on the type of area identified and the substance it gives;
- the need to integrate staff training;
- the need for working procedures in identified areas, with access control and usable equipment;
- the need to introduce certain specifications for materials and new equipment to be installed;
- the need to establish proper procedures for the storage and handling of materials, substances or wastes;
- the need to specifically manage the activity of suppliers and contractors in the company.

Zoning in general is based on specific CEI EN standards of the CEI EN 60079-10-1 (CEI 31-87) and CEI EN 61241-2 (CEI 31-88), and through the relevant CEI 31-35 interpretative guides and CEI 31-56 according to the following steps:

1. Identify the sources or possible sources of emission and the chemical / physical characteristics of the substances emitted.
2. Assign the degree of output for each source:
   - Continuous degree;
   - First degree (periodic or occasional issue);
   - Second degree (unexpected emission, breaks off).
3. Assess the flow rate.
4. Assess the type of Zone, that is, the probability of an explosive atmosphere, based on the degree of emission and ventilation.
5. Calculate and graph graphically the extension of the Zone, based on:
   - emission rate;
   - ventilation (artificial, natural, degree and availability, with or without physical impediments, number of air intakes, etc.).

Charging the batteries

The batteries commonly used in the company are lead or nickel cadmium and are distinguished, as already anticipated, in:

- traction batteries, ie batteries that equip forklift trucks, pallet trucks, cleaning machines, etc.
- stationary batteries, ie batteries that equip UPS (integrated or not), auxiliary services of power and telephone, rescuers, etc.

Batteries are usually recharged in dedicated areas, or in areas located inside production areas.
As is known, during the charging phase, the lead-acid battery emits several gases, including hydrogen, or a particularly volatile gas with high explosion characteristics, gas that is specifically emitted following water electrolysis.

Depending on how the gas is emitted into the atmosphere, the batteries are classified in:

- open batteries, ie batteries that allow free gas outlets, as they are free of cover, or have a cover through which the gas can freely leak;
- Batteries controlled by valves (closed or sealed), ie batteries closed with a hermetic cover, but equipped with a valve to vent any overpressure.

For zoning, as an alternative to Generic Gas Gases series 60079-10 CEI EN, it is possible to refer to CEI EN 50272-2 (CEI 21-39) standards on stationary batteries and CEI EN 50272-3 (CEI 21 -42) on traction batteries. These two rules analyze the problem by focusing in particular on proper ventilation to ensure the areas where charging points are located to limit the extension of the area, which should otherwise be considered to be the same as that of the entire local area and beyond if there are ducts or openings that put it in communication with other premises.

CEI EN 50272-2 and CEI EN 50272-3

Hydrogen has a high level of explosiveness, as a 4% concentration in the air (Lower Explodibility Limit) is sufficient to generate an explosion in the presence of an effective trigger. EN standards therefore propose to keep hydrogen concentration significantly below 4%, by ensuring proper ventilation. The EN standards thus provide simplified formulas to calculate the required ventilation air flow rate in a battery recharge room and the minimum ventilation opening surface that ensures such air flow with a good safety factor.

In the immediate vicinity of a charged battery, even in the presence of the calculated minimum ventilation, there is always a foreseeable existence of a dangerous zone which, for its characteristics, should be classified as Zone 1: "area where the formation of an explosive atmosphere, consisting of a mixture of air and flammable substances in the form of gas, vapors or fog, is likely to occur occasionally during normal activities. " This area extends for a distance of 0.5 meters from the source of the traction battery gas, or from the battery valves itself. As for parking batteries, the distance varies depending on the battery characteristics, depending on the voltage and the rated capacity of the battery.

Conclusions

Standards CEI EN 50272-2 and CEI EN 50272-3 identify the necessary measures in battery charging locations to prevent the explosion hazard due to the emission of hydrogen, particularly dangerous gas, not only for the above-mentioned Lower Explodibility Limit but also because it is very light, with the tendency to stride in narrow spaces and focus on the high areas of the premises.

The standards then analyze the specific ATEX problem of charging areas:

- prescribe that battery cells have a minimum (natural or forced) ventilation to keep the hydrogen concentration far below 4%;
- indicate how to calculate the required ventilation and the minimum aperture width to ensure it naturally, without the use of fans or extractors;
- specify that even in the presence of proper ventilation, near a battery there is a potentially explosive zone;
- provide simplified formulas to calculate the extension.

In order to prevent explosions in battery cells, therefore, it is sufficient:

- Provide rooms for the minimum ventilation openings provided by CEI EN 50272-2 and CEI EN 50272-3 or adequate localized ventilation;
- check the absence in the potentially explosive area near the ignition battery (electrical systems, electrical and mechanical equipment) or install in the area of Ex II 2G electrical and mechanical components marked CE marked in accordance with the Atex 2014/34/EU Directive.