

Post-Plating Films Which Enhance Corrosion Protection

Since 1975 various coatings have been available which, when applied to fasteners, have greatly increased the resistance to corrosion. As with any new development, a number of changes has taken place not only in the coatings but also in the means of applying them to the fastener.

Fastener manufacturers, such as Atlas, worked with many different compounds in search of one which would not have some of the shortcomings which were brought to light in either field applications or in quality control checks.

Desirable characteristics of coatings include; providing good corrosion protection and having hardness characteristics so that the coating is not broken or chipped by the abrasion of the tool driving the fastener.

Some coatings have excellent corrosion resistance when tested in salt spray and others have excellent resistance when tested in SO₂, commonly referred to as the Kesternich Test. Since SO₂ testing is a combination of heat, humidity and SO₂ gas (sulfur dioxide), this test approximates a highly concentrated acid rain condition, which we will discuss in detail later.

Sulfur Dioxide Testing

The Environmental Protection Agency estimates that approximately 31 million tons of sulfur dioxide particles fall to the ground each year.

These oxides slide into narrow pockets of the metal sheeting created by over-driven fasteners or by collapsed sealing washers. Only the presence of moisture in the form of dew, rain or even high humidity can create a highly acidic solution which attacks the panels as well as exposed fasteners. On roof applications, this highly acidic solution forms a pool around the fastener head and slowly but surely attacks the protective barrier coating placed over the base metal of the fastener.

Therefore, it is apparent that SO₂ testing of corrosion resistant coatings is more appropriate to the metal building industry than is salt spray testing which was developed many years ago by, and for, the automotive industry.

Kesternich Testing

To be valid, Kesternich testing must be done in accordance with a European specification, DIN50018.

This standard provides for two specific levels of corrosive atmosphere within the test cabinet.

One level injects 0.2 liters of SO₂ gas per cycle, the other level, much more severe, injects a full 2.0 liters of gas.

In addition to the concentration of gas which is specified by this DIN specification, the actual size of the cabinet is also specified. In order to compare results from different test cabinets, one must be certain that each cabinet adheres to this DIN specification.

Results of Kesternich testing are always expressed in units of measure called "cycles." A cycle begins with the injection of the SO₂ gas into the closed cabinet. Then moisture is added to bring the atmosphere to 100% relative humidity at a temperature of 40° Centigrade. This atmosphere is held for an 8-hour period. Then, the door of the cabinet is opened and ambient air is allowed to circulate through the cabinet for 16 hours. This comprises one full cycle.

All of the SO₂ (Kesternich) testing which Atlas Bolt & Screw Company does is always in the most severe atmosphere, 2.0 liters of sulfur dioxide gas .

The pH Scale

In order to measure the concentration of acidity or alkalinity of a solution, the pH scale was devised. A reading of 7.0 is the neutral point. pH numbers that are above 7.0 are alkaline and numbers that are lower than 7.0 are acidic. Rainfall, as measured in the Eastern and Northeastern coastal regions of the United States averages a pH reading of 4.0. The rains in the West and Southwest regions of the United States average between 6.0 and 7.0.

When 2.0 liters of sulfur dioxide gas is present in a Kesternich cabinet, the pH level is less than 2. This is an extremely corrosive atmosphere and is much more acidic than normal atmospheric conditions would cause.

Effectiveness of Post-Plating Films

Please note the attached photograph which compares fasteners which were merely electroplated and other fasteners which were plated and coated with the Atlas "Oxyseal®" post-plating film. These tests were run in a concentration of 2.0 liters of SO₂ gas.

The fasteners which merely had a 0.5 mil electrozinc plating (a very heavy plating) showed 100% red rust after 5 cycles. After the third cycle, red rust began to appear and after the fourth cycle these screws showed 65% of their area covered with red rust.

Conversely, the fasteners which were coated with "Oxyseal[®]" show no signs of red rust, even after 21 cycles of the test.

Application of Films

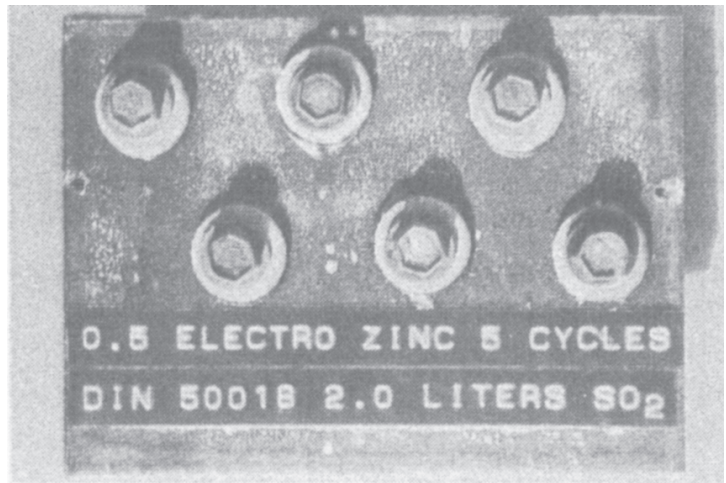
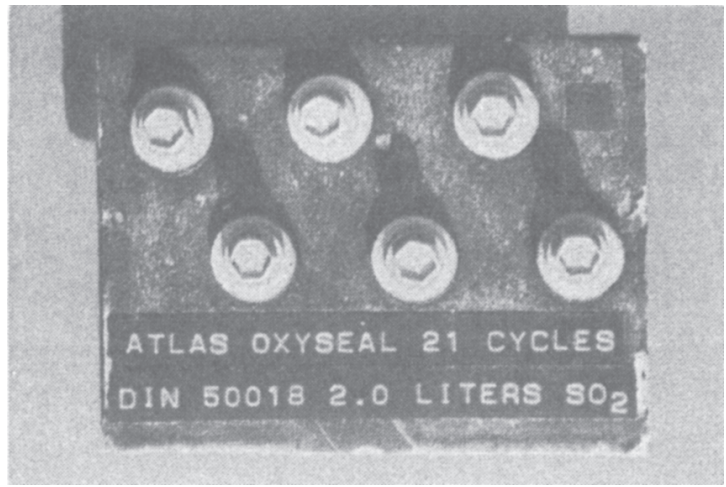
Post-plating films may be applied to fasteners by either spraying the head of the fastener, in much the same manner as paint is applied to a fastener. Spraying assures uniform and complete coverage to the exposed fastener head.

Another coating method involves dipping whole batches of fasteners into the coating solution and spinning off the excess in a centrifuge. To be effective, this dip-spin application should be done several times to insure that the whole fastener is being coated and that voids are eliminated. Voids can easily occur by the nesting of the fasteners when the batch is immersed in the coating compound.

Conclusion

There is no question that post-plating films can effectively retard the formation of corrosion as compared to fasteners which merely have electroplating applied. However, care must still be used when installing the fastener to insure that the fastener head is not overly abused, thereby breaking and chipping the coating, and allowing corrosive elements to attack the electroplating underneath.

Only by using stainless steel fasteners or a fastener having its head made from a material which cannot rust, such as the Atlas UltiMate[®] screw can a user be assured of eliminating fastener head corrosion.



NOTE: Fastener Talk 103 combines and replaces the former Fastener Talks 103 and 106.



Fasteners For Construction

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