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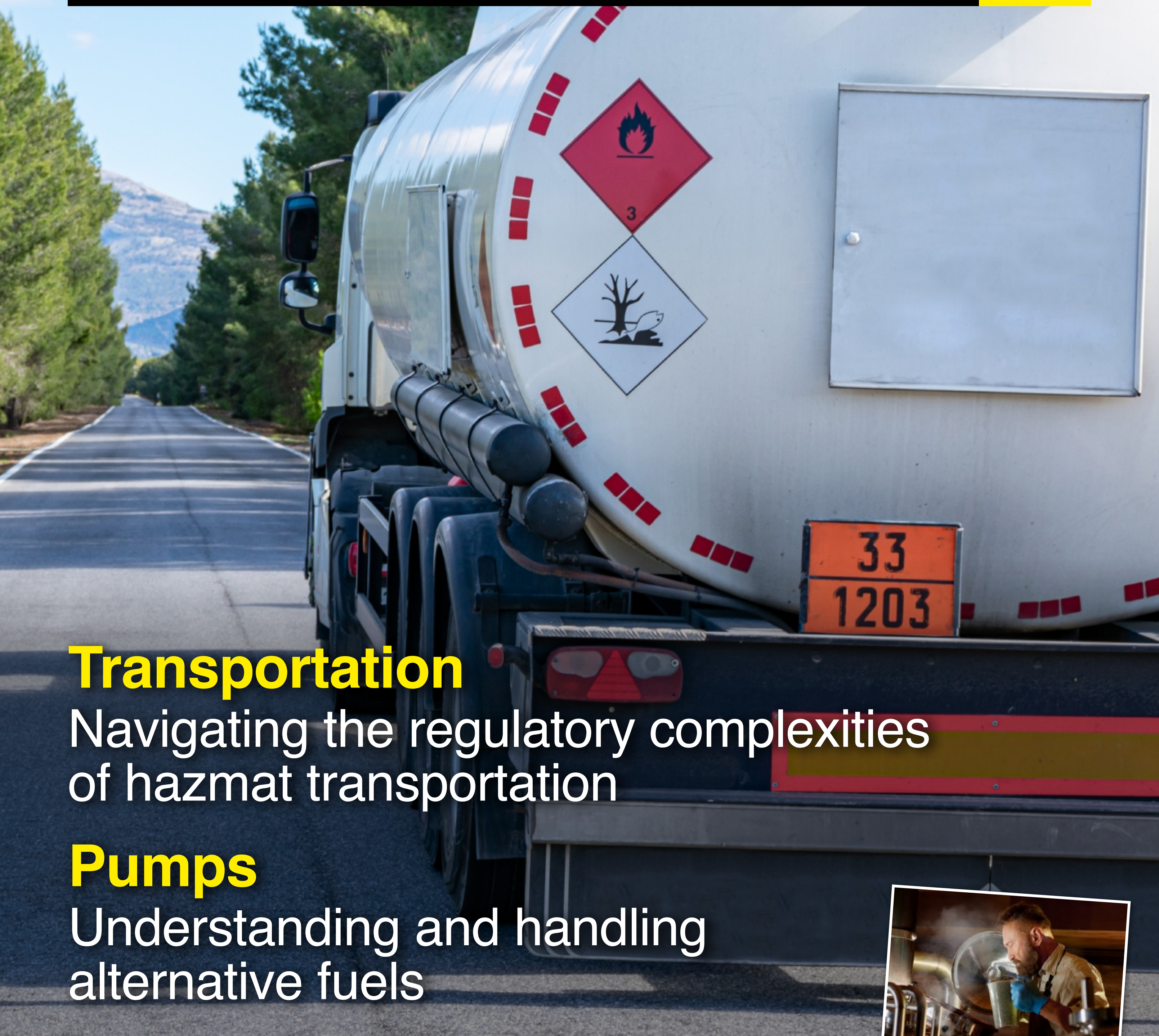

