

## Environmentally friendly and pH-neutral: Initial cleaning and passivation of new plants

Even rust-free stainless steel has to be taken care of.

*The syllable "precious" in the word "precious steel" (German for stainless steel) implies imperishability, purity and permanently clean surfaces as assumed with precious metals. But unfortunately the facts tell a different story. Even for new plants or newly constructed plant components, that were exposed to the influences of daily production, stainless steel surfaces require special attention in pharmaceutical, chemical, food industry or medicine plants. The stainless or stain resistant alloys are still contaminated with residues of releasing agents, oil film, dust, grit, etc. and have not yet formed an adequately protective layer. Therefore, they do not yet fulfil the chemical and particularly the hygienic requirements that are placed on such plants. Here, a new development offers an environmentally friendly option of cleaning the (new) plants pH-neutrally and subsequently sealing the surfaces. All chemicals and all process steps are certified and permitted according to the relevant international specifications for the pharmaceutical industry and food industry.*

In many sections of the industry, where hygiene is imperative, stainless steel surfaces are preferred. The robust material braves cleaning and disinfection media as well as steam jets, superheated steam and aggressive reagents in the plant. The optimal protective effect is achieved by means of a closed chromium oxide rich surface layer, the passive layer. Unfortunately, this is not stable in the long-term and is not strong enough by its own virtue. It must first be created for new plants or modifications. In order to offer the operators of such plants an optimal service encompassing commissioning, cyclical maintenance and compliance with statutory regulations, the specialists from Ateco Services AG Rheinfelden in Switzerland have expanded their portfolio.

### About Ateco

Since 2004, ATECO Services AG is engaged in the sector of high purity media in the pharmaceutical industry.



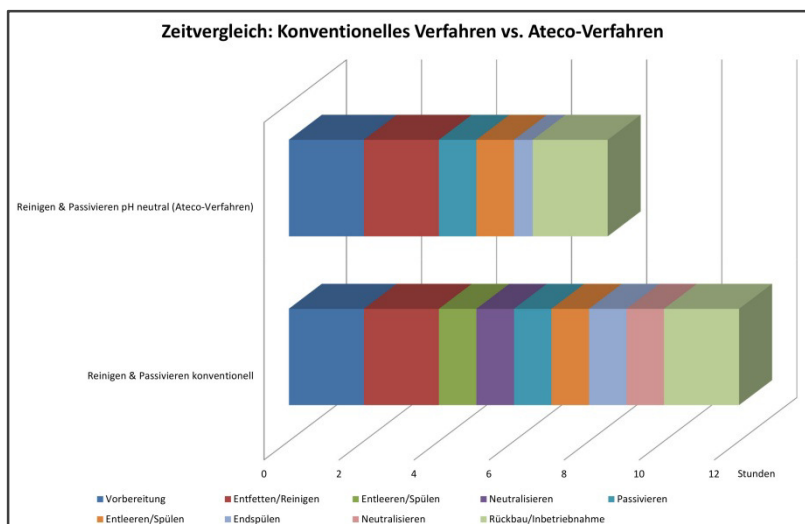
With extensive experience in planning, qualification and validation of high purity media systems and the know-how for treating high-quality stainless steel surfaces, Ateco provides consultation for removing of rouging and for the use of passivation methods. The execution of assignments with simultaneous documentation of the work as per the standards of the pharmaceutical industry, saves not only time and money but also gives the assurance that all regulations for complex cleaning processes are complied with. For operations carried out independently, Ateco delivers also high quality cleaning products.

With headquarters in Switzerland, the company is most flexible in the European market and can quickly and easily help clients in resolving their derouging problems.

They now offer basic cleaning for new and converted plants using cleaning, derouging and passivation technologies with maximum environmentally friendly and pH-neutral methods.

## Thoroughly clean

Surfaces located in the hygiene sections are generally processed as smoothly as possible. However, a number of impurities such as abrasion particles, graphite dust and oil films are deposited on the stainless steel parts when the plant is manufactured. These must necessarily be removed before further surface conditioning by means of an initial cleaning to eliminate impurities and defective formation of the passivation layer and to prevent a medium for biofilms. The cleaning specialists for stainless steel provide proven methods for this. Increasingly, pH neutral cleaners are used due to environmental and cost reasons. The cleaning of particles and grease or oil films takes place in the neutral range at pH 7. Complexing agents and additives work best at temperatures of over 50 °C. After about 2 hours, all surfaces are metallically bright and are prepared for passivation.



**Comparison of required time for a conventional cleaning and passivation (alkaline degreasing with subsequent acidic passivation) and the pH neutral Ateco method.**

cleaning step is recommended before passivation using the similarly pH neutral Dirunetra, to obtain the best possible surface for the formation of a protective layer. The intermediate step cleans deeply and removes iron oxides and hydroxides if existing. The Cr/Fe ratio thus improved, then results in a reinforced passivation layer with the following "sealing" step.

The advantages of the new, environmentally friendly method has already convinced well-known clients in the chemical and pharmaceutical industry. Hans-Georg Hof, Managing Director of Hof Sonderanlagenbau GmbH comments: "As a manufacturer of freeze-drying systems, we always endeavour to satisfy the ever increasing quality demands. Therefore, we have always followed the principle of "basic cleaning, derouging and passivation" for years at our plants and successfully work together with Ateco for this."

