Why Stainless Steel?

What is Stainless Steel?

The many unique values provided by stainless steel make it a powerful candidate in materials selection. Engineers, specifiers and designers often underestimate or overlook these values because of what is viewed as the higher initial cost of stainless steel. However, over the total life of a project, stainless is often the best value option.

Stainless steel is essentially a low carbon steel which contains chromium at 10% or more by weight. It is the addition of chromium that gives the steel its unique stainless, corrosion resisting properties.

The chromium content of the steel allows the formation of a tough, adherent, invisible, corrosion-resisting chromium oxide film on the steel surface. If damaged mechanically or chemically, this film is self-healing, provided that oxygen, even in very small amounts, is present. The corrosion resistance and other useful properties of the steel are enhanced by increased chromium content and the addition of other elements such as molybdenum, nickel and nitrogen. There are more than 60 grades of stainless steel. However, the entire group can be divided into four classes. Each is identified by the alloying elements which affect their microstructure and for which each is named.

Samples of machined stainless steel components

Grades / Applications of Stainless Steel

400 Series Martensitic – Typical grade: 410
Straight chromium (12 - 18%); magnetic and can be hardened by heat treatment. Typical use: Fasteners, pump shafts.

400 Series Ferritic – Typical grade: 430
Straight chromium (12 - 18%); low carbon, magnetic, but not heat treatable. Typical use: Appliance trim, cooking utensils.

300 Series Austenitic – Typical grade: 304
Chromium (17 - 25%), Nickel (8 - 25%); nonmagnetic, not heat treatable. Can develop high strength by cold working. Additions of molybdenum (up to 7%) can increase the corrosion resistance. Typical use: Food equipment, chemical equipment, architectural applications.

Precipitation Hardening – Typical grade: 17-4
Chromium (12 - 28%), Nickel (4 - 7%); martensitic or austenitic. Develop strength by precipitation harden reaction during heat treatment. Typical use: valves, gears, petrochemical equipment.

Benefits of Stainless Steel

Corrosion resistance – Lower alloyed grades resist corrosion in atmospheric and pure water environments; high-alloyed grades can resist corrosion in most acids, alkaline solutions, and chlorine bearing environments making their properties useful in process plants.

Fire and Heat Resistance – Special high chromium and nickel-alloyed grades resist scaling and retain high strength at high temperatures.

Hygiene – The easy cleaning ability of stainless makes it the first choice for strict hygiene conditions, such as hospitals, kitchens and food processing plants.

Aesthetic appearance – The bright, easily maintained surface of stainless steel provides a modern and attractive appearance.

Strength-to-weight advantage – The work hardening property of austenitic grades, that results in a significant strengthening of the material from cold working alone, and the high strength duplex grades, allow reduced material thickness over conventional grades yielding considerable cost savings.

Ease of fabrication – Modern steel making techniques mean that stainless can be cut welded, formed, machined, and fabricated as readily as traditional steels.

Impact resistance – The austenitic microstructure of the 300 series provides high toughness at elevated temperatures ranging to far below freezing, making these steels particularly suited to cryogenic applications.

Long term value – When the total life cycle costs are considered, stainless is often the least expensive material option.