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ZONE 2 SOLUTION SELECTION - ACTIVE OR PASSIVE?

WHITE PAPER

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ABSTRACT

When operating a forklift truck, or any other piece of materials handling equipment, in a Zone 2 potentially explosive environment the manager of the site has two choices of protection against ignition, passive protection or active protection using gas detection.

While both approaches meet the requirements of the manufacturers' Directive, the use of gas detection provides a compelling basis for also meeting all the requirements of the Users' Directive.

In this whitepaper, we review the attributes of an active system using gas detection against using a passive approach.

This paper refers to the ATEX Directive and EU references. The principles apply to the UK requirements post-BREXIT.

INTRODUCTION

A business using substances that have the potential to create a gas/air mixture, that might then be ignited by an ignition source (such as a contactor on a forklift truck), will be obliged to operate under the requirements of the ATEX Directive.

This will affect the choice of materials handling equipment that can be used, as it too must meet the strict requirements of the ATEX Directive.

Compliant equipment is not readily available from the standard portfolio of most materials handling equipment providers. They will, in-turn, work with conversion companies to modify the equipment to meet the needs of the Directive.

This white paper explains the two options available when modifying trucks intended to work in an area classified as Zone 2, which makes up the majority of classified areas. It provides information on passive and active approaches that can assist the user in determining the optimum solution for their hazardous applications.

EXPLOSION PROTECTION MEASURES

In 2006 a new Directive, ATEX 1999/92/EC, became mandatory to protect workers potentially at risk from explosive atmospheres. This obliged the employer to take technical and/or organisational measures to prevent the formation of explosive atmospheres or avoid the ignition of explosive atmospheres and mitigate the detrimental effects to workers.

In places where explosive atmospheres may occur, the employer shall classify them into Zones and take the appropriate explosion protection measures:

- control releases (intended or otherwise),
- prevent ignition hazards,
- plant and equipment (such as fork lift trucks) shall only be brought into service if they are safe to use in a potentially explosive atmosphere and
- provide optical and/or acoustic warnings so that workers can be withdrawn before explosive conditions are reached.

Areas are zoned according to the frequency and duration of the occurrence of an explosive atmosphere. Hazards can be gas/vapour, powder or dust.

The zone designation will be from Zone 0 to 2 for gas and vapour and Zone 20 to 22 for dust. The lower value number being the highest frequency and duration.

ABOUT ZONE 2

Zone 2 is where an explosive atmosphere consisting of a mixture of air and flammable substances in the form of gas, vapour or mist is not likely to occur in normal operation, but if it does occur, will persist for a short period only.

Zone 2 makes up most of the area classifications in industry and the employer usually has two types of protection to choose from for the materials handling equipment, both of which must comply to the ATEX requirements.

1) Passive protection

2) Active protection using gas detection

PASSIVE PROTECTION

OVERVIEW

Passive protection involves isolating ignition sources from the gas/air mixture by housing components inside enclosures, using encapsulation techniques or replacing components with a suitable alternative.

Additionally, temperatures will be monitored, electrostatic risks and mechanical ignition sources shall also be addressed.

STRENGTHS

The design of the passive approach means that the equipment can work through an uncontrolled release.

There are no consumables such as calibration gas.

WEAKNESSES

If a gas/vapour release occurs, for example from a leaking drum deep in a storage location, the operator will not be made aware when approaching the spill area, unless additional measures such as fixed gas detection systems are installed in the facility.

Some passive solutions are promoted as “maintenance free” which is misleading.

As all electrical equipment remains energised, even if a gas release occurs, passive protection relies on good maintenance and inspection routines to ensure integrity of the explosion protection concepts is maintained.

> *Example: The main contactors and fuses are likely to be located in flameproof Ex d enclosures. If during use the enclosure is damaged or during routine truck maintenance the enclosure cable entries (glands) are not re-tightened, the enclosure lid surface is damaged or fixing screws not tightened then the Ex-protection of the enclosure is compromised and will not prevent an explosion occurring.*

Passive conversions usually take longer than active conversions. Additionally, maintenance costs could be high as the Ex-modifications to the OEM components will need to be repeated when a part is replaced; for example a pump motor on a pallet truck will require a full flameproof Ex d conversion. Overall, this could result in increased labour time and increased component part costs.

Finally, the ATEX 1999/92/EC User’s Directive stipulates in ANNEX II that:

> *2.6. Where necessary, workers must be **given optical and/or acoustic warnings** and withdrawn before the explosion conditions are reached.*

Passive conversions will not give any warning, potentially leaving the operator unaware of an explosive atmosphere having become present following an accident, spill or leakage which may not be obvious.

