DUST EXPLOSION PROTECTION

dos and don'ts in grain and milling industries

Mark Shannon from BS&B Safety Systems shares key tips on ensuring adequate protection from dust explosions and what mistakes to avoid

Devastating grain dust explosions have been recorded for decades as the risk of flour dust ignition is so high. Without adequate controls and safety measures, grain flour explosions have been known to level entire milling facilities and take lives. While mill owners are making the effort to comply with DSEAR and ATEX regulations to ensure their staffs' safety, the execution of preventive measures has not always been correct. Many milling facilities share common problems when it comes to the installation of protective equipment. In some cases, they inadvertently exclude "fail-safes" where necessary.

Here are some examples of the most regularly encountered issues when it comes to protecting against dust explosion risk in grain processing and milling. These observations come from years of experience. Always seek the help of a professional to visit your site and make the recommendations bespoke to your facilitys' needs.

The management of hot particles

By detecting and preventing sparks, embers and hot particles from reaching dust rich downstream process equipment, such as dust collectors; bins and silos, both fire and explosion risks can be managed.

Dust explosion severity classifications are measured from St1 to St3. Grain dust has an St1 rating – not the highest explosion severity, yet grain dust can ignite at a fairly low temperature and that makes it a dangerous combustion risk. If a known risk may exist then a spark detection system should be installed to counteract the risk of severe damage and harm to personnel.

Don't forget to protect bucket elevators

Bucket elevators are high risk equipment because they have many possible ignition sources. What's more, they are usually connected to the rest of the plant, so if there are sources of ignition, a primary explosion could easily spread to the other processes and a secondary explosion occur.

Overlooking isolation of connected equipment

If you fit an explosion vent to a dust collector, then there must be isolation of the dirty inlet duct and isolation of the clean air outlet duct if it returns to the process area. This is vital because the explosion could propagate along these ducts causing other safety risks to people and equipment. Non-isolated equipment could cause a chain reaction of explosions.

Explosion vent installation errors

Do fit an explosion vent duct, but make sure it's done properly and that it's the correct size for your process requirements. Failure to do so will result in a variety of dangerous health and safety risks:

- The possible leak of combustible materials from an incorrectly fitted vent could result in burning materials being expelled at high pressure with a possible flame reach of between 10 and 30 metres. Factor in changes to the manufacturing process being used in relation to the size of vent required. i.e. if the materials that you are processing have changed and have a higher Kst and PMax value, then explosive pressures may have increased.
- Vent ducting must be properly calculated and engineered to strict guidelines so that the flame path can escape freely to a safe area without any backpressure. Correct size and length of ductwork is key to the efficient performance of a vent.
- Ensure that your vent discharge path cannot possibly endanger nearby personnel. If a hazard exists due to explosion venting,

then clearly indicate the area with signage and cordon it off.
- Do not obstruct the explosion vent path.
- Do not try and make your own vent – have it professionally calculated and installed. Otherwise you are at risk of unsafe performance.
- Once your vent is correctly installed ensure it is regularly inspected and that the inspection records are visible.

Unsafe ducting and pipework

Weak explosion ducts can encourage an ignition to transform into a destructive explosion. The strength of explosion vent ducts should be calculated so that they can withstand the maximum pressure of a vented explosion (Pred). Always avoid long horizontal runs of ductwork which attract uninterrupted dust build up.

Silos and storage bins inadequately protected

Venting is often the most appropriate preventive measure for silos because of the potential explosive pressure that can build up inside them. Vents should be placed on the top of the silo or on the sides at a height above the contained material.
- Silos need to be able to withstand explosion pressures. The length to diameter ratio of the silo is important when calculating the vent area. Correct vent area sizing is critical so that the vent is large enough to prevent damage from explosive pressures.
- Always test the material to be stored or handled and determine its Kst value and PMax. Both of these figures will allow for the size of vent area required in your silo. Guessing the Kst and the PMax is the lazy and unsafe option.

Electrical grounding and bonding not in place

Electrical sparking in a dusty environment just invites disaster. Ensure that grounding wires are not broken or unconnected. Do you know the MIE (Minimum Ignition Energy) of the dust? Dusts with an MIE < 10mj should be treated carefully. If there is piping across a flexible connection, make sure it is well bonded. Static is a big risk factor on dusts with low MIE values and it wouldn't take much to cause a fire or explosion.

Improve housekeeping

Arguably the most obvious activity but the most overlooked - cleaning up the dust. Dust accumulations in the ceiling spaces, beams and walls can fuel an explosion to the point of destroying a mill. Ensure your employees know where the dust accumulation 'hot spots' are and keep them clean. Do not use air sprays to remove dust, this just creates a dust cloud which is a secondary explosion risk waiting in the atmosphere.

Absence of risk management

As part of your risk management strategy, it's important to seek advice from an explosion protection consultant who can provide the right advice on what controls you need. A new installation of any equipment handling dusty product must be based on measurable data, so that your mill will be sufficiently protected.

So in summary before the installation of dust handling equipment, always carry out a combustible dust test and subsequently review your combustible dust classifications (KSt and Pmax levels) at regular intervals as process operations and materials change. This provision should be incorporated into Management of Change procedures.

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