



WHAT ARE ZINC WHISKERS?

Zinc whiskers (a.k.a. zinc needles) are tiny hair-like crystalline structures of zinc that have been found to sometimes grow on the surface of electroplated steel. Electroplating is a commonly used method of galvanizing steel and has been used on a variety of steel products now present in data centers and other computer controlled environments. In recent years, whiskers have been found growing on electroplated components of computer hardware, cabinets and racks; as well as on some galvanized-pan access floor panels.

PROBLEMS CAUSED BY ZINC WHISKERS

In some cases, the electrically conductive whiskers can break free, become airborne and be transported into the computer equipment - causing short circuits, voltage variances, and other signal disturbances. These events are capable of causing equipment service interruptions or failures.

WHY ARE THESE PROBLEMS OCCURRING NOW?

Two things have happened in data centers that have brought the zinc whisker phenomenon to the forefront today. First, in many cases where whiskers have formed, they have become large enough after years of growth to easily be dislodged from the surfaces on which they have grown. Second, technological advances have dramatically reduced the sizes of circuit boards and other electronic assemblies. The denser circuitry used today has made it easier for the whiskers to bridge the distance between adjacent relays, circuits or connectors and cause short circuits.

DETERMINING IF YOU HAVE A POTENTIAL WHISKER PROBLEM

You first need to determine if you have panels that contain electroplated steel. Galvanized-pan panels will typically have a flat, unpainted bottom surface. If your panel has a series of pockets formed into its underside (and is painted), it will not have this condition.

Important Note: Not all galvanized-pan panels are made with electroplated steel. A panel that is made of electroplated steel will be uniformly gray in color with a dull finish. If the panel is hot-dip galvanized, the finish may appear in one of two ways: a shiny spangled (mottled) finish; or a light gray surface that is often referred to as a satin finish.

CHECKING FOR ZINC WHISKERS

If you suspect whisker growth on floor panels, you must carefully remove some panels from the equipment area for inspection in order to avoid causing equipment contamination. Placing them in plastic bags for transportation to a safe area is the best way to do this. Using a high-intensity light or flashlight, shine the light on the steel surface at an angle. Look for a reflective sparkling or twinkling on the surface. If there is a reflection, 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 because of consistent unexplained equipment failures, you can send a panel to a laboratory that performs plating analysis.

GETTING RID OF ZINC WHISKERS

If you discover zinc whiskers, an immediate step to take is to make sure that panel handling is kept to an absolute minimum and that it be done carefully so that whiskers are not forcibly broken away from panels. When contaminated panels are left undisturbed, whiskers will generally remain attached to the panels.

Abating zinc whiskers requires getting rid of the electroplated panels. Encapsulation of whiskers by application of paint is only a temporary fix because whiskers will eventually grow through the paint. The task of removing contaminated floor panels is a rigorous process that is best performed by people with prior experience or 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”.

GALVANIZATION METHODS AND ZINC WHISKER AVOIDANCE

Galvanization Methods

Zinc is universally applied as a coating to galvanize steel. *But whether whiskers may grow on galvanized steel depends upon the method used to apply the zinc.* The two common methods of applying zinc to galvanize steel are *electroplating* and *hot-dip galvanizing*. It is the electroplating method that studies have shown is the reason behind the zinc whisker phenomenon.

Electroplating Galvanization Method

The electroplating method is referred to as “cold” process galvanization because of its low working temperature – approximately 200° F. In this method, steel stock is immersed in a pure zinc-galvanizing bath while high energy electrical current is supplied through the steel to create a “molten reaction” between it and the zinc. This produces a layer of zinc oxide a few molecules thick with a protective substrate of pure zinc below.

Studies have concluded that whiskers grow as a result of high compressive stresses in the zinc plating which are imparted during the plating process. Over time, the pure zinc will attempt to relieve the stresses by growing zinc crystals (whiskers) out of the plating surface. These crystals are normally only a few microns in diameter, but can reach lengths up to 1 cm (0.4 inches). Their growth time is unpredictable – months or years may pass without any growth at all – followed by growth rates as high as 1 mm per year.

It has been observed that not all electroplated surfaces grow whiskers at the same rate and density, and some do not grow whiskers at all. It is believed that the propensity of an electroplated surface to grow whiskers depends upon the prevailing conditions during the plating process. And it is known that the molecular makeup of the zinc used in electroplating can vary from one application to another. Lastly, the growth of whiskers is not affected by the environmental conditions. Electroplated steel does not require moisture, light (or darkness) or any nutrient source to initiate and sustain whisker growth.

Avoiding Zinc Whiskers with the Hot-Dip Galvanizing Method

In the hot-dip galvanizing method, steel stock is passed through a *molten* bath of zinc at temperatures typically around 850°F, producing a coating comprised of several metallurgical bonded layers. *To date, no variation of the hot-dip process has demonstrated the compressive stress condition in the plating that afflicts the electroplating method.* Since the discovery of the zinc whisker phenomenon over 50 years ago, zinc whisker formation has not been identified on any hot-dip galvanized steels.

CAN TATE'S ACCESS FLOOR SYSTEM DEVELOP ZINC WHISKERS?

Tate's ConCore, All-Steel and Perforated Airflow panels are painted and will not grow zinc whiskers. Tate's floor panels are epoxy painted – not galvanized. The electro-coating painting process uses electrical current to deposit paint onto the panels while they are immersed in a bath. After the panels are removed from the bath, the paint is heat-cured and converted to a hard film.

Tate's Bolted Stringer understructure components are made of hot-dipped galvanized steel and will not grow zinc whiskers. Our Bolted Stringer system specifications for data centers and computer rooms explicitly state that zinc electroplating shall be prohibited on all panels, understructure components, fasteners and accessories. The specifications can be found on Tate's Web site, www.tateaccessfloors.com, by clicking on "Products & Specs" on the home page. In the drop-down menu that appears, click on "ConCore System" or All Steel System". The statements in the specifications prohibiting the use of electroplated steel appear under (Part 2.2) Support Components, (Part 2.3) Panel Components and (Part 2.4) Accessories. For your convenience, these statements are reprinted below.

Panels: Floor panels shall be protected from corrosion by electro-deposited epoxy paint. The use of zinc electroplating shall be prohibited.

Pedestals and Fasteners: Pedestal assemblies shall be corrosive resistant, all steel welded construction, and shall provide an adjustment range of +/- 1" for finished floor heights 6" or greater. Zinc electroplating shall be prohibited on all pedestal components, including head plate, threaded rod, adjustment nut, pedestal tube, base plate, and all fasteners.

Stringers: Steel stringer shall have conductive galvanized coating. Zinc electroplating shall be prohibited on stringers and stringer fasteners.

Accessories: Zinc electroplating shall be prohibited on all accessories.