



WHITE PAPER | 1999

Passivation: Is it really necessary?

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January 6, 1999

Stainless steels are called "stainless" because in the presence of oxygen, they develop a thin, hard adherent film of chromium oxide that protects the metal from corrosion. In the event the surface is scratched, this protective layer develops again.

During handling and processing operations such as forming, machining, and tumbling, particles of iron or tool steel may be embedded in or smeared on the surfaces of the stainless steel component. Although stainless steel is highly corrosion resistant, the iron contamination induced during fabrication is subject to rust and corrosion. If allowed to remain, these particles may corrode and produce rust spots or stains on the surface of the stainless steel. While these particles might cause surface blemishes, the base material remains unchanged, and it maintains its basic mechanical performance characteristics.

It has been traditionally thought that passivation is the standard method of cleaning stainless steel; when in fact passivation is not a cleaning process at all. The passivation process removes any residual carbon from the surface of the part by the use of nitric and citric acids. SPIROL utilizes citric acid. The acid dissolves the surface imperfections, such as embedded tool steel or other free iron particles. However, the sole purpose of passivation is to remove embedded iron; not to clean the part. Passivation will not remove any oils or other non-ferrous contaminants. These other contaminants are removed through a vigorous cleaning process, prior to the passivation process. William Snyder wrote in the March 1983 issue of *Plating/Anodizing Forum* in *Industrial Finishing*: "Thousands of dollars are wasted every month by manufactures going through complete passivation cycles when all they need is a proper cleaning." In addition to proper cleaning, the use of carbide tooling minimizes iron contaminants in the stainless steel. SPIROL has implemented many carbide tools in order to reduce tool wear, and this has a side benefit of minimizing the particles of embedded tool steel.

SPIROL International is dedicated to helping our customers reduce component costs. One way to reduce costs is to eliminate non-value-added processes; and passivation tends to be one of these. Passivation is a costly operation and is not environmentally friendly. We recommend that a review of the customer's application requirements be done in order to determine whether or not passivation is really necessary for each particular application. Some typical applications where passivation is appropriate is in medical implants or instruments, components used in the food or drug industry, fuel system applications, and any application requiring a clean environment.

Excluding the above mentioned applications, and others where the user deems it appropriate, there are thousands of applications in which passivation is not necessary. Remember that any residual carbon may cause *superficial* blemishing, however this should not impede the corrosion resistance of the base metal, or impact the basic performance of the part.

The cost differential between a passivated and non-passivated part is approximately 10%. If the customer's application does not require passivation, you may recommend a part with a plain finish versus passivated.

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