emmbi
INDUSTRIES LIMITED

Mitigating Electrostatic Ignition During FIBC Operations

Table of Contents

Executive Summary:

Flexible Intermediate Bulk Containers (FIBCs) are one of the most preferred bulk packaging solutions for the storage and transportation of industrial goods, especially dry bulk goods.

Manufactured from woven polypropylene, FIBCs have very high load-bearing capacities. They can be cusytomized in a wide range of sizes and shapes, and can be used for storing and transporting a variety of dry bulk goods like fine powders, chemicals, food products, pharmaceuticals, agro products, construction materials, etc.

Growing at a CAGR of 5.9%, the global FIBC market is estimated to reach USD 6.4 billion by 2026 as per a report from Grand View Research, Inc. [2] With the advent of new-age technologies, FIBC manufacturers like Emmbi continue pushing the innovation envelope and launch new FIBCs in the market every year.

Notwithstanding their innumerable benefits for the bulk transportation and storage of industrial products, FIBCs are prone to electrostatic discharges that can cause fires and explosions with devastating results. In the absence of sufficient safety measures, this can be extremely dangerous for human life and industrial infrastructure.

In this White Paper, we discuss the various aspects involved with electrostatic ignition during FIBC operations.

Understanding Electrostatic Discharges:

An electrostatic charge – also known as static electricity, is something many of us must have experienced at least once in our lifetime. Recall the sudden jolt of tiny electric shock you must have received when you touched the escalator handle, or when you touched a doorknob after walking on a thick fabric carpet. That tiny jolt of electric shock is static electricity at work!

In the case of materials, especially dry goods, when two different materials come into contact with each other, positive or negative electrons can move from one material to the other. This in turn creates a buildup of a positive or negative charge.

Subsequently, when these two materials move away from each other, the positive and negative charges remain on them. Eventually, they release themselves in the form of electrostatic discharge.

In the case of FIBCs, an electrostatic discharge can occur during the loading and unloading stages when the material comes in contact with the FIBC's internal and external walls causing friction. This happens due to the high speed of filling or discharging of materials.

As FIBCs can be loaded and unloaded in seconds, a buildup of electrostatic charge is imminent. Since the rate at which electrostatic charges are generated can often exceed the rate at which these charges can relax, an accumulation of a static electric charge is bound to develop.

If the accumulated charge is strong enough and is released in the presence of a combustible environment, or if the materials are inflammable, an ignition can occur.

Types Of Electrostatic Discharges:

1. Brush Discharges

These are low-energy discrete electrostatic discharges that can occur from insulating surfaces such as the bulked material or the FIBC's wall. The maximum discharge energy is around 4 mJ.

Brush discharges can ignite flammable dusts requiring up to approximately 4mJ for ignition.

2. Propagating Brush Discharges

A propagating brush discharge takes place when materials (such as fine powders) bulk and ions are created. These ions are then repelled and accumulate at the FIBC's walls causing an opposite charge to be created at the FIBC's outer surface.

Since propagating brush discharges have equivalent energy of up to 1 J, they can quickly ignite the surrounding flammable vapors and powder dusts.

3. Bulking Brush Discharges

Bulking brush discharges are partial surface discharges that take place during powder bulking. They appear as a bright, distributed channel that flashes radially from the FIBC's wall to its center.

With effective energy between 10 - 20 mJ, bulking brush discharges can quickly ignite flammable gases, hybrid mixtures, and combustible air particulate matter.

4. Cone Discharges

Cone discharges occur across the surface of the bulked material in an FIBC.

More powerful than brush discharges, the limiting energy of a cone discharge depends on the dimensions of the FIBC and the particulate size of the loaded material.

5. Corona Discharges

Instantly visible as a bluish glow, a corona discharge occurs when the air surrounding an electrical conductor becomes ionized.

While this type of discharge is not as hazardous as others, it results in energy overuse leading to high power costs. In high-voltage environments, it can also release toxic gases.