“Passive systems are not maintenance free”

ACTIVE PROTECTION

OVERVIEW

The other solution for equipment working in Zone 2 areas is an active system using gas detection, where the equipment will be brought to a controlled stop and electrical systems turned off on detection of flammable hydrocarbons.

The gas detection system consists of a gas sensing head that, once initiated, is constantly monitoring the atmosphere as the equipment moves within the facility, for the presence of flammable vapours and gases. If a low concentration is detected an audible and visual alarm will be triggered but the truck retains full functionality. This allows the operator to take appropriate action, such as lowering the load and driving out of the area.

If a higher concentration is detected the operator gets an audible and visual alarm and the truck is brought to a controlled stop thereby eliminating ignition sources from the truck. The operator is able to leave the area.

As such situations are uncommon, by the definition of zone 2 area classification, a gas detection activation and shutdown should be investigated to ensure the area is safe to operate in. The gas detection system should not automatically reset or allow the operator to reset it. Reset should only be carried out by the Person in Authority on site who holds the reset device (key).

Once the area and truck are cleared for safe return to operation, as long as no gas/air mixture remains, the gas detection system will allow the truck to be started up safely again.

"...workers must be given optical and/or acoustic warnings..."

STRENGTHS

One of the main advantages of active gas detection is the confidence for the operator that they will receive audible and visual alarms if they approach a release of flammable gas or vapours.

As the gas detection system continues to monitor even when the truck is switched off, the system will still activate the warnings and shutdown if a release occurs whilst the truck is unattended. The operator is then aware that a release had happened in the area and can take appropriate actions.

The use of gas detection also satisfies the ATEX 1999/92/EC User's Directive requirements in ANNEX II that states:

> *2.6. Where necessary, workers must be **given optical and/or acoustic warnings** and withdrawn before the explosion conditions are reached.*

From a service and maintenance perspective, active solutions are generally less invasive than passive solutions. Taking the pallet truck pump motor as the same example, the active solution modifies the motor to restricted breathing Ex nR which is more cost effective for the initial conversion and also for any subsequent replacement.

Gas detection technology can be provided in two forms: pellistor and infrared (IR), each offering their own unique advantages. Pellistor gas sensing heads are suitable for a wide range of flammable gasses and therefore the preferred option for most applications. Silicone, in large quantities, can poison pellistor heads and therefore an infrared sensor may be more appropriate. Infrared sensors are suitable for specific applications which is confirmed during the pre-sale assessment as IR technology is not appropriate for every application. For example, IR sensors do not respond to Toluene which is a common product in our industry and therefore this technology is not suitable.

Generally, active systems are easier and more cost effective to operate and maintain than passive systems.

Conversion times are typically faster than passive systems.

WEAKNESSES

In some applications, neither pellistor nor infrared gas sensing heads are suitable; in which case a passive system should be used.

If the system uses an onboard gas bottle for the pre-start-up calibration and integrity checks, the bottle will need to be replaced periodically. This is usually every year and is an additional cost. This is however outweighed by the cost and delay of replacement parts and the annual service/maintenance costs seen on most passive systems.

If the system does not use an onboard gas bottle, the quantity of gas sensing heads will be duplicated, increasing the lifetime cost for replacement parts.

SUMMARY

When assessing the optimum Zone 2 solution for your application there are two solutions available to you, and although both meet the requirements of the Directive, they differ in what they offer the end user.

The passive approach typically only provides warning for over-temperature conditions and will not warn or shut down if the equipment approaches or enters a flammable gas or vapour cloud. Lifetime costs might prove to be higher than the active approach; passive systems are certainly not “maintenance free”.

Active gas detection will provide feedback on the status of temperature monitoring and will also provide warning if explosive concentrations are being reached and will automatically take necessary action. The control system might also provide some system fault diagnosis information. With the less invasive conversion approach lifetime costs are likely to be lower than for passive systems.

Our recommendation is that whoever you chose to provide your solution for zone 2 applications, check that the choice of gas detection sensor meets your requirements, understand if the system uses a gas bottle or multiple sensing heads, to understand the lifetime cost and for passive systems understand the true maintenance requirements as no Ex equipment is “maintenance free”.

With active protection, this VNA operator will be made aware of a gas leak.

ABOUT PYROBAN

Pyroban provide explosion protection solutionsfor materials handling equipment and diesel engines.

For nearly 50 years we have been at the forefront of the industry developing products to protect your people, your site and equipment when operating in hazardous areas.

QUALITY

Additional to the ISO9001:2015 quality standard certification, each Pyroban Group company attains the required level of 3rd party certification for the business markets it serves including ATEX, IECEx, GB and NEC.

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