Transportation

Navigating the regulatory complexities of hazmat transportation

Pumps

Understanding and handling alternative fuels

Static

Safety in jet-pulse dust collectors

Safety Cuture

Top ways to measure safety culture

Competence

Mitigating risks by employing a competent workforce

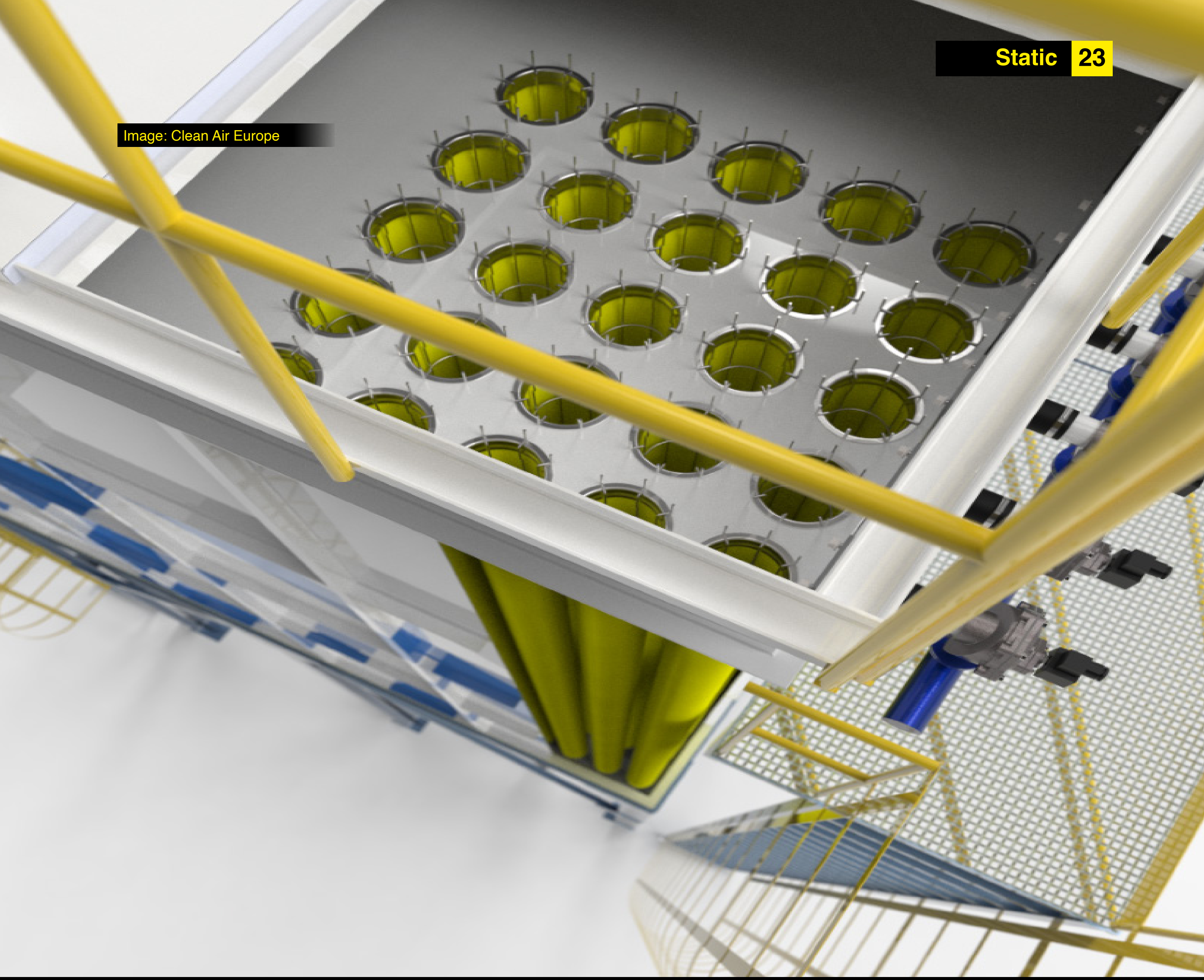
Image: Clean Air Europe

Safety in **jet-pulse dust collectors**

When considering fire and explosion prevention in combustible dust environments, a key area of focus is looking at the nature and number of incidents that have happened after an apparent electrostatic discharge and attempt to establish whether filter bags and filter bag cages were potential ignition sources.

It is well known that in numerous incidents, electrostatic discharges have occurred due to ungrounded insulative filter bags being poked by metal rods during maintenance operations. Important applications in the metal industry for filtering metallic powders often utilise installations with thousands of filtering supports coupled with insulative thermoplastic filter bags. Likewise, combustible powders are present in wood, agricultural, plastics, coal treatment, and chemical industries where similar risks are present.

One method used to clean dust filters is jet-pulse which blasts compressed air to remove dust from the filters towards a dust collector. However, this method detaches the insulative bags from the conductive cage support, causing dust to fall while potentially electrostatically charging the whole system. The energy level needed to ignite an explosion should normally be avoided through the earthing of the system's components such as the cell plate, the filter bag cage supports, and the fabric sleeves.