Mitigating Electrostatic Ignition During FIBC Operations:

Although preventing an electrostatic discharge altogether is difficult, mitigating an electrostatic ignition is possible by choosing the right type of FIBC and implementing suitable grounding mechanisms.

FIBCs are categorized into four types – A, B, C, and D. Choosing the right type of FIBC is crucial to avoid electrostatic ignition.

Additionally, understanding the Minimum Ignition Energy (MIE) of the materials present in a particular environment becomes paramount to choosing the right type of FIBC.

1. Type A FIBCs

Type A FIBCs provide zero protection against static electricity which is generated when materials rub against the internal surfaces of the FIBC when it is loaded or unloaded.

Since Type A FIBCs do not offer any protection against electrostatic ignitions, they should not be used to store or transport flammable materials or used in a combustible environment.

Permissibility: Type A FIBCs should be used only for storing and transporting non-flammable materials with an MIE >1000 mJ.[3]

2. Type B FIBCs

While Type B FIBCs too do not have any mechanism to dissipate static electricity, what sets them apart from Type A FIBCs is that they are made from materials that

have a low breakdown voltage of <5kV to prevent the occurrence of propagating brush discharges (PBDs).

Although Type B FIBCs can prevent PBDs to some extent, they should not be assumed to provide effective antistatic protection as they do not dissipate electrostatic charges. While Type B FIBCs can be used to store and transport dry, flammable materials, they should not be used when flammable solvents or gases are present around them.

Permissibility: Type B FIBCs should be used only in environments where the combustible dusts have an MIE greater than 3 mJ but less than 1000 mJ. [4]

3. Type C FIBCs

Manufactured from non-conductive polypropylene tapes / filaments that are interwoven with conducting threads usually woven in a grid pattern, Type C FIBCs

are also known as ‘E-Conductive’ FIBCs.

The conducting threads must be electrically interconnected and firmly connected to the ground to achieve electrical grounding for dissipating the electrical discharge to the earth.

It is imperative to note that Type C FIBCs should not be used in the absence of a firm grounding connection or when there is any non-conductive obstruction between the grounding mechanism and the earth.

Permissibility: Type C FIBCs can be used in environments where the combustible dusts have an MIE greater than 0.14 mJ. Conductive powders can be used for Type C FIBCs for added protection. [5]

4. Type D FIBCs

Type D FIBCs are manufactured using antistatic and static dissipative materials that prevent accidental sparks, brush discharges, and propagating brush discharges without the need for a separate grounding mechanism.

While Type D FIBCs are the safest type of FIBC to store and transport flammable products, they should not be used if the FIBC's surface is contaminated or has any accidental coating of conductive or flammable materials like grease or oil.

Permissibility: Just like Type C FIBCs, Type D FIBCs can be used in environments where the combustible dusts have an MIE greater than 0.14 mJ. However, conductive powders should not be used for Type D FIBCs.[6]

Summing Up:

Apart from assessing the MIE of dry bulk goods and the surrounding environment in which they are transported and stored, choosing the right type of FIBC is paramount for safe operations.

Since its inception in 1994, Emmbi Industries Limited has consistently introduced a wide range of FIBCs that are suitable for every use case. As a leading polymer processing company headquartered in India, Emmbi's product portfolio spans Packaging, Water Conservation, Human Safety, and Agri-Inputs.

Guided by the philosophy of 'Brighter Every Way', we relentlessly strive to be brighter in the way we think, work and do good for the society.

To learn how Emmbi's FIBCs can help your organisation, please visit **https://emmbi.com/** or write to us at **sales.export@emmbi.com.**

References:

[1] Cover Page Image – Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Big_bag.jpg

[2] Global FIBC Market Size - https://www.grandviewresearch.com/press-release/global-fibc-market

[3], [4], [5], [6] MIE-based Permissibility Limits – Fauske & Associates - https://www.chemicalprocessing.com/assets/wp_downloads/pdf/understanding-risks-associated-with-FIBCS-electrostatic-hazards.pdf