

How to identify the potential for raised floor zinc whiskers and remediate the threat

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ZINC WHISKERS – TATE ACCESS FLOORS TECHNICAL BULLETIN #277

What Are Zinc Whiskers?

Zinc whiskers are microscopic hair-like structures of zinc found to grow on the surface of electroplated steel and zinc plated fasteners. Electroplating was the common method of galvanization used on many unpainted steel products now present in data centers and other computer hardware environments. In recent years, zinc whiskers have been discovered on computer cabinets, racks, hardware and some galvanized-pan access floor panels.

It is thought that zinc whiskers grow due to high compressive stresses in the plating imparted during the electroplating process. Over time, the pure zinc will relieve the stresses by growing whiskers out of the galvanized surface. The whiskers are normally a few microns in diameter, but can reach lengths up to 1 cm. Their growth time is unpredictable – months or years may pass without growth – followed by growth rates as high as 1 mm per year. It is believed that the propensity of an electroplated surface to grow whiskers depends upon the prevailing conditions during the plating process. In addition, the molecular makeup of the zinc used in electroplating can vary from one application to another.

Problems Caused by Zinc Whiskers

Over time, the highly conductive whiskers can break free from the steel and be transported by air movement into computer equipment - causing short circuits, voltage variances, and other signal disturbances. These events are capable of causing equipment service interruptions or failures.

Why Is This Condition Showing Up Now?

Two things have happened in data centers that have brought the zinc whisker condition to the forefront.

- In many facilities where whiskers have grown, the fragile zinc filaments have become large enough after years of growth to dislodge from the surfaces on which they have grown.
- The denser circuitry of circuit boards and other electronic assemblies has made it easier for whiskers to bridge the distances between adjacent relays, circuits or connectors and cause short circuits.

Determining if Floor Panels Are Made of Electroplated Steel

- Painted Tate panels are not electroplated.
- A galvanized woodcore panel *made of electroplated steel* will be uniformly gray in color and have a dull finish.
- A galvanized woodcore panel made of hot-dip galvanized steel may appear in one of two ways: a shiny spangled (or mottled) finish or a light gray surface (often referred to as a satin finish).

Checking For Zinc Whiskers on Galvanized Floor Panels

If you suspect whisker growth on panels, carefully remove a few panels from the equipment area for inspection. To avoid causing further contamination, immediately place them in plastic bags for transportation to a safe area. Using a high-intensity light or flashlight, shine the light on the surface at an angle. Look for a reflective sparkling or twinkling. If you see reflections, it is very likely that there is whisker growth.

Whiskers can be very difficult to see without magnification. If you do not see whiskers but have reason to believe they exist, you can send a panel to a laboratory that performs plating analysis.

Getting Rid of Zinc Whiskers on Existing Systems

If you discover or suspect the existence of whiskers, an immediate step is to make sure panel handling is kept to a minimum and that it be done carefully so that whiskers are not forcibly dislodged from the panels. Abating whiskers requires getting rid of the electroplated panels. Encapsulation of whiskers by paint or other coatings may only be a temporary fix because whiskers may eventually grow through the paint. Removing contaminated panels is a rigorous process best performed by experts with remediation experience and thorough knowledge of the correct procedures involved. Companies that specialize in getting rid of zinc whiskers can be found through Web searches using the following keyword phrases: “zinc whisker abatement”, “zinc whisker removal” and “zinc whisker cleaning.”

Conclusion

The zinc whisker phenomenon has been directly attributed to the electroplating process, which produces a layer of zinc under high compressive stress that over time may allow for the growth of zinc filaments outward through weak spots in the coating. We use only hot-dip galvanized (HDG) steel for our understructure. (Our panels are painted or powder coated). *Although hot-dip galvanization still coats steel in zinc, it produces a layer of zinc under far less internal stress than an electroplated coating.* Further, in the hot-dip galvanizing process, the zinc and steel form an adherent metallurgical bond that is far superior to the mechanical bond formed by electroplating. As a result, the steel and its coating perform as one during fabrication and in service.

Research also indicates that in addition to the *residual* compressive stresses caused by electroplating, externally applied mechanical stress appears to be partially responsible for whisker growth found on galvanized steel. We do not believe our understructure is unduly subject to mechanical stress under normal service conditions.

While there have been reports in other industries of whisker growth on hot dip galvanized products, we have no indication of whisker growth on our HDG understructure. Some studies that address the issue conclude HDG material is *less likely* to produce zinc whiskers while others say the use of hot dip galvanizing is only a delaying tactic against whisker growth. Assuming this worst-case scenario, we do not know what the time frame is for whisker growth on HDG steel. Moreover, we are not aware of a procedure for accelerating the age of an HDG coating on steel to examine it and confirm whether it has grown whiskers.

Hot dipped galvanizing is the most economical solution for protecting steel understructure from corrosion and mitigating the risk of zinc whisker growth. Other data center products made of HDG steel or which contain HDG components include cable tray systems, server components, and server rack accessories.

Finishes on Tate Products

Tate uses the following finishes for floor panels, understructure components, and fasteners.

- ConCore and All-Steel Panels - Electro-deposited epoxy paint on steel
- Perforated Laminated Airflow Panels - Electro-deposited epoxy paint on steel
- Perforated Directional Airflow Panels – Powder coat on steel
- DirectAire 68% Open Area Directional Airflow Panel – Powder coat on steel
- GrateAire 56% Open Area Airflow Panels – Powder coat on die-cast aluminum
- Pedestal Head - Hot-dip galvanization on head plate and oxide finish on adjustment nut
- Pedestal Base - Hot-dip galvanization (or Electro-coated epoxy finish on some seismic bases)
- Stringer – Hot-dip galvanization (Galvanneal)
- Cornerlock and Stringer Fasteners – Phosphate conversion coating
- Wood Core Panel – Hot-dip galvanization on steel bottom and sides

Tate CSI Specifications

Tate's system specifications (Sections 10270 / 09 69 00) located on our web site (www.tateinc.com) strictly prohibit the use of zinc-electroplated steel on all panels and understructure components.