Plastics and Insulating Materials-

Containing the risk in hazardous areas

Traditionally, flammable liquids have been transported in metal drums and the need to earth these during filling and emptying operations, in order to prevent the build up of static electricity, is generally well known. Likewise, powders were often stored in paper sacks or fibre kegs, which allow a reasonable degree of static dissipation. This topic was discussed in detail in the last issue of Ear To The Ground, copies of which are still available from Newson Gale Ltd.

Over the past few years, the need to improve efficiency has often led to materials being stored and moved in larger bulk. Today, it is quite common for liquids to be transported in 1000 litre containers, and powders in 1 tonne bags, both of which are approximately 1 metre cubed. These larger containers are generally produced from moulded plastic, as with IBCs (Intermediate Bulk Containers), and polypropylene fabric in the case of FIBCs (Flexible Intermediate Bulk Containers). Often pipes used to transfer these products are lined with plastic or PTFE, for corrosion resistance, hygiene or avoidance of contamination. This use of insulating materials presents three areas of risk in flammable atmospheres:

1) The liquid or powder in the container is likely to have built up an electro-static charge during the transfer operation, and even a conductive material will retain its charge, as the container or pipe will prevent it from flowing back to earth.

This could lead to a static discharge from the surface of the material if, for example, it was approached by an earthed container for sampling.

2) An insulating container will gather charge during filling, in a similar manner to an unearthed metal one. When the electro-static field reaches the breakdown strength of air, a brush discharge could occur at the container surface.

Whilst likely to be less energetic than a spark from unearthed metal, it will still ignite many solvent vapours and occasionally, certain dust clouds, particularly the low MIE powders used in modern pharmaceutical operations.

3) The container could allow metal parts, such as its tap, to become isolated conductors, which could give rise to energetic spark discharges. Even a tool placed on top of a plastic IBC could become charged and spark to the unit's metal strengthening frame.

Large plastic containers can also cause a charge to be induced on nearby objects or personnel. This is particularly true of insulating FIBCs.

Ensuring Safety - Controlling the Risk

Owing to developments in materials technology, it is now possible to obtain plastic kegs, large IBCs, FIBCs and pipe grounding paddles, specifically designed for use in hazardous areas.

Large plastic IBCs are now available with a complete steel shroud, in addition to their strengthening cage, which will prevent discharges from their surface, providing they have been suitably earthed using a discharge lead and clamp. They also have a conductive valve, protruding into the liquid, to give a static-dissipation path. Using a different approach, but giving a similar result, kegs are now being produced from plastics that contain a conductive substance, usually carbon. These should have an electrical resistance of less than 1x10^8 ohms, and are designed to dissipate static electricity. This will prevent the risk of brush discharges from their surface, and will give a path for electrical discharge of their contents.

In all cases, these type of containers should be suitably earthed using either a discharge lead and clamp, or in the case of the kegs, by being in contact with an earthed metal plate.

FIBCs have now been categorised into four categories, A, B, C and D by the Swiss Institute of Safety and Security. The type C variety contains thin conductive strips spaced closely together in the polypropylene weave. All these strips are interconnected at the seams, and via the lifting handles and a labelled earthing point. These conductive parts will carry away any static electricity on the surface of the bag, and provide a path to dissipate static electricity from the powders within.

Type C bags have been proved to be safe for use in flammable atmospheres, providing they have been earthed using a suitable discharge lead and clamp, such as the special FIBC clamp. A common worry with these bags is the uncertainty of whether or not an earth has actually been achieved, and a solution to this problem has been found in the Cenelectrex Earth-Rite FIBC system, which was specially designed to work with static-dissipative plastics, including type C FIBCs. Besides monitoring the earth, this system has the added benefit of ensuring that the correct type of FIBC or plastic liner is being used, and importantly, that it is working within its specification.

If a pipeline is made from insulating plastic or lined metal, its contents will be prevented from dissipating static electricity through the pipe wall and back to earth. However, by introducing a static-dissipative Grounding Paddle between each flange connection, with an external bond to the grounded metal pipe or other suitable earth, static dissipation paths along the length of the pipe are provided. A complete range of Grounding Paddles is now available for many pipe diameters to ensure that the contents of lined pipes can dissipate their static, whilst moving along the pipe.

Warning

There is a common misconception that attaching an earthing lead to an insulating plastic container will make it safe. This is certainly not the case, as the container will prevent charge moving towards the lead and down to earth. Likewise, a lead attached to the metal frame of a regular plastic IBC will not discharge static electricity from areas of the plastic not directly in contact with the frame.

It should also be noted that even when conductive or dissipative containers are correctly earthed, any insulating contents may retain charge for some considerable time. Liquids that are conductive will loose their charge rapidly if the correct earthing conditions are met, but many powders tend to be non-conductive.

Table of Typical Resistance Values of Static-Dissipative Materials

Static-dissipative (or anti-static) materials are described as those with the ability to allow static-electricity to flow back to earth faster than it can be generated. These may be compared to conductive metals, which usually have a resistance of less than 10 ohms.

Examples include:

Grounding paddles	“	“	1x10^6 ohms	
Type C FIBCs	“	“	1x10^8	“
Dissipative kegs or liners	“	“	1x10^8	“
Anti-Static footwear	“	“	1x10^9	“

Reference Sources

The above information is based on the following literature :
British Standard 5958 Control of Undesirable Static Electricity (1991)
Cenelec Report R044-001 Avoidance of Hazards due to Static Electricity (1999) ■