# Driving Innovation: Hazardous Areas as a Catalyst for Enhanced Corrosion-Resistant Equipment

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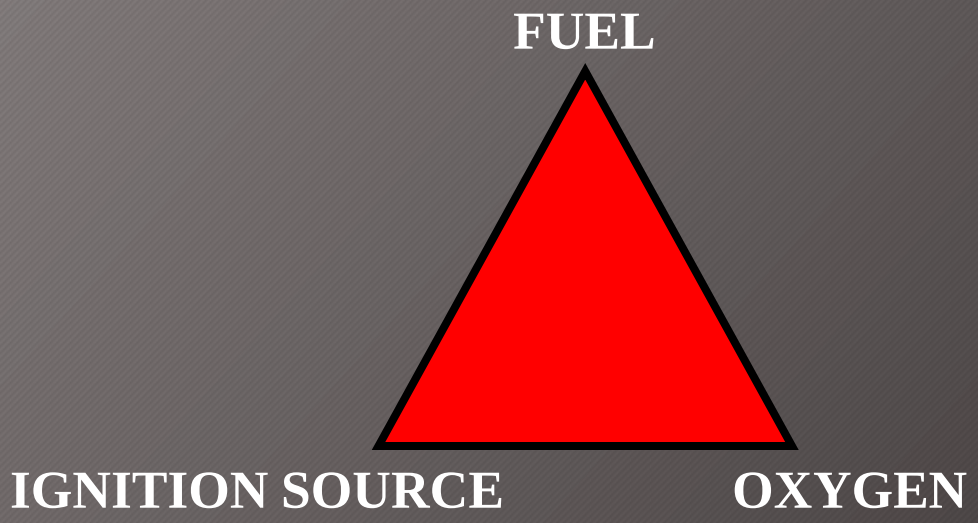
# Gas Explosion: The Fire Triangle

For an explosion/fire to take place there must be 3 elements present, namely:

**FUEL** – Liquid, gas or vapour/mist of flammable mixtures

**IGNITION SOURCE** - flames, sparks, friction, lightning, static or heat.

**OXYGEN** - air, oxidising agent or chlorine



# Zones for Gases

- **Zone 0**

- an area where an explosive mixture of flammable gas, vapour or suspended liquid droplets/mist with air is **continuously** present, or present for long periods.

- **Zone 1**

- an area where an explosive mixture of flammable gas, vapour or suspended liquid droplets/mist with air is likely to occur during **normal** operation.

- **Zone 2**

•an area where an explosive mixture of flammable gas, vapour or suspended liquid droplets/mist in air is likely to occur under **abnormal** operating condition of the facilities.

# Dust Explosion: The five Requirements

- A combustible dust.
- The dust is dispersed in the air within certain flammability limits.
- There is an oxidant present (typically atmospheric oxygen).
- There is an ignition source.
- The area is confined – a building can be an enclosure as well.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# Zones for Dust

- **Zone 20**

• A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is present **continuously,** or for long periods, or frequently.

- **Zone 21**

• The atmosphere is likely to contain ignitable concentrations of inflammable dust or fibres under **normal** working conditions.

- **Zone 22**

• An area in which dust clouds might occur infrequently and persist for only short periods or combustible dusts might be present under **abnormal** conditions.

# Ex e – [Increased Safety] Explained

- *Electrical apparatus in which **measures are applied to prevent**, with a minor degree of security, the possibility of excessive temperatures and of the occurrence of arcs or sparks in the interior and on the external parts of electrical apparatus that does not produce such arcs or sparks in normal service.*

- Ex e equipment is normally junction boxes that are manufactured from a material that cannot produce **static electricity**. Carbon black is put into the material, the boxes must also have a certain IP rating and resistance to impact.

- Ex e can be best explained as a manufacturing process **where special methods and processes** are used to prevent an explosion from occurring.

# Ex d – [Flameproof] Explained

- *Electrical apparatus in which the parts of the apparatus that can ignite an explosive atmosphere are placed in an enclosure that can **withstand the pressure developed during an internal explosion** of a defined explosive mixture and that **prevents the transmission of the explosion** to the explosive atmosphere surrounding the enclosure*

- Ex d junction boxes are normally manufactured from cast iron to withstand the pressure and incorporates flame-paths to prevent the transmission of flames to the outside atmosphere.

- Ex d Flameproof can be best explained as a **robust** **mechanical manufacturing process** to prevent the cause of explosions.