The lack of proper grounding appears to be a serious issue in many incidents, highlighted in a study published in the *Journal of Physics* by A. Ohsawa in 2011, which analysed fires and explosions attributed to static electricityghbv over the last 50 years in Japan. The presence of parts with a wide enough distance in the triboelectric scale to reach potentially dangerous levels of minimum ignition energy due to distributed charge presence is also a concern.

Confinement and the mixing of powders with oxidants underscore the need for better prevention in such environments. Until now, adherence to the ATEX Directive for main components in dust collectors has mostly been ignored by the market, likely due to the mistaken assumption that a pile of metal filter supports coupled with fabric filter bags would not significantly impact safety. However, the ATEX Directive states that essential components for equipment operation should be considered[1], which has not been the case for filter bags and cages.

On the other hand, some manufacturers have addressed the issue with insulative fabric filter bags by producing a new line of products: anti-static sleeves. These sleeves are recommended for use in zone 21 and 22[2].

An anti-static sleeve, in its most common form, is a plastic material sleeve with a stainless-steel mesh core incorporated into the nonwoven fabric. This mesh can alter the insulative properties of filters such as Polyester, PTFE, or Aramid, introducing some conductive or static dissipative behaviours. The assumption here is that by preventing charge accumulation, such discharges cannot occur. Static dissipative material prevents the charge from building up and being locally retained.

Some major test institutes have studied the problem and provided indications[3] for resistance to earth ranging from 10^6 to 10^8 Ohms, calculated as sufficient to prevent easily reaching the minimum energy required for ignition. The need to determine such properties for good resistance to earth arises from the necessity to ensure that all semiconductive and conducting items are electrically connected to earth.

A test to determine charge transfer, as described in EN 80079-36[4], involves rubbing the sample to be tested to create a charge and measuring the charge transfer with subsequent classification into ATEX groups. These tests are always conducted with the sample well-connected to ground and their observations enable the classification of the static dissipative nature of semiconductors.

Measuring an electrostatic discharge in the absence of proper grounding is quite challenging. Despite proper grounding of all elements – conductive, semiconductive, and insulative – being the primary safety measure for any appliance in dust collectors, it is often overlooked or not certified in the field. The mentioned tests do not provide information about what occurs under poor grounding conditions or have not been studied to consider the conditions when “something goes wrong,” which is often the basis of many incidents. This consideration could also extend to filter metallic supports, which are not only coupled with fabric filter bags but are also in contact with the normally grounded conductive cell plate, and in many applications, cages are not separately grounded, necessitating measurement of different earth potentials.

