

## **STAINLESS STEEL**

**What is Stainless Steel?** In metallurgy, stainless steel is defined as an iron-carbon alloy with a minimum of 11.5 wt% chromium content. Stainless steel does not stain, corrode or rust as easily as ordinary steel (it "stains less"), but it is not stain-proof. It is also called corrosion resistant steel when the alloy type and grade are not detailed, particularly in the aviation industry. There are different grades and surface finishes of stainless steel to suit the environment to which the material will be subjected in its lifetime. High oxidation-resistance in air at ambient temperature is normally achieved with additions of a minimum of 13% (by weight) chromium, and up to 26% is used for harsh environments. The chromium forms a passivation layer of chromium oxide ( $\text{Cr}_2\text{O}_3$ ) when exposed to oxygen. The layer is too thin to be visible, which means that the metal remains lustrous. It is, however, impervious to water and air, protecting the metal beneath. In addition, Nitronic alloys (trademark of Armco, Inc.) reduce the tendency to gall through selective alloying with manganese and nitrogen. Nickel also contributes to passivation, as do other less commonly used ingredients such as molybdenum and vanadium.

### **Types of stainless steel**

Austenitic, or 300 series, stainless steels comprise over 70% of total stainless steel production. They contain a maximum of 0.15% carbon, a minimum of 16% chromium and sufficient nickel and/or manganese to retain an austenitic structure at all temperatures from the cryogenic region to the melting point of the alloy. A typical composition of 18% chromium and 10% nickel, commonly known as 18/10 stainless, is often used in flatware. Similarly, 18/0 and 18/8 are also available. Superaustenitic stainless steels, such as alloy AL-6XN and 254SMO, exhibit great resistance to chloride pitting and crevice corrosion due to high molybdenum contents (>6%) and nitrogen additions, and the higher nickel content ensures better resistance to stress-corrosion cracking over the 300 series. The higher alloy content of superaustenitic steels makes them more expensive. Other steels can offer similar performance at lower cost and are preferred in certain applications. Ferritic stainless steels are highly corrosion-resistant, but less durable than austenitic grades. They contain between 10.5% and 27% chromium and very little nickel, if any. Most compositions include molybdenum; some, aluminium or titanium. Common ferritic grades include 18Cr-2Mo, 26Cr-1Mo, 29Cr-4Mo, and 29Cr-4Mo-2Ni. Martensitic stainless steels are not as corrosion-resistant as the other two classes but are extremely strong and tough, as well as highly machineable, and can be hardened by heat treatment. Martensitic stainless steel contains chromium (12-14%), molybdenum (0.2-1%), nickel (0-2%), and carbon (about 0.1-1%) (giving it more hardness but making the material a bit more brittle). It is quenched and magnetic. It is also known as series-00 steel. Precipitation-hardening martensitic stainless steels have corrosion resistance comparable to austenitic varieties, but can be precipitation hardened to even higher strengths than the other martensitic grades. The most common, 17-4PH, uses about 17% chromium and 4% nickel. There is a rising trend in defense budgets to opt for an ultra-high-strength stainless steel if possible in new projects, as it is estimated that 2% of the U.S. GDP is spent dealing with corrosion. The Lockheed-Martin Joint Strike Fighter is the first aircraft to use a precipitation-hardenable stainless steel? Carpenter Custom 465? in its airframe. Duplex stainless steels have a mixed microstructure of austenite and ferrite, the aim being to produce a 50/50 mix, although in commercial alloys, the mix may be 40/60 respectively. Duplex steels have improved strength over austenitic stainless steels and also improved resistance to localised corrosion, particularly pitting, crevice corrosion and stress corrosion cracking. They are characterised by high chromium (19-28%) and molybdenum (up to 5%) and lower nickel contents than austenitic stainless steels.

