



An Overview of
The Passivation Process

What is passivation?

Stainless steel is resistant to surface attack as long as the corrosive environment isn't too harsh. However, once a certain corrosion threshold is passed pits can form on the surface or within details of the component. To prevent this from happening, a transparent passive film can be applied to the stainless steel which protects it from corrosion and oxidation - a process known as passivation.

Although passivation occurs naturally on most types of stainless steel, the passivation process was developed as a way of making sure the process occurs uniformly and quickly. The passivation process can also improve the aesthetics of the component. Nitric passivation will not adversely affect the stainless steel itself.



Reducing Reactivity

One of the most important features of passivation is its ability to deter corrosion, oxidation, and mild chemical attack. Passivation creates a layer of film that is only a few atoms thick, but is chemically inert so it reduces the reactivity of the stainless steel.

Concerns When Passivating a Component

There are contaminants that can undermine the success of passivation. The grit in dirt, various types of oils and grease, a number of naturally-occurring and chemical compounds, as well as iron are some of the top agents that corrupt passivation film. Electro-Spec combats these concerns by implementing a comprehensive cleaning procedure involving vacuum vapor degreasing with ultrasonic capabilities. All components go through vacuum vapor degreasing prior to the passivation process.

Passivation Applications

Corrosion and contamination can greatly impact the performance of stainless steel parts and therefore passivation is important for safety and performance. Passivation is often necessary when preparing parts for an aerospace application where accuracy is critical, as well as instruments for measurement or machine parts. Passivation is also a critical process for stainless steel medical devices, where sterile equipment is a matter of life and death. In fact, many varieties of hospital equipment require passivation, as well as parts used in the; military, aerospace and many other high reliability and safety critical industries.

Electro-Spec's Passivation Process

At Electro-Spec we utilize a full range of passivation methods on parts up to approximately 12", which is also dependent on the geometry of the part. Electro-Spec's focus is always on quality, and since passivation is a process that finishes safety critical and high reliability components, the temperature, solution concentrations, and timing are adhered to as outlined for the type II, VI, VII, and VIII methods listed in AMS-QQ-P35 and QQ-P-35, and Nitric 1-5 in ASTM A967. We have a fully staffed chemistry lab on all three shifts, which allows; cleaners, rinses and passivation baths to be monitored continuously. Inspection and testing is required to make sure the passivation process is complete and that parts are rinsed, dried and free of any surface defects. These tests can include salt spray, high humidity testing, and water immersion.

A typical passivation process looks somewhat like this: Cleaner -> Multiple Rinses -> Passivation Bath -> Multiple Rinses -> Dry the parts -> Final Inspection -> Shipping.

There are several formulations that can be used, each balance the concentration of Nitric Acid used, temperature, and the amount of time the parts are in the Nitric Acid Passivation bath. These factors are determined by the customer and governed by the appropriate specifications.

Mini Case Study: Electro-Spec, Fountain Cola Machines and Passivation

One Electro-Spec client is a manufacturer of fountain cola machines. It's very important that parts used in these machines are not damaged by placement in the moist and acidic environment, so parts in the cola machines that come into contact with cola syrup or water are put through the passivation process. The passivation film protects the parts from corrosion and oxidation.

An added benefit of passivation in this application is that the process doesn't impact the taste of the cola at all. In fact, the manufacturer has a coveted quality assurance measure at its facility, appointing one employee per shift to drop components from each batch of passivated parts into cola syrup to see if the taste is influenced at all. So far, we have had a 100% success rate.

Think that passivation might be required for your next project? Don't hesitate to contact us today.