

TYPES OF STAINLESS STEELS

Stainless Steel is a name given to a group of steel alloys that contain more than 12% Chromium. Chromium has a high affinity for oxygen and forms a stable oxide film on the surface of the stainless steel. This film is called the passive oxide layer and forms instantaneously in ordinary atmospheres. The film is self healing and rebuilds when it has been removed. It is this film that gives Stainless Steel its corrosion resistance.

The large group of stainless steels can be divided into two groups – Austenitic and Ferritic, the Ferritic group being split again into two groups, Martensitic and Ferritic.

AUSTENITIC GRADES

This group of stainless steels contains 17 – 25% Chromium and 8 – 20% Nickel with various additional elements to achieve the desired properties. In the fully annealed condition Austenitic stainless steels exhibit a useful range of mechanical and physical properties. Mechanical properties can be increased with cold working. Welding of this group must be carried out with correct methods but the low Carbon content results in fewer problems than with the Ferritic and Martensitic grades. Normally these stainless steels are non-magnetic but will become slightly magnetic when cold worked. Basic grades of Austenitic stainless steels are listed below.

Description and General Uses

303 Specially developed for machining purposes where production involves extensive machining in automatic screw machines. Sulphur or Selenium is added to give excellent free machining and nonseizing properties. Due to the addition of Sulphur or Selenium the corrosion resistance is lowered to slightly below that of 304. 303 is Non hardenable and not recommended for welding. Non-magnetic when annealed but becomes slightly magnetic when cold worked.

304 The most versatile and widely used stainless steel with the best all round performance. Its Carbon content is lower and its corrosion resistance somewhat higher than 302. It is less susceptible to intergranular corrosion after welding. Non-magnetic but becomes slightly magnetic when cold worked.

304L Type 304L is a very low Carbon stainless steel with general corrosion resistance similar to 304 but with superior resistance to intergranular corrosion following welding or stress relieving. It is recommended for use in parts which are fabricated by welding and which cannot be subsequently annealed. Parts made from this type are generally limited to service at temperatures up to 426°C. The physical properties and thermal treatments of T304L are similar but not necessarily identical to those of 304. Non-magnetic when annealed but becomes slightly magnetic when cold worked.

310S Type 310S has been developed for high temperature service where high creep strength is required. Its maximum service temperature is approximately 1100°C but it is not recommended for applications of prolonged service as brittleness may occur. Non magnetic when annealed or cold worked.

316 Known as the marine alloy – 316 has a 2-3% addition of Molybdenum which improves the corrosion resistance. 316 has superior corrosion resistance to other Austenitic steels when exposed to many types of chemical corrodents as well as marine atmospheres – 316 also has applications in the chemical, textile and paper industries. It has better strength and creep resistance at high temperatures than 304 and greater work hardening properties. Non-magnetic but becomes slightly magnetic when cold worked.

316L Type 316L is a very low Carbon stainless steel with general corrosion resistance similar to 316 but with superior resistance to intergranular corrosion following welding or stress relieving. It is recommended for use in parts which cannot be subsequently annealed. Parts made from this type are generally limited to service temperatures up to 426°C. The physical properties and thermal treatments of Type 316L are similar but not necessarily identical to those of 316. Non-magnetic when annealed but becomes slightly magnetic when cold worked.

321 Basically 302 (basic 18/8) stabilised by the addition of Titanium to five times the Carbon content. This prevents intergranular corrosion and offers scale resistance at higher temperatures, up to 850°C. Corrosion

resistance is slightly lower than 304. This grade is not recommended for bright or mirror polishing. Non-magnetic when annealed but becomes slightly magnetic when cold worked.

MARTENSITIC GRADES

This group contains a 12% - 14% Chromium and 0.08% - 2.00% Carbon. The high Carbon content of the martensitic stainless steels allows them to respond well to heat treatment to give various mechanical strengths such as hardness 500004574. However, the Carbon is detrimental when welding and care must be taken. In the heat treated condition, this group of stainless steels show a useful combination of corrosion resistance and mechanical properties that qualify them for a wide range of application.

Description and General Uses

409 Type 409 is a general purpose construction stainless steel. It is primarily intended for automotive exhaust systems, structural and other applications where appearance is secondary to mechanical and corrosion resistance properties.

410 Type 410 is the general purpose corrosion and heat resisting stainless steel. It has good corrosion resistance and can be easily forged and machined. It exhibits good cold working properties. It is the most inexpensive corrosion resistant steel for general purposed, but it not suitable under severe corrosion conditions. 410 is magnetic in all conditions. Frequently used for stainless steel cutlery.

420 Type 420 has a higher Carbon content than 410 to increase hardness to a maximum of approximately 500 Brinell. It has optimum corrosion resisting qualities in the hardened and tempered conditions. Magnetic in all conditions.

431 Type 431 is a Nickel bearing martensitic stainless steel designed for heat treatment to the highest mechanical properties. Its corrosion resistance is superior to that of types 410 and 430. Magnetic in all conditions.

FERRITIC GRADES

This group contains a minimum of 17% Chromium and 0.08 – 2.00% Carbon. The increase in Chromium imparts increased resistance to corrosion at elevated temperature, however the lack of mechanical properties due to the fact that it cannot be heat treated, limits its applications. Like Martensitics they are magnetic and the welding of the group should be carried out with care.

Descriptions and General Uses

430 Type 430 is a corrosion and heat resisting stainless steel with superior corrosion and heat resistance compared with 410. 430 is a non hardenable and possesses only mild cold working properties due to high chromium content. Its weldability is excellent and it does not require subsequent annealing. Magnetic in all conditions.

DUPLEX / SUPER DUPLEX GRADES

This group of stainless steel has an annealed structure which typically consists of equal parts of austenite and ferrite. These steels have 18 – 29% chromium, 3 – 8% nickel and various other elements, particularly nitrogen and molybdenum. This group of steels has several advantages over austenitic steels. The duplex grades are highly resistant to chloride stress corrosion cracking, they have excellent pitting and crevice corrosion resistance and have about twice the yield strength of the common austenitic grades.,

Description and General Uses

2205 2205 is a duplex stainless steel designed for superior resistance to pitting and crevice corrosion, for resistance to stress corrosion cracking, and for high strength. The steel is well-suited for high chloride environments. Applications include heat exchangers, chemical tankers, chemical reactor vessels, flue gas filters, acetic acid distillation, oil and gas industry equipment.

S32750 S32750 is a Super duplex stainless steel designed for very high resistance to pitting and crevice corrosion, for resistance to stress corrosion cracking, and for very high strength. Applications include oil and gas industries, offshore, petrochemical plants, desalination plants and mechanical and structural components demanding high strength combined with high corrosion resistance