



SPS CleanTech Application Note 003 – June, 2021 304 Stainless Steel versus 316L Stainless Steel

Executive Summary

Cleanrooms have historically used stainless steel as the material of choice for much of the furnishings used inside the cleanroom. The type of chemicals and substances used in the manufacturing process as well as the harsh cleaning agents applied to surfaces make stainless steel a suitable material to use. Whether to use 304 or 316L stainless steel is often asked. This Application Note tries to explain the difference between the two metals and what the pros and cons are for each.



Background

Cleanroom furnishings are often made using stainless steel and this material has proven to be the best material choice considering the types of substances used in cleanrooms and the cleaning regimes typically used in these environments. In recent years there has been a trend in cleanrooms to apply more concentrated disinfectants using more rigorous sterilization applications. This growing trend has caused many End Users to question if they should use 304 or upgrade to 316 stainless steel. To shed light on this dilemma we need to look at the material property differences between 304 and 316 stainless steel. While both are durable and provide excellent resistance to corrosion and rust there are some pros and cons for each.

304 stainless steel has 18% chromium and 8% nickel added to it to enable it to be resistant to oxidation and corrosion. 304 stainless steel is a very durable material and is

easily cleaned to prevent contamination on its surface. 316 stainless steel has 16% chromium, 10% nickel and 2% molybdenum added to it to provide an added level of corrosion resistivity. 316 stainless steel has greater resistance to chemical attack than 304 stainless steel due to the addition of molybdenum. Molybdenum is a chemical element used for the strengthening and hardening of steel. In addition, the molybdenum makes 316 stainless steel more resistant to sulfuric acids, chlorides/salts, bromides, iodides and fatty acids than 304 stainless steel.

304 stainless steel provides good protection against oxidation and corrosion and is considered standard material from most suppliers, so it is more readily available. 316 stainless steel is not as common so typically there is a longer lead time. A lower usage rate and unique composition combine to make 316 stainless steel 35% more expensive than 304 stainless steel. If you don't expose your 304 stainless steel furnishings to sulfuric acids, chlorides, bromides iodides and fatty acids than 304 stainless steel is a perfect choice of material to use in cleanrooms. Even if these substances are present around your 304 stainless steel furnishings, the 304 stainless steel can still be used but its useful life could be shortened due to pitting and localized areas of corrosion over time. Using 316 stainless steel in these situations will provide added protection. So, while it costs more upfront, the extended functional lifespan of 316 stainless steel could result in long term savings.

Despite the differences in chemical composition, there is no visible difference to the appearance of 304 versus 316 (at least to the naked eye) and the performing characteristics are comparable. 304 stainless steel has a slightly higher tensile strength and higher operating temperature range (by 150°F) but in cleanroom applications these differences do not come into play.

Some people also question the difference between 316 and 316L stainless steel. 316 stainless steel has a midrange level of carbon in it ~ typically a maximum of 0.08% carbon. 316L stainless steel has the "L" suffix to designate low carbon content ~ typically a maximum of 0.03% carbon. 316L stainless steel is more weld friendly than 316 stainless steel due to the lower carbon content.

Both 304 and 316L stainless steel are great choices to use in cleanroom applications. Unless you have sulfuric acids, chlorides, bromides iodides and fatty acids in your process or in your cleaning agents then 304 stainless steel is the most affordable choice. But if you have these caustic materials in your cleanroom then 316 stainless steel should be considered for long term use.