Precautions

Alloys have generally been developed to have maximum corrosion resistance to specific environments. Careful evaluation of the service conditions is needed for successful alloy selection.

Chromium within the alloy can react with carbon and form localized Cr-depleted areas and brittle compounds, normally at grain boundaries. This effect is known as “sensitization” and can have serious consequences for corrosion resistance, especially stress corrosion cracking. “Stabilized” stainless steels have alloying additions (Ti, Mo, Nb) specifically to “tie-up” carbon as carbides and so prevent sensitization (also known as weld decay). Unstabilized, austenitic steels have a service temperature limit of 370 ºC. With the exception of stabilized or low-carbon grades (e.g. 321, 347, 316L, 304L), welded assemblies need solution treatment and quenching after welding.

Austenitic stainless steels can suffer stress corrosion cracking in chloride environments and they can be prone to pitting, crevice corrosion and weld decay unless composition, heat-treatment and service conditions are carefully controlled.

Austenitic stainless steels of the 300-series are generally resistant to stress corrosion cracking. Martensitic stainless steels of the 400-series are more or less susceptible, depending on composition and heat treatment. Precipitation hardening stainless steels vary in susceptibility from extremely high to extremely low, depending on composition and heat treatment. The susceptibility of these materials is particularly sensitive to heat treatment, and special vigilance is required to avoid problems due to SCC.

Stainless steel parts and fabrications shall be cleaned carefully prior to operation in service. Heat treatment can thicken the oxide film to produce scale or deplete the subscale metal of chromium. Welding spatter and flux residues can promote localized corrosion. Embedded carbon-rich materials from machining can react with chromium at high temperatures. Cleaning processes are normally chemical pickling using various combinations of acids, the residues of which also have to be removed thoroughly. Some grades can be susceptible to hydrogen embrittlement resulting from hydrogen pick-up during pickling processes.