

STAINLESS STEEL IN THE PHARMACEUTICAL, FOOD AND BEVERAGES INDUSTRIES

There are over 150 different grades of stainless steel, of which fifteen are the most used worldwide. Due to its inherent resistance to contamination - which is generalized as “corrosion” in the metals industry - stainless steel is usually the preferred material for good manufacturing practice (GMP) applications.

Corrosion Resistance of Stainless Steel

All stainless steel are iron-based alloys that contain a minimum of around 10.5% Chromium. Stainless steel does not release contaminants because the chromium content of the steel combines with oxygen in the atmosphere to form an invisible film of chrome-containing oxide, called the *passive layer*.

If the metal is scratched and the passive film is disrupted, more oxide will form and recover the exposed surface, protecting it from oxidation corrosion. The self-healing nature of the oxide layer means the corrosion resistance remains intact regardless of fabrication methods.

Though the protective layer is too thin to be visible, it is responsible for the glossy look of stainless steel.

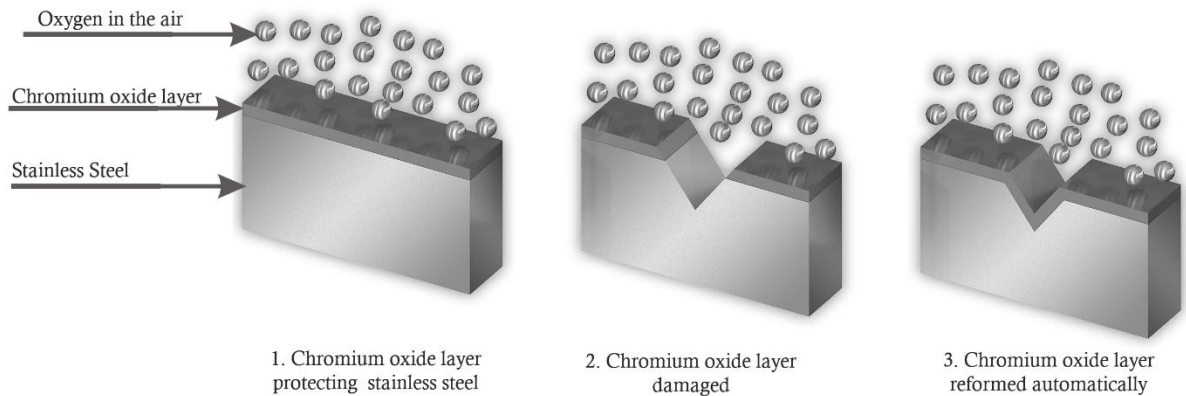


Figure 1 the automatic reforming of the passive layer in stainless steel



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Austenitic Stainless Steels (200 and 300 Series)

The 300 series of austenitic stainless steel is the most popular choice. It is an iron-based, low-carbon alloy that is non-magnetic and owes its high-corrosive resistance to chromium. The basic structure of 300-series austenitic stainless steel is 18% chromium, 8% nickel alloy, and 0.10% carbon; it is commonly known as *18/8 steel*.

However, this designation isn't recommended for general use, as there are tolerances in the allowable range of these elements that overlap with other grades.

Within the 300 series, **304** stainless steel is used primarily in brewery, dairy, and pharmaceutical production equipment applications. While grade **304** is an excellent general-purpose stainless-steel option, grade **316** is preferable, particularly within the pharmaceutical industry.

316 stainless steel contains molybdenum and a higher nickel content (10%) than **304**. In conjunction with chromium, molybdenum provides superior resistance to attack by most chemicals and an increased resistance to chloride corrosion as compared to **304** stainless steel.

316L is the most common type used in the industry. Corrosion resistance is the same as standards 316, but the low carbon content is used to avoid possible *sensitization corrosion* in welding.

While grade **304** is used for “non-product” applications, **316L** is used wherever pharmaceutical products are directly handled or manufactured.

In AFAQ, we are always making sure that the proper material is used in the right conditions, through the implementation of the appropriate quality assurance documents like **MTR** (*material test report*), which can either be provided by the original manufacturer of the material or by analyzing a sample in a specialized industrial laboratory. Our machines are always manufactured and installed in accordance with the cGMP requirements and international regulation and guidelines.



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