

Note: This guidance note is produced in good faith and may not cover all risks and eventualities with all equipment of this type. If in doubt, our process safety specialist team will be delighted to help you navigate risk assessment, basis of safety definition and testing requirements.

POTENTIAL FIRE AND EXPLOSION CONSEQUENCES

- Ignition of a dust cloud resulting in a flash fire causing potentially serious burns.
- Agitation of powder and entrainment in the air stream generates flammable dust cloud, resulting in blast effects including, flame ejection, pressure effects and/or projectiles with possible explosion propagation into upstream interconnected equipment.

OVERVIEW

This method of transferring powders is often used in many industries such as the chemical, energyfrom-waste, and food industries, to convey large amounts of powdered material quickly. The tanker will often use an on-board compressor, or sometimes the site will use their own for hygiene reasons, which generates a fast moving stream of compressed air which entrains the powder from the tanker and carries it along a transfer line to the intended vessel. Once inside the vessel the powder disengages from the air and settles, while the air can be exhausted via a filter plenum. Pneumatic conveying need not be to a silo or from a tanker but will often be between two vessels with similar risks. The agitation of the powder and entrainment in the air stream will generate a flammable dust cloud by definition with flammable powders.



IMAGE 1. SILOS AND ROAD TANKERS

SUMMARY OF DUST EXPLOSION RISKS

MOST LIKELY INTRINSIC IGNITION SOURCES	MOST COMMON BASIS OF SAFETY	TEST REQUIRED TO SUPPORT BASIS OF SAFETY
 UNSUITABLE OR MALFUNCTIONING ELECTRICAL APPARATUS; 	CONTROL OF IGNITION SOURCES	IGNITION TEMPERATURE OF CLOUD AND LAYER (MIT AND LIT)
MECHANICAL FRICTION AND HOT SURFACES;	AND	MINIMUM IGNITION ENERGY (INDUCTIVE SPARK)
MECHANICALLY GENERATED SPARKS; STATIC ELECTRICITY.	EXPLOSION PROTECTION (FOR CONNECTED VESSELS)	MINIMUM IGNITION ENERGY (CAPACITIVE AND INDUCTIVE SPARK)
STATIC LLLCTRICITI.	CONNECTED VESSEES)	• 20 L SPHERE

Peripheral / associated risks to consider:

- If the filters that exhaust the air to atmosphere are blocked the vessel being filled can be exposed to the full pressure of the conveying compressor. This can be significant and can either rupture the vessel vent panel or even rupture the vessel if it is not protected.
- Although the compressors that provide the air flow will not normally contain any dust, sources of ignition produced by them will be conveyed into the powder.

RISKS

- The fast movement of material in pneumatic transport gives rise to a lot of charge being generated, especially when using hoses made of insulating material. For plants handling foodstuff, food safe materials will be required. An example of this is food grade rubber conveying hoses that connect tankers to the filling line for silo. These will have a metal braid running though the wall that is bonded to the metal fixing on each end, in turn ensuring no conducting metal components are left isolated from earth. In this situation, a propagating brush discharge can occur where the accumulated charge punctures the wall to flow to earth. This form of discharge has a very high energy which will ignite almost all know flammable powders.
- Other ignition sources will likely not be directly from the transported powder but by other objects that may be entrained in it. An example of this is foreign objects such as loose bolts etc. that are bought in with the bulk material. High speed impacts between these items and, for example, the walls of the conveying line can form incendive sparks. Any ignition sources that are produced by the blower such as impact sparks from a fan malfunction may escape down the blowing line and be introduced to a flammable dust cloud. To control these ignitions sources blowers should be installed such that the air passes through two filters in series.
- It is not common practice to use Explosion
 Protection techniques such as Explosion
 Venting, rather if some ignition sources cannot
 be controlled it is possible to operate conveying
 lines with flow though inerting. Due to the
 peripheral asphyxiation risks of using inert
 gases such as nitrogen, this should no be
 seen as preferable to ignition source
 control.

