

# Finding the Right Scale and Platform for Hazardous Areas

## COVER STORY: PLANT SAFETY

By Ryan Titmas

The very strict hygiene regulations applied in the pharmaceutical and medical technology industries are quickly migrating into the chemical industries. It is becoming mandatory that high washdown/caustic areas require equipment with better grade stainless - better finishes and lower surface roughness - that is easy to clean and maintain.

More and more companies are putting their trust in stainless steel with electropolished surfaces. Electropolishing meets the strictest hygiene requirements because its surfaces are smooth enough that neither micro-organisms nor the residues that they feed on can take hold. Moreover, it is highly corrosion-resistant and can withstand even the most aggressive cleaning agents used in sterile environments.

The preferred material for product surfaces that come into contact with products in these applications is austenitic stainless steel in the AISI 300 Series (e.g., AISI 304, 316, 316L, or 316Ti).

### **Stainless Steel Grades**

Stainless steel is especially resistant to chemically aggressive, aqueous solutions. Most grades of stainless steel contain 12 percent chrome and a maximum of 1.2 percent carbon by weight. The high corrosion resistance of stainless steel is due to a passive layer that forms on the surface of the metal. This consists of a metal oxide or hydroxide layer, rich in chrome, only a few Angstrom units thick, that separates the metal from the attacking medium. The passive layer on stainless steel is not constant; over time it tends toward a state of equilibrium in composition and structure with the ambient media. Thus, a passive layer once formed cannot be transferred to another medium. If the passive layer is damaged (e.g., mechanically), it generally reforms spontaneously. If a particular medium cannot form an adequate passive layer, or if the existing passive layer is penetrated or destroyed by a given chemical, corrosion damage may ensue.

Chrome is the decisive alloy in determining the ability of a stainless steel to form a passive layer. Chrome content above the level of 12 percent will suppress the formation of rust under normal atmospheric corrosive influences. A further increase of the chrome content or, under certain circumstances, the addition of molybdenum or other alloying elements will extend the corrosion resistance of the stainless steel so that it can withstand far more aggressive conditions. Only the alloying additions dissolved in the metal are effective in achieving passivation. This is why the best corrosion resistance is provided by matrices that are free of segregation and are not

depleted of chrome or molybdenum due to precipitations or formation of inter-metallic phases.

The correct heat treatment for achieving optimum material structure is described in data sheets on the particular materials. Stainless steels can suffer from wear corrosion on the surface and various forms of local corrosion. Surface-wear corrosion can be expected primarily when working with acids and strong alkalis. For more details on corrosion resistance of stainless steels when exposed to various media, see "Corrosion of Stainless Steels," available for download from [www.NIROSTA.de](http://www.NIROSTA.de) (click on "English" and then navigate to "Products" and then to "Materials").

### The Stainless Weighing Surface

It is essential that equipment surfaces be easy to clean and maintain. All surfaces that come into contact with the product must be completely resistant not only to the product itself but also to the detergents and other agents used in cleaning, disinfecting, and sterilizing the equipment.

Furthermore, these surfaces must be made of a non-absorbent material and must conform to the specifications dictating the permitted surface roughness. The surface characteristics must conform to the defined mean roughness Ra (Ra refers to the average roughness of the steel across its surface) and must be free of defects such as holes, brush marks or grooves, or fissures. Surfaces that do not touch the product must be smooth enough to enable easy and thorough cleaning.

The following methods are used to ensure surfaces with low roughness characteristics:

- **Bead Blasting:** The abrasive polishing agents used on unalloyed metals cannot be used to polish stainless steel because the iron particles rubbed off in polishing might lead to extraneous rust on stainless steel. To avoid corrosion and extraneous rust, it is also important to ensure that polishing agents used on stainless steel are free of both iron and sulfur.
- **Electropolishing:** Electropolishing, which is also called chemical polishing or finishing, is ideal for polishing metal parts that cannot be mechanically polished. Examples are parts that have complex forms or thin walls or that bend easily. In the electropolishing procedure, the part to be polished is immersed in a special bath and made anodic. The introduction of a cathodic metal to the bath causes the metal ions to be removed from the surface of the anodic test piece, which both decreases its surface roughness and significantly increases the proportion of chromium on the surface, which in turn improves corrosion resistance.

The advantage of an ultra-smooth surface is clear: it prevents deposits that could otherwise lead to crevice corrosion. Only a perfectly smooth, bright surface is effectively resistant to the corrosion that can originate in crevices or holes. The surface roughness of electropolished stainless steel is as low as 0.2 to 0.3  $\mu\text{m}$ .

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## Mechanical Designs

Constructing weighing devices with stainless steel is only a part of developing a scale suitable for manufacturing environments. Typical bench and floor scales used in everyday weighing applications are constructed with one thing in mind - price. This is an excellent strategy when an application doesn't require accuracy or washdown; however, a "typical" scale should never be used in a caustic area or even an environment where sanitation is critical.

Scales designed for cleanroom environments will have several of the following characteristics in common.

- They should have open frame design for easy cleaning.
- They should have limited corners and crevices to eliminate gathering points for bacteria or cleaning agents.
- Large platforms must be equipped with some type of pressure lifting device to allow cleaning underneath the platform.

## Conclusion

Finding the right scale for your hazardous area application is not as easy as it looks. There are many factors that first must be investigated to determine if a piece of weighing equipment will not only satisfy your accuracy needs but also satisfy stringent cleaning regiments. Carefully inspect the scales currently in your manufacturing area and ask the following questions:

1. What resolution to capacity ratio are the scales? Take the maximum capacity of the scale and divide it by the resolution (readability). If this number is less than 15,000, then you probably can find a higher accuracy alternative with little price increase.
2. Does the scale look easy to clean? Every scale looks simple to clean on the surface, but what does it look like when you lift the weighing surface off? Does it have an open frame design and are there large amounts of corners and crevices? Do you have a floor scale with no means of cleaning below the unit? If your scale is located in a sanitary area and it is not easy to clean, then scale replacement should be considered.

In summary, before you purchase weighing equipment for your hazardous area, consult with an expert in the field of weighing. Most major manufacturers have free phone or e-mail consultation with some providing on-site consultation at little cost. Ryan Titmas has been with Sartorius Mechatronics for over six years as product manager for industrial scales and is currently head of customer relations. He holds a mechanical engineering degree from the U.S. Merchant Marine Academy and an MBA from Dowling College. More information is available by contacting him at 631-254-4249, ext. 8307, or [Ryan.Titmas@sartorius.com](mailto:Ryan.Titmas@sartorius.com). Sartorius Mechatronics ([www.sartorius-usa.com](http://www.sartorius-usa.com)) is an internationally leading laboratory and process technology provider, specializing in manufacturing of weighing, measurement, and

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