Image: Shutterstock

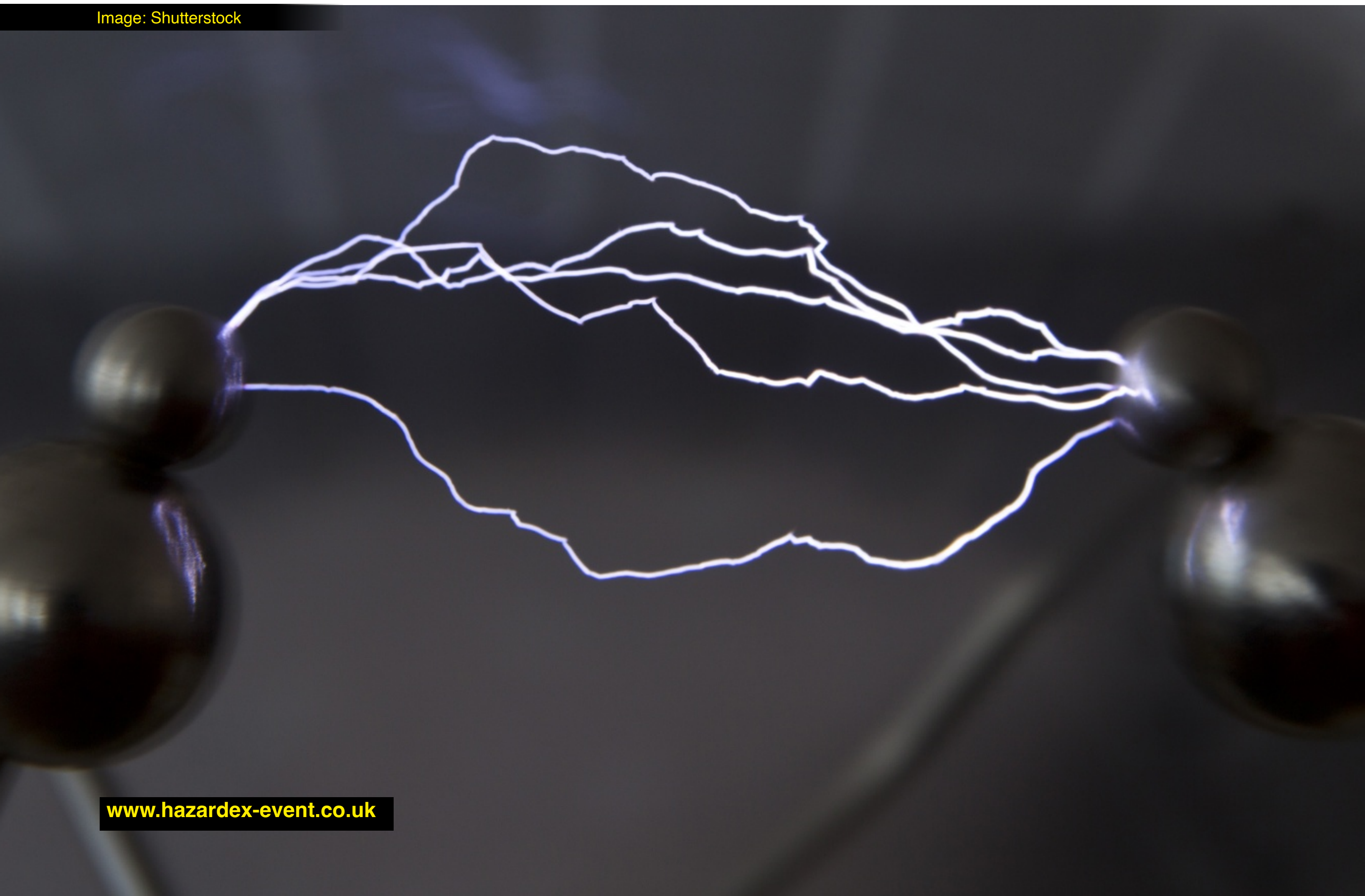

Image: Clean Air Europe

The way filter supports are in full contact with the cell plate could vary depending on cage geometry, the presence of flanged collars (which provide greater surface contact), or hooked ones. The presence of powder and dirt could also affect this contact. The inability to capture the rare but potentially fatal moment of spark ignition in a pre-arranged test necessitates following technical recommendations by adopting materials and treatments that mitigate the risk preventively against poor grounding practices during installation or maintenance activities.

To this end, some filter cage manufacturers have recently revised their surface treatments and materials used with a focus on the superficial resistivity of their products to introduce anti-static and static dissipative features. Among the surface treatments used in the industry, cataphoresis seems to offer the best performance. Already used for optimal resistance to corrosion and chemicals, and for applications in dust collectors up to 250°C, it also has the ideal superficial resistivity to decrease the potential retention of electrostatic charges. The treatment provides a homogeneous surface with an average surface resistivity of 10^7 Ohm square. In contrast, classic epoxy powder painting, tested under similar conditions of relative humidity and temperature, showed an average resistivity value of 10^13 Ohm square, placing it among the more dangerously insulative finishes with high potential jumps in the triboelectric scale.

Interposing a semi-conductive cage (preferably with a flanged collar) between a well-earthed steel cell plate is an excellent choice to lower the risk of ignition from electrostatic sparks. Keeping in mind that earthing is always the safest procedure and that anti-static filter bags are a proven means to decrease risk, a new category of safer filter bag cages is now available in the market. ■

References

[1] *Directive 2014/34/EU Article 1 – Scope, comma (c)*

[2] *EN 60079-10-2:2009*

[3] *Practical Guide – Industrial Electrostatics – Hazards, Problems and Applications*

[4] *BS EN ISO 80079-36 2016 Nonelectrical equipment for use in potentially explosive atmospheres*

About the author

Corrado Maggi is Head of Product and Business Development at CleanAir Europe Srl, a manufacturer of filter parts. Entrepreneur and inventor, he holds several patents in various sectors, from automotive to industrial, filtering and security. With 30 years of international experience in engineering, he now dedicates himself to advancing technology for air filtering operations in dust collectors.