# What is a corrosive environment

- Presence of Harmful Chemicals: Contains substances like acids, bases, or salts that can chemically degrade materials.
- High Humidity or Moisture: Excess moisture accelerates corrosion, particularly in metal structures.
- Exposure to Extreme Temperatures: High heat or extreme cold can contribute to the breakdown of materials, enhancing corrosion rates.
- Industrial or Marine Locations: Areas with frequent exposure to pollutants, saltwater, or industrial byproducts are more prone to corrosion.
- Oxygen and Water Interaction: Environments with a combination of water and oxygen (e.g., rain, condensation) promote oxidation and rust formation.

# Impact of a corrosive environment

- **Compromised Sealing Integrity:** Corrosion on junction boxes or cable glands can damage seals, allowing moisture or contaminants to enter, potentially causing electrical faults or short circuits.
- **Loss of Structural Integrity:** The corrosion of metallic components can weaken the junction box or cable gland, leading to deformation, cracking, or even failure under stress, compromising safety.
- **Reduced Performance and Reliability:** Corrosion can cause poor connections and degraded functionality, leading to equipment malfunctions, increased downtime, and potential hazards in electrical systems.

# What does this mean for Hazardous Areas?

## Ex e

- **Increased Risk of Ignition:** Corrosion can compromise the integrity of electrical enclosures and cable glands, potentially leading to sparks or heat generation, which can ignite flammable gases or dust in hazardous areas.
- **Failure to Maintain Safety Standards:** Damaged junction boxes and cable glands due to corrosion may no longer meet the necessary Ex e protection standards, reducing the safety of the environment.
- **Decreased Equipment Lifespan:** Corrosion accelerates wear and tear, shortening the lifespan of critical equipment in hazardous areas, leading to more frequent replacements or repairs.
- **Potential for Hazardous Leaks:** Corroded seals and enclosures can allow hazardous substances to enter, exposing workers to dangerous environments and compromising the area's safety.

# What does this mean for Hazardous Areas?

## Ex d

- **Compromised Flameproof Integrity:** Corrosion can weaken the flameproof enclosures, potentially causing them to fail in containing an internal explosion, which could lead to catastrophic consequences in a hazardous environment.
- **Risk of Uncontrolled Release of Explosions:** Damage to corroded junction boxes or cable glands may prevent them from effectively containing and redirecting the energy of an internal explosion, increasing the risk of ignition in the surrounding area.
- **Loss of Explosion Protection:** Corrosion can cause gaps or cracks in the flameproof seal, rendering the Ex d equipment non-compliant with safety regulations and putting personnel at risk.
- **Increased Maintenance and Downtime:** Corroded equipment in Ex d areas requires more frequent inspection, maintenance, or replacement to ensure ongoing compliance and minimize the risk of failure, leading to operational disruptions.

# What is the solution?

- Polymeric Junction boxes – Junction Boxes made from tough engineering polymers do not corrode.

- Polymer Encapsulated cable glands – Polymer encapsulation ensures all external brass components are completely protected from external elements, preventing corrosion.

# Corrosion prevention for Standard Applications: Junction Boxes

- Polymeric Junction boxes are not only solutions to Hazardous Areas regarding corrosion.
- The lessons learnt and methods used to prevent corrosion in hazardous areas can be used for standard applications.
- The use of polymer junction boxes in standard applications allows for complete corrosion resistance of the junction box.
- Polymer Junction Boxes with an Ingress protection rating of IP66/68 also ensures that there will be no dust or water ingress into the junction box.

# Corrosion prevention for Standard Applications: Cable Glands

- Cable glands specifically designed to prevent corrosion in hazardous areas can additionally be used in standard applications to prevent corrosion.
- The superior design of polymer encapsulation allows for complete corrosion protection of external brass components that would normally be exposed to the elements.
- These cable glands, due to their brass internal structure and components allow for improved mechanical strength and promote earthing continuity.

# Benefits of Corrosion Resistant Solutions

- **Corrosion Resistance**: Polymeric junction boxes and encapsulated cable glands provide superior resistance to corrosion compared to metal, ensuring longer service life in highly corrosive environments such as marine, chemical, or offshore settings.
- **Lightweight Design:** Polymeric materials are significantly lighter than metals, making installation easier and reducing transport costs, while also minimizing the load on mounting structures.
- **Enhanced Durability:** Polymeric materials are resistant to UV radiation, chemicals, and environmental stress, reducing the risk of degradation and ensuring the junction boxes and cable glands maintain their integrity in harsh conditions.
- **Cost-Effective Maintenance:** The non-corrosive properties of polymeric junction boxes and encapsulated cable glands lead to lower maintenance costs and less frequent replacement, improving the overall cost-effectiveness over time.

# Thank you

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