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Electrostatic discharge sparks

Electrostatic discharge sparks need to be avoided in hazardous areas because they can provide the ignition energy required to cause an explosion.

So what causes these sparks? Going right back to basics, all matter consists of atoms that are inherently electrically neutral. They have an equal number of positively charged protons and negatively charged electrons that balance each other out. The electrons in different materials can be exchanged when the two materials make contact with one another. If an electron is missing a positive ion is formed and when an electron is added a negative ion is formed. Ions are atoms with either more or fewer electrons. This is known as the triboelectric effect.

When the two materials become separated they are no longer electrically neutral as they have become either positively or negatively charged with an extra electron. When this imbalance occurs it is called "static". It also possible for materials to become charged without making direct contact. This happens when an object passes through the charged electrostatic field surrounding another object. This is known as inductive charging.

At the moment of separation the charge on the objects surface is stationary hence the term "static". Usually the charge that is created is gradually dissipated; however, if the differential charge between the objects is high enough, the rate at which the excess charge is neutralized will increase. More and more electrons suddenly move across the gap between the two objects and as they do so they can, under the right conditions, heat up the air so much that it glows momentarily. This is a spark.

Charge differential between objects can be greater in dry conditions; making electrostatic discharge sparks more likely. In damp conditions conductive water molecules on the surface of objects can help gradually dissipate electrical charges. This is the reason for the warning sometimes seen on plastic enclosures "Do not wipe with a dry cloth".

Every day experiences of static discharge include the shock felt when a metal door handle is touched having walked over a nylon carpet or when removing clothes from a clothes dryer. (For a discharge to be felt, seen or heard the voltage has to exceed approximately 3,500 volts).

Lightening is the most dramatic static discharge and is usually caused when tiny pieces of ice collide within a thunder cloud generating static electricity that is eventually discharged. Volcanic lightening is even more spectacular as conventional lightening caused by the cooling of a volcanic cloud high in the atmosphere is joined by the lightening caused by the static electricity generated from the collision of volcanic rock and ash particles.

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In addition to sparks, static charge differentials can cause objects to be attracted to one another (if there are opposite charges) or repelled from one another (if there are like charges).

The issue of electrostatic discharge is dealt with in Part 0 of EN 60079-0:2006 Electrical apparatus for explosive gas atmospheres

Clause 7.3 deals with electrostatic charges on external non-metallic materials of enclosures and clause 7.3.2 addresses the avoidance of build-up of electrostatic charge.

Electrostatic charges on the external non-metallic materials of enclosures can be avoided be either by selection of a material with a surface resistance which does not exceed 1G Ohm (at 23°C +/-2°C and 50% +/-5% relative humidity) i.e. carbon loaded, or by limitation of the surface area.

For Group IIC gases in Zones 1 and 2 the maximum allowable surface area of non-metallic parts of enclosures is 20 cm^2. Note: 20 cm^2 is equivalent to the surface area of a 5cm diameter disc.

For Group IIB and IIA gases in Zones 1 and 2 the maximum allowable surface area of non-metallic parts of enclosures increases to 100 cm^2

Above the 20 cm^2 and 100 cm^2 limits special conditions for safe use will apply.
This is designated with the suffix 'X' on the certification number marked on the product.

For example the end user must be warned that static charge will build when wiping clean with a dry cloth or if the enclosure is placed in the path of a forced draught. E.g. In the flow path of an extractor fan. A warning label is therefore attached to the product. The standard states that "Care should be taken when selecting the use of a warning label for static risk control. In many industrial applications it is highly likely that warning labels will become illegible through the deposition of dust. If this is the case, it is possible that the act of cleaning the label may cause a static discharge."
IMPORTANT: For full details please refer to EN 60079-0