White Paper

Controlling Static Hazards when handling IBCs in potentially hazardous atmospheres

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Introduction

The UK's Health & Safety Executive, in collaboration with the Chemical Business Association (CBA) and Solvent Industry Association (SIA) has issued general guidance outlining the type of assessments that should be carried out to manage the risks associated with IBCs storing flammable and combustible material.

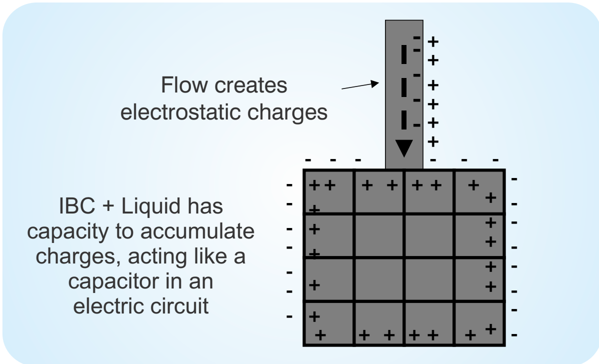
Of particular interest is the assessment for managing the risk of electrostatic ignitions. The HSE refers to the SIA's notice No.51a which provides guidance on minimising the risk of incendive electrostatic spark discharges when storing solvents in IBCs.

Electrostatic hazards and IBCs

The risk of electrostatic discharges in potentially flammable or combustible atmospheres is well documented in best practice standards like Cenelec's CLC/TR:50404 and NFPA 77. Although identifying static as a hazard is difficult to visualise, as it is not readily tangible or easily detectable, the underlying theory and safe practices that can be put into place are relatively straightforward.

The flow of any material in pipes, filters and fittings, whether the material is conductive or non-conductive, results in the separation of charges. The separation of 1 electron in half a million is all that is required to provide the right conditions for an incendive spark discharge to occur. Much the same way a spark plug works in the engine of a car, electrostatic discharges result from the existence of a spark gap. The spark gap only needs to be momentary and if a flammable or combustible atmosphere is present in the spark gap, the energy released can exceed the minimum ignition energy of the surrounding atmosphere. Uncontrolled spark discharges have enough energy to ignite the majority of flammable atmospheres.

When liquid entering an IBC has surplus charges attached to it, it creates an electric field which induces opposite charges on the inner wall of the IBC. If the IBC is not properly grounded, it will act like a capacitor plate in an electric circuit, accumulating charges on the outer surface of the IBC.



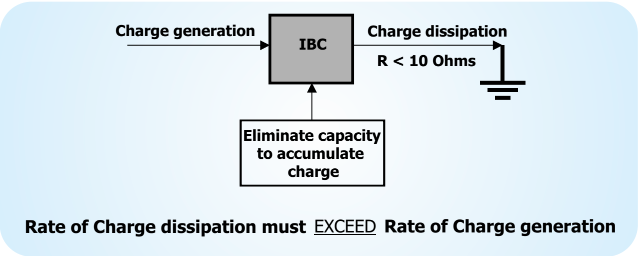
The accumulation of charges is now a potential ignition hazard as surplus charges are available to discharge to objects in the vicinity of the IBC in an uncontrolled manner. The commonest form of object charged IBCs will discharge to are grounded conductors like surrounding plant equipment, dip tubes, forklift trucks and, most commonly, the operator handling the IBC. What is of critical importance is that the IBC is conductive and has a low resistance static dissipative connection to earth. This will enable any surplus charges to flow immediately to ground from the hazardous area in a controlled manner. The standards, including the guidance issued by the SIA, categorically state this resistance must be less than 10 ohms and regularly checked to ensure the IBC is always capable of dissipating charges.

A connection resistance of 10 ohms or less ensures there is no doubt that the rate of charge dissipation exceeds the rate of charge generation and charge accumulation, allowing the static charges to be dissipated safely from the IBC.

It follows that the first thing an operator must do before filling or dispensing from an IBC is to ensure the IBC has a positive static dissipative ground connection.

There are also a number of additional factors that must be borne in mind when using IBCs. Filling flow rates and the conductivity of the liquid are especially important factors to consider. When the IBC is filled initially, a potential spark gap will be present between the end of the filling pipe and the surface of the liquid. The SIA guidance recommends 1 m/s until the fill pipe is covered by the liquid and a limit of 2 m/s thereafter. Splash filling must be completely avoided as this will encourage the separation of charges.

If the liquid is conductive charges can dissipate through the conductive wall of the ground connected IBC. If the liquid is low conductivity (<50 pS), the appropriate charge relaxation times should be incorporated into the handling process. NFPA 77 provides a comprehensive list of flammable liquid conductivities and their corresponding charge relaxation time periods.



The IBC types

The proliferation of IBC types can complicate the application of best practice static control procedures. Lower cost materials like plastic IBCs are being developed in response to the cost of purchasing IBCs made from stainless steel. It is of paramount importance to consult experts and relevant static control guidance documents when selecting IBCs that are potentially non-conductive.

