WHITE PAPER:

Primer on Zinc Plating

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Corrosion prevention is a major concern in the caster industry. There are various finishes available to halt or postpone the development of corrosion over the life of a caster. The two primary methods used to prevent steel products from corroding are paint and Zinc Plating. For the most part everyone is familiar with both methods and interact with products using these technologies every day but are unaware of how these two methods function as well as how they differ from each other. While this article focuses on the zinc plating, it is important to understand the basic differences between these two standard coatings.

When it comes to corrosion prevention coatings, there are two categories. The first is known as Barrier Protection while the second is known as Sacrificial Protection. A barrier protection coating works by sealing the steel off from the outside environment. Corrosion is prevented by simply not allowing moisture, oxygen or other atmospheric gases to come into contact with the steel. Paint is an example of this sort. Others would include powder coating, ecoating, chrome plating and nickel plating. Sacrificial coatings work differently because they actually sacrifice themselves to prevent the steel underneath from corroding. Zinc corrodes much slower than exposed steel would. Another difference between the two is that a barrier coating must be continuous to be effective whereas a sacrificial coating can have interruptions and still protect (though the zinc coating will corrode faster than it otherwise would). If a zinc plated part does have interruptions in the plating, the steel underneath will become a cathode (negative) while the zinc itself becomes an anode (positive). The flow of electrons in the steel/zinc from negative to positive serves to counteract any corrosion that may occur on the exposed steel.

Because of the sacrificial nature of zinc plating, different types and thicknesses have been developed over time to serve a multitude of applications. Some environments are harsher than others and as such require further protection. Standard types are known as Type I through Type IV. In Types II and III a hexavalent chromium coating is used to boost the corrosion resistance of the plating. However, in recent years the Restriction of Hazardous Substances Directive (known as RoHS) put out by the European Union has banned the use of hexavalent chromium in electrical and electronic devices. As such the

ASTM Type	Description
Type I	Bright Zinc Plating (Silver)
Type II	Zinc with a colored chromate coating (Typically Iridescent/Yellow)
Type III	Zinc with a colorless chromate coating
Type IV	Zinc with a phosphate conversion coating

Table 1. Standard Types per ASTM B633

ASTM	Service Condition Thickness
SC1	0.0002” min.
SC2	0.0003” min.
SC3	0.0005” min.
SC4	0.001” min.

Table 2. Service Conditions per ASTM B633

industry has developed a system of trivalent chromium coatings to be used in place of the hexavalent coatings and thus be RoHS compliant. Thickness of the plating is denoted as the service condition of the part. A higher service condition (seen as SC1 to SC4) means the part will be exposed to a harsher environment and thus will require a thicker plating to keep the host part from corroding. The tables below explain both types and service conditions.

So why should you choose one type of zinc plating over another? The easy answer is that the different types provide different amounts of protection. The conditions of the environment in which the product is expected to perform determine the sort of plating necessary. Table 3 will give you an idea of how the different zinc types perform.

Plating Type	Hours to White Rust	Hours to Red Rust
Type I	8 hours	75 hours
Type II (Yellow/ Iridescent Chromate)	96 hours	250 hours
Type III (Clear Chromate)	75 hours	200 hours

Table 3. Approximate Hours to White & Red Rust via ASTM B117 Salt Spray/Fog Test

As mentioned above, there are many different types of chromates that can be used. They are usually referred to by their finish color. Each of them has their own properties and differing levels of corrosion protection. In addition to the various chromate types, post-sealers can be used to further increase corrosion resistance. However, these are best left to another paper as they are quite numerous and this is only meant to be a basic primer.

In the caster industry Type I zinc plating is common and can be found on many caster types. In most cases, these casters are meant to be used in environments where corrosion is expected but not excessive. In more harsh cases, Yellow Chromate Type II plating is offered. Below you can see two sample photos.

Photo 1. Type I Zinc Plating

Photo 2. Type II Zinc Plating

Figure 3. An example of a Zinc Nickel plated part

While the standard zinc plating types cover most caster applications, there are situations that will place the caster into an extremely corrosive environment. When an environment like this is encountered, another sort of zinc plating can be used to protect parts. Zinc Nickel plating can provide protection for parts even in the harshest conditions. In standard ASTM salt spray tests the coating has resisted white rust for up to 360 hours and red rust for up to 1000 hours. Below is a photo showing a sample that has been Zinc Nickel plated. It is mostly a dull gray color with just a bit of the iridescence found in Yellow Chromate Type II plating.

RWM offers both of these zinc plating options to our customers and can work with special applications to provide further protection as necessary. If required for an application, parts can be plated to a higher service condition or a more aggressive option can be specified. If you have a special requirement, please allow our customer service and sales staff to assist by providing recommendations specific to your application.