Prevent Zinc Whiskers with Hot Dip Galvanised Products

Zinc whiskers can spell big trouble if not dealt with. Despite their non-threatening name, they can wreak havoc in data centres. While temperature monitoring and an effective layout reduce risk, it's vital to be aware of this hidden threat.

Hobson's hot dip galvanised range is ideal for applications that require a high degree of corrosion resistance. No evidence of zinc whiskers has ever been found on these products, making them optimal for sensitive applications. Rely on Hobson for effective data centres with minimised risk of zinc whiskers.

Read our guide below to better understand their causes, signs and how to handle them.

Definition

Zinc whiskers are tiny filaments that grow from steel surfaces that have been electroplated with zinc. Zinc is used to guard against corrosion, but the molecular stress from the electroplating process causes it to expand and crystallise in an effort to relieve the pressure. They begin at only a few microns in length but can reach several millimetres. It's important to note that different surfaces grow whiskers at different rates and densities. Zinc whisker growth is unpredictable but believed to be impacted by conditions during the electroplating process itself.

The tiny shards can have catastrophic consequences for data centres. They can develop undisturbed for years on floor tiles and other infrastructural supports. While they are more common in older data centres that used electroplated zinc, they can form on this material anywhere, regardless of environmental conditions.

Hazards

Unchecked zinc whiskers can cause anything from a short circuit to a full system reset, leading to downtime, repairs and data loss. Even an air current can be enough for them to break away from the material. Due to their microscopic size, they easily bypass filters and land in sensitive hardware.

Zinc is a highly conductive metal and is charged by the electroplating process, making the whiskers both tiny wires and low-capacity fuses. When they come into contact with microcircuits, they can connect currents or cause malfunctions by introducing their own charge. They also possess a DC fusing current, defined as the amount of current necessary to melt the fuse. This is measured in milliamps (mA) and ranges from 10 mA3 to 30 mA3.

Currents from short circuits can potentially vaporise the whisker, erasing all evidence and making it more difficult to identify the culprit. However, if the issue is not addressed, the electrical failures will only escalate.

Warning Signs

The clearest sign of zinc whiskers is the behaviour of the equipment. If a specific piece of equipment continues to malfunction while the rest are operating perfectly, it's likely an individual issue. But if equipment is being afflicted at random, zinc crystals may be behind it. Pay close attention to any changes in equipment operation after maintenance work or a significant disturbance in the data centre as this could indicate a large number of zinc filaments were dislodged.

Identification

It is important to be vigilant and identify a zinc whisker problem as early as possible. There are two main methods:

1. Visual inspection

Collect multiple samples from different spots in the room, especially from places that haven't been touched or moved in a long time. Conduct the assessment away from equipment susceptible to the zinc filaments and be careful not to accidentally break off any whiskers. It may be helpful to shine a light or laser on the surface and tilt the material to better examine it. Use a magnifying glass and search for a dull, slightly shiny silver or dust-textured appearance.

2. Scanning electron microscopy (SEM)

As above, use a sample likely to have zinc whisker growth. Cut off a tiny section and use double-sided conductive tape or similar to hold it under the microscope. Tilt it vertically and shine the light down the surface to search for any filaments growing from the metal.

Removal

Unfortunately, cleaning or coating strategies won't do the trick. Cleaning is a short-term solution as it doesn't stop future growth and there is no way to be certain it was thorough. Additionally, the cleaning process will cause the whiskers to break free, meaning they will inevitably end up back in the equipment. Coating only puts a band-aid on the problem as the whiskers will keep growing underneath. They can even cause the coating to chip, further contaminating the air.

The only way to solve the problem is to address the cause. Replace all zinc-electroplated materials with alternatives to minimise risk. Consider working with an installation company and ensure zinc whiskers that break off during the replacement process cannot access the equipment. While working, wear high-proficiency particulate air (HEPA) masks to avoid breathing in pollutants. Use a HEPA vacuum to clean any remaining particles and install HEPA filters throughout the data centre to stop even the smallest particles from sneaking in.

The data centre should be able to keep running throughout the process, and the time and resources spent replacing the zinc elements is more than worth it.

Prevention

Avoid using zinc electroplated materials as this is where the trouble starts. Find another method to protect susceptible steel and aluminium in data centres from corrosion as rust brings its own set of problems. Hot dip galvanising is one of the best solutions as it maintains a corrosion-resistant layer of zinc but submerges the steel in molten zinc instead of electroplating, removing the risk of whiskers. Powder coatings are a less effective but cheaper alternative that perfectly suit applications needing only a light defence against rust.

Contact our engineering team for further details about the applications and corrosion resistance of Hobson's quality hot dip galvanised products.