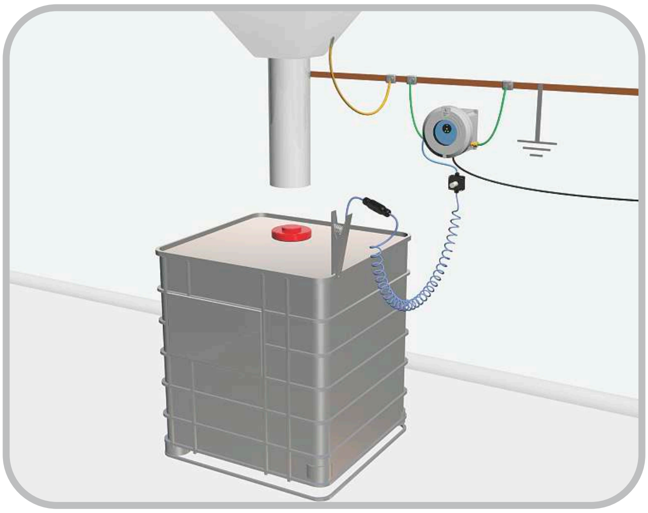
The Solvent Industry Association guidance notice No.51a provides clear instructions on the types of IBC to be used depending on the solvent flash point and its tendency to conduct or insulate charges (oxygenated or hydrocarbons). Depending on these parameters, either stainless steel IBCs or composites with "anti-static sheaths" are recommended.

In any event, whatever type of IBC is used, it is of paramount importance to ensure any conductive parts that make up the IBC system including the filling pipe, funnels, nozzles and dispensing cans are all bonded and connected to a dedicated static dissipative earth with a continuous resistance of less than 10 ohms. It is also prudent to ensure composite IBCs handling flammable materials are at least classified as static dissipative.

Methods for demonstrating compliance

There are several ways of ensuring an IBC has a low resistance static earth connection. The easiest way is to provide flexible quick releasing static earthing clamps that are designed to make positive low resistance electrical contact with the IBC. The static earthing clamp should have a conductive connection to a dedicated static earthing point. It should contain a positive clamping mechanism capable of achieving low resistance connection to the IBC and be capable of maintaining positive contact in response to vibration effects when the IBC is being filled. Wherever possible IBC users should specify clamps approved for use within hazardous areas. This will provide additional security and guarantees the clamp will do what is designed to do – *dissipate static effectively and safely*.

ATEX certification guarantees clamps are not made from material or components that could act as mechanical sources of sparking. Factory Mutual (FM) approved clamp tests ensure clamps are conductive to less than 1 ohm, are capable of maintaining positive electrical contact in response to pulling forces and cannot be disconnected due to equipment vibration. Clamps with combined FM and ATEX certifications provide the most comprehensive and convenient safeguards against electrostatic ignitions.



Instead of maintenance engineers regularly monitoring and maintaining static dissipative grounding circuits and connections, it may be more convenient to adopt the use of self-testing static grounding clamps to offset the time required to monitor the condition of circuits (*and the risk of it not being done at all*). Each time the self-testing clamp is connected by the operator to an IBC a bright green Light Emitting Diode flashes informing the operator the IBC has a groud connection of 10 ohms or less. The clamp continuously monitors the circuit between the IBC and the designated factory earth point so should the clamp lose its connection to the IBC the LED will stop flashing, warning the operator of a potential fire hazard.

When a company is running processes that require frequent or repeated filling of IBCs, it may be desirable to add an extra dimension of safety to the options outlined above. If a ground connection, for any reason, is compromised the rapid generation and accumulation of static charges in the IBC can be eliminated by cutting the flow of material into the IBC. If the risk assessment concludes there is a likelihood that connections have the potential to be compromised, or not made should operators forget to clamp the IBC, output control contacts can be specified to safeguard against such events. Earthing systems with output control contacts prevent the flow of charged material into the IBC when the system detects a lost connection.

The above measures pertain to IBCs that are metallic and are highly conductive. In processes that require static dissipative composite IBCs, users need to specify earthing systems that can monitor to the recommended static dissipative levels. IBC vendors must be capable of informing customers whether or not the IBC is classified as conductive or static dissipative and what the maximum volume resistivity of the IBC material is.

The main points to consider with each of these options is they enable companies to demonstrate compliance with recommended industry best practice and provide options to customers with different approaches to fire risk management of IBCs.

Checklist for effective static control in hazardous areas:

- Identify hazardous areas and processes where static electricity may accumulate.
- Specify conductive or static dissipative items of plant, equipment and packaging. Only use insulating plastics after carrying out thorough risk assessment/hazard evaluation.
- Ensure correct Grounding & Bonding and other prevention techniques are in place, and are properly maintained.
- Provide on-going training and awareness for employees and contractors in safe working practices in hazardous areas.

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