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THE DANGER OF EXPLOSION IN GRAIN SILOS

The grain silos are a store or a place outside or inside a building, in which are stored food industry products, such as wheat, corn, rice or other similar products. All the loading operations are carried out generally with mechanical means such as pipes, conveyor belts, augers, etc., through loading inlets placed in the upper part of the silo tower. Once stored, the products are taken from unloading hatchback doors placed in the lower part or they can be collected and transported by means of pneumatic or manual conveying systems.

All products of the food industry are made up of carbon, hydrogen, nitrogen, sulfur, oxygen, etc.. Therefore, they are combustible and, consequently, able to causing fires and explosions. If undergo grinding operation before storage, cereals may have a very fine grain size and, in the case the particle size is below than 500 μm , they can originate explosive atmosphere if mixed with air.

In any case, even if the grains have higher dimensions, we must consider that the solid parts generate normally dust. It should be always kept in mind the rule saying that dusts generate finer dust.

Obviously, the presence of combustible dust always involves, if triggered, danger of explosion.

Danger of explosion by dust clouds

Within the silos, there is always air and, the stored grain, forms deposited layers of dust. During the operations of loading and unloading, such layers, because of the motion due to the circulation of air, always generate a permanent cloud.

The dispersed combustible dust clouds in the air form an explosive atmosphere. The clouds, if triggered, are able to oxidize so fast as to generate an explosion. The reactivity of the dust is as greater as smaller are the particles that compose it.

So that the cloud is explosive, it's required a concentration of dust within the explosive field of the substance which should be between the L.E.L (Lower Explosive Limit) and the U.E.L. (Upper explosive Limit), expressed in grams of powder in air volume, g/m³.

Areas Classification

The classification of hazardous areas in a silo can be carried out using the IEC 60079-10-2 (CEI 31-90) which replaced the previous EN 61241-10. This Standard will help you performing the classification considering all the hazards due to the presence of dust clouds or dust layers.

Areas within the containment system

Inside the volume of the silo, the storage layer of grain must be considered Source of Emission of continuous degree able to originate a Zone 20 extended to the entire internal volume of the silo.

If the operation of loading and unloading is carried out through automatic conveying systems, within the conveying system dust/air may create a mixture in concentrations that may fall within the explosive field. In this case, the interior of the transport system is classified as Zone 20.

Areas outside of the containment system

During the phases of loading and unloading, a certain amount of dust is normally emitted from the doors that communicate with the outside. In case of frequent or continuous operation, the doors of loading and unloading are considered Sources of Emission of first degree able to create a Zone 21 and, possibly, a boundary Zone 22.

If there are open automatic transport systems, such as conveyors and open bucket elevators, they can be considered Sources of Emission of First degree and create a Zone 21 and, probably, a boundary Zone 22.

Electrical Systems

Therefore, any electrical control systems for loading / unloading equipment must be manufactured and certified to be used in areas with an explosive atmosphere.

Regarding the classifications of electrical equipment, we can follow the following table which indicates the ATEX marking that must be present:

ZONE	MARKING
ZONE 20	CE EX II 1D
ZONE 21	CE EX II 2D
ZONE 22	CE EX II 3D

In next newsletter, we'll analyze the types of protection specific for dusts which can be used in these danger zones.