GROUNDING MONITORING

Notes On The Evaluation and Avoidance of Electrostatic Charges

Electrostatic charges can occur when two surfaces are rapidly separated, whereby at least one surface must be an insulator. Critical processes, for example, are pneumatic conveyors, Big Bag filling stations, or even silos with the danger of a conical pile discharge. In order to avoid electrostatic discharges at such FIBC filling stations, it is necessary to assess the bulk material and to select the proper FIBC Type.

Electrostatic discharges and their ignition potential

Energy Ascending	Discharge Type	Hydrogen / Acetylene Mie ≤ 0.025 Mj	Solvent Vapours Mie > 0.025 Mj	Dust > 1 Mj Mie > 1mj
+++	Propagating Brush Discharges	+	+	+
+++	Conical Pile Discharge	+	+	+
++	Sparks	+	+	+
+	Brush Discharge	+	+	–

Fig. 1: Electrostatic discharges and their ignition potential. Source: www.bgrci.de

Selection of the suitable Big Bag

Big Bags, also referred to as FIBC´s, are divided into the types A, B, C, D, which can be categorized according to their protective characteristics as follows:

Avoid brush discharges: Type C and D

Avoid propagating brush discharges: Type B, C and D

Avoid spark discharges: Type B, C and D

Type C Big Bag has conductive filaments, which makes it necessary to ground type C Big Bag. Such grounding can be carried out by means of a cable and clamp. Another option is the grounding by means of a grounding monitoring system such as FARADO II FIBC. An approval function enables the Big Bag Type C to only be filled if the grounding is correctly established.

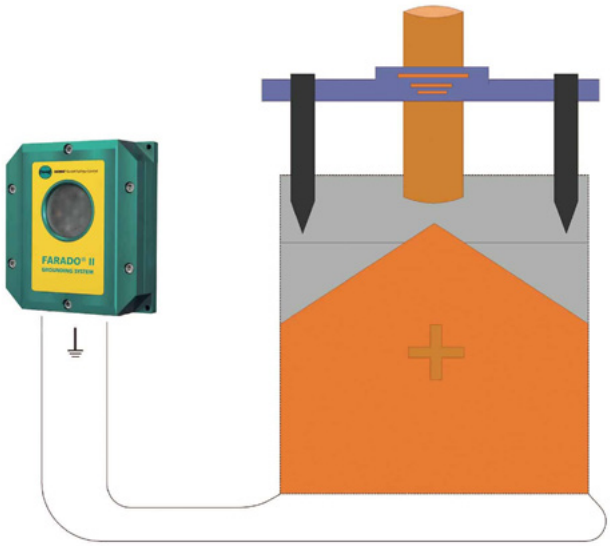

Fig. 2: Electrostatic charges by means of grounding monitoring device FARADO II FIBC

Type D FIBC transfers the resulting charges to the environment via dissipation. However, this requires grounding of all conductive equipment and objects located within reach of the type D Big Bag. Likewise, persons must wear conductive footwear, otherwise these persons will be charged up as well and act as an ignition source themselves.

The Big Bag must be selected strictly in accordance with the requirements of IEC TS 60079-32-1 “Explosive Atmospheres – Electrostatic hazards, Guidance”, and depends on the minimum ignition energy (MIE) and the zone classification. However, the division also depends on the zone defined on the outside. If a gas zone is present at the same time, special measures must be considered.

Use of the different types of FIBC

Bulk Product in FIBC	Surroundings		
MIE of dust[a]	Non flammable atmosphere	Dust zones 21-22[b]	Gas zones 1-2[b] (Explosion Groups IIA/IIB)[c]
MIE > 1000 mJ	A, B, C, D	B, C, D	C, D[d]
3 mJ < MIE ≤ 1000 mJ	B, C, D	B, C, D	C, D[d]
MIE ≤ 3 mJ	C, D	C, D	C, D[d]

[a] Measured in accordance with IEC 61241-2-3, ASTM E2019 and EN 13821 with a capacitive discharge circuit (no added inductance)
[b] See D.2 for the definition of zones.
[c] See D.3 for an explanation of Explosion Groups.
[d] Use of Type D should be limited to Explosion Groups IIA/IIB with MIE ≥ 0.14 mJ.
NOTE 1: Additional precautions are usually necessary when a flammable gas or vapour atmosphere is present inside the FIBC, e.g. in the case of solvent wet powders.
NOTE 2: Non-flammable atmosphere includes dusts having a MIE > 1000 mJ.
NOTE 3: The MIE limit of 3 mJ is based on the incendivity of cone discharges. Cone discharges might have a much higher energy in a Type B FIBC than in a Type C or D FIBC because the wall of a Type C oder D FIBC will be at close to zero potential. Based on this fact the internal field distribution will be such that in Type C oder D FIBC cone discharges will at most only jump across half the diameter of the FIBC. A calculation with the formula given in A.3.7 for the largest FIBC commonly used (diameter of 1,5 m) yields 3 mJ for powder with a median size of only 0.055 mm in a Type B FIBC, whereas in a Type C or D FIBC the 3 mJ limit is only reached with a coarse powder having a median size of 0.27 mm or higher. However, such coarse powders usually have a MIE higher than 3 mJ.

Fig. 3: Selection of suitable FIBC types depending on bulk material and operating conditions. Source: IEC TS 60079-32-1

Electrostatic charges during the filling of silos with a pneumatic filling

Another source of electrostatic charges is in places where a pneumatic transport or pneumatic filling of silos by trucks is carried out. If an explosive atmosphere develops outside the truck, and the truck charges up electrostatically due to the conveyance, there will be an acute risk of explosion. For this purpose, always ensure that the truck is properly grounded. Here, there are also systems on the market that are able to monitor the proper grounding of the truck and, via relays, provide an approval system that can be used to control valves or other equipment (Figure 2). In addition to grounding the truck, care must also be taken to ensure that the conveying line is properly executed. Adequate means that this must be electrically conductive/conductive dissipating and grounded.

Insulating intermediate pieces such as sight glasses or similar should be avoided, as these may lead to propagating brush discharging.

Fig. 4: Grounding monitoring of a truck by means of FARADO II

Conical pile discharge in silos

An often not considered circumstance is the possibility of so-called conical pile discharges in silos. Bulk solids are generally not to be regarded as conductive and are dangerously charged during the pneumatic conveying. If the silo is correspondingly large and the median of the bulk material is also larger in median, there is a risk that the cloud of dust above the bulk material will ignite due to a conical pile discharge. If the conical pile discharge cannot be excluded as an effective ignition source, a protection through protective systems must be established in case of doubt.

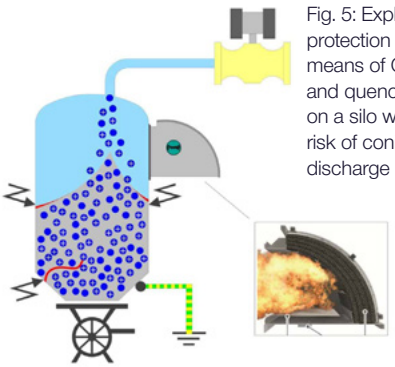

Fig. 5: Explosion protection by means of Q-Box and quench valve on a silo with the risk of conical pile discharge