POTENTIAL SOURCES OF IGNITION

From the 13 identified sources of ignition taken from EN 1127-1, those which are considered most likely to occur with sack rip and tip stations are:

- 1. Flames and hot gases (including hot particles)
- 2. Unsuitable or malfunctioning electrical apparatus
- 3. Mechanical friction and hot surfaces
- 4. Mechanically generated sparks
- 5. Static electricity

TESTING REQUIRED TO MITIGATE THE POTENTIAL SOURCES OF IGNITION

- Minimum Ignition Energy (Capacitive assessment) – to assess the potential of incendive spark discharges from isolated conductors and and potential propagating brush discharges in transfer lines.
- Minimum Ignition Energy (Mechanical spark assessment) – to assess the potential of mechanical sparks.
- Minimum Ignition Temperature (dust cloud) for correct specification of Temperature Class rating of ATEX equipment and used in conjunction with MIE (mechanical) to assess the potential of mechanical sparks.
- Layer Ignition Temperature (5 mm layer) used with MIT (dust cloud) for the correct specification of



TYPICAL BASIS OF SAFETY

A proposed Basis of Safety for a Pneumatic Conveying would be the Control of Ignition Sources by using full metal construction and connecting of all items to earth. This basis of safety can be supplemented with nitrogen inerting but is not often recommended due to peripheral risks this introduces.

OTHER CONSIDERATIONS

Nitrogen inerting may be used to further control ignition sources should normal control measures as discussed not be sufficient to reduce the risk. Should this be the case then for any sections of the conveying line which passes though occupied and enclosed area, an asphyxiation risk assessment should be carried out considering scenarios of leaks of inert gas leading to oxygen depletion.

PROCESS SAFETY

The breadth and depth of expertise in process safety makes us globally recognised specialists and trusted advisors. We help our clients to understand and evaluate their risks and work together to develop pragmatic solutions. As a part of the world's leading expert organisation DEKRA, we are the global partner for a safe world.

DEKRA PROCESS SAFETY TESTING

- Flammability/combustibility properties of dusts, gases, vapours, mists, and hybrid atmospheres.
- Chemical reaction hazards and chemical process optimisation (reaction and adiabatic calorimetry RC1, ARC, VSP, Dewar).
- Thermal instability (DSC, DTA, and powder specific tests).
- Energetic material, explosives, propellants, pyrotechnics to DOT, UN, etc. protocols.
- Regulatory testing: REACH, UN, CLP, ADR, OSHA, DOT.
- Electrostatic testing for powders, liquids, process equipment, liners, shoes, FIBCs.

PROCESS SAFETY CONSULTING

- Dust, gas, and vapour flash fire and explosion hazards.
- Electrostatic hazards, problems, and applications.
- Reactive chemical, self-heating, and thermal instability hazards.
- · Hazardous area classification.
- Mechanical equipment ignition risk assessment.
- Transport & classification of dangerous goods.

PROCESS SAFETY MANAGEMENT (PSM) PROGRAMMES

- Design and creation of relevant PSM Programmes.
- Support the implementation, monitoring, and sustainability of PSM Programmes.
- Audit existing PSM Programmes, comparing with best practices around the world.
- Correct and improve deficient programmes.



DEKRA Organisational & Process Safety **Contact**

DEKRA Organisational and Process Safety are a behavioural change and process safety consultancy company. Working in collaboration with our clients, our approach is to assess the process safety and influence the safety culture with the aim of making a difference.

In terms of behavioural change, we deliver the skills, methods, and motivation to change leadership attitudes, behaviours, and decision-making among employees. Supporting our clients in creating a culture of care and measurable sustainable improvement of safety outcomes is our goal.

The breadth and depth of expertise in process safety makes us globally recognised specialists and trusted advisors. We help our clients understand and evaluate their risks, and we work together to develop pragmatic solutions. Our value-adding and practical approach integrate specialist process safety management, engineering, and testing. We seek to educate and grow client competence in order to provide sustainable performance improvement. Partnering with our clients, we combine technical expertise with a passion for life preservation, harm reduction and asset protection.

We are a service unit of DEKRA SE, a global leader in safety since 1925 with over 48,000 employees in 60 countries and five continents. As a part of the world's leading expert organisation DEKRA, we are the global partner for a safe world.

We have offices throughout North America, Europe, and Asia.

For more information visit www.dekra-uk.co.uk

Would you like more information?

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