Now the pH-neutral passivation agent will be added directly into the hydrogen-peroxide based rinsing solution. A time consuming, intermediate rinsing is not required. The actual subsequent passivation lasts then for approximately 45 to 90 minutes depending on the surface finish of the material being treated. For special cases, such as surfaces that are not electro-polished for example, an intermediate

In the currently used "pH-neutral method", an optimum level is achieved in terms of efficiency, usage and environmental compatibility according to his opinion. "We perform these cleaning and passivation measures with our own qualified personnel. The measures are supported by our biologist Ms Eva Hof (process development) and Ateco. The experience of the previous years has shown that a very satisfactory result is achieved."

Generally, low chemical concentration with very good passivation is mentioned as a main advantage here. The low quantities of chemicals along with the pH neutral work area also lowers the consequential costs as the required solution can be directly disposed of into sewage. And we must not forget the low hazard potential in case of a damage; one should be particularly careful with new plants in spite of all checks. The passivation can be seen as a control run for the plant, so to speak. Furthermore, the very short processing time and the missing intermediate rinsing lower the costs for commissioning of new plants or upgraded components as compared to the older methods. Thus, a new WFI (water for injection) distribution system with a storage tank, for example, can be cleaned and passivated within one working day with the new method.

### **As required or "all inclusive"**

The specialists from Switzerland advise the users to find an optimal solution for each case. In addition to the certified cleaning chemicals, implementation requirements, that is, concentration of the cleaner, solution temperature and application time are important. The parameters for this are determined in the laboratory for the process impurities that occur at the client's site.

In order to coat all the surfaces in large autoclaves, batching tanks, production tanks and storage tanks safely in production, static, rotating and orbital spray nozzles are used for the distribution of the pre-rinse, the cleaning solution and for subsequent rinsing.

Naturally, the requirements for cleaning and passivation intervals are as different as the plants and industries in which the stainless steel components are used. Also, the on-site infrastructure is not the same. Thus, not every user may be able fulfil all certification prerequisites completely. Due to this reason, Ateco also offers a scalable service. Managing Director, Marc Vernier remarks: "As our client requirements vary substantially depending on the sector and the product, we offer a wide range of support. From the delivery of certified chemicals and manuals for complete self-operation, to consultation and laboratory analysis of impurities to an one-stop shop with detailed pre-planning including finding and analysis, approving SOP (Standard Operating Procedure), schedule, etc., for implementation (develop system, execute defined processes, running protocols, etc.) to post processing. The latter includes review of the protocols, documentation and subsequent delivery to the clients. Thus, the user can choose the variant that is most appropriate for his production without compromising on quality."



**Marc Vernier, Managing  
Director Ateco Services AG**

Regular care of the plant components made of stainless steel ensures trouble-free production of the highest standard. Depending on the requirements of the plant and the operator, different statutory provisions must be taken into consideration. Here, an all-round service helps. All operations and documentations are provided by one contact person. This saves time and money. If one wishes to carry out the initial cleaning or derouging on his own, one receives all the required chemicals with a certified programme and a manual.

Text: Marc Vernier, Managing Director of Ateco Services AG  
und Dipl. Chem. Andreas Zeiff, Editorial Office, Stutensee



*Employees applying chemicals for passivation.*

## "Care" for the protective layer on stainless steel

Chromium is the main additive of almost all rustless and rust resistant stainless steels and provides the actual protective passivation layer. Other alloying constituents such as nickel or molybdenum support the process or improve the basic mechanical properties of the alloy. Generally, chromium improves the resistance to oxidising media while nickel "toughens" the alloy against the attack of reducing acids. The protective layer that is formed is exposed to influences of the environment due to the metallurgic inclusions in the material surface as well as chemical reactions that interfere with its homogeneity or wear it away. Iron particles, e.g. from sawing operations or oil and dust created during manufacture of the plant, result in rusting of the stainless steel and hinder the complete formation of a passivation layer. Thus, a basic cleaning is imperative before commissioning. Under the influence of chloride ions in the medium, stainless steel is prone to pitting corrosion. Even ordinary hot water above 80 °C damages the passivation layer permanently by changing the chromium-iron ratio on the surface in favour of iron.

Thus sooner or later every plant made of stainless steel is covered with a rust-red rouging layer. This layer is not only chemically less resistant than the desired chromium oxide rich passivation layer, the surfaces are also becoming rougher and iron oxide particles can be carried over to adjacent production facilities. A major disadvantage for perfectly hygienic working conditions.

In case of plants, the stainless steel specialist from Rheinfelden approaches the problem from two sides. First, a pH neutral basic cleaning is carried out for new plants, and a so-called derouging is done for plants in use. Then the protective layer (passivation layer) is built anew. During derouging, the iron oxide rich surface layer is removed with a pH neutral, environmentally friendly cleaner. The previously used acidic cleaners on phosphoric acid base are obsolete. After basic cleaning or derouging, the stainless steel surfaces are newly "sealed" using oxidising media. The new chromium oxide rich passivation layer thus formed then covers the complete surface that was treated; rouging or pitted areas are again completely sealed and adequately protected.



*Rouging in a stainless steel pipe of an ultrapure water pipe*