## Stainless steel finishes

Grade	Features	Usages
304	Most widely used steel grade. Good corrosion resistance. Thermal resistance, low-temperature strength and mechanical properties. Good drawability such as deep drawing, bending and does not harden during heat treatment Non-magnetic.	Facilities in chemical, food and dairy industries, sinks, interior piping, hot-water boilers, vessel parts, medical instruments, building materials.
304L	Low carbon Ni-Cr steel, normal conditions, it has corrosion resistance that is similar to 304 grade. But, excellent resistance to inter-granular corrosion after welding and stress relieving.	Machinery and tools used in the chemical coal, textile, nuclear energy and petroleum industry that required high inter-granular corrosion resistance, building materials, heat resistant parts that are difficult to implement heat treatment on
316	Excellent corrosion resistance, pitting corrosion resistance and high temperature strength by adding Mo & Ni 2~3%. Useful in severe/harsh conditions. Excellent drawing hardening. Non-magnetic.	Sea water equipment, equipment for chemicals, paper, dye, acetic acid, fertilizer, photo and food industry and construction in coastal areas, ropes, nuts and bolts part.
316L	Low carbon Ni-Cr steel type with adding Mo. It has the normal properties of 316 grade, but plus excellent inter-granular corrosion resistance after welding and stress relieving.	Pulp, paper, chemical fiber, dye, mesh, phosphoric acid manufacturing facilities.

## STS Coils & Sheets

### Hot Rolled Products

**Specification:** Hot Rolled Products are used in many applications in the production of process plant equipment. They are also used as feedstock in the manufacture of cold rolled flat products, tubes and bar. Product surface is clean and attractive. It has superior corrosion resistance and thus can endure pollution and corrosion environment

**Grades:** T301L, 304/L, 304J, 316L, 321, 310S, XM15J1, 329J3L, 430(M), 410, 420J1, 420J2 etc

**Applications:** Tableware, Kitchen Equipment, Elevator, Pipe Laying Machinery, Automobile Parts, Building Material, Chemical Refining, Paper Manufacturing Plants, Structures In The Coastal etc

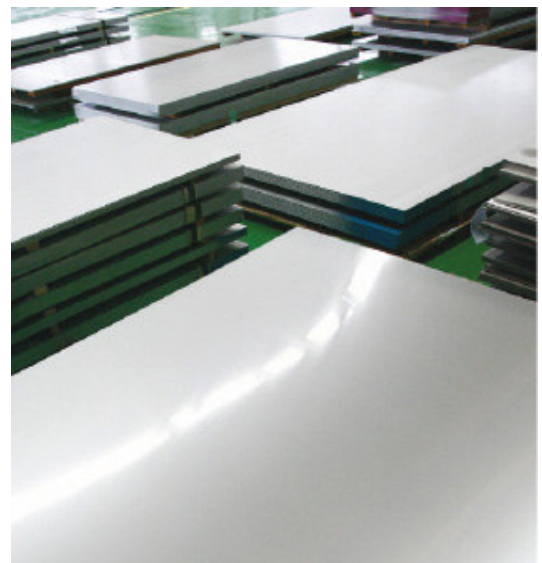


### Cold Rolled Products

**Specification:** Cold Rolled Products are used in a wide variety of end uses, ranging from providing corrosion resistant solutions for the process industry, to polished strip for consumer durables, to patterned sheet for prestigious buildings or other architectural applications. Due to their excellent dimensional tolerances and high surface quality, cold rolled products are the predominant category of stainless steels currently used on the market. Product surface is clean and attractive. Finishing surface treatment is classified by designated no. According to its grade Products of 0.1~3.0mm in thickness, max. Width of 1524mm and variety of shapes and surface treatments.

**Grades:** 301(L), 304(L), 304Cu, 304Ni(N2), 316(L), 321, 409L, 410(L), 430, 430Ti, 436L, 439 etc

**Applications:** Tableware, Kitchen Equipment, Elevator, Pipe Laying Machinery, Automobile Parts, Building Material, Chemical Refining, Paper Manufacturing Plants, Structures in the Coastal and Industrial Area, etc



## STS Plates

**Specification:** Chemical processing, transport and storage, Oil and Gas exploration and processing equipment, Marine and other high chloride environments, Pulp and paper digesters, liquor tanks and paper machines. Products surface is clean and attractive. It has superior corrosion resistance and thus can endure pollution and corrosion environment..

**Grades:** 304(L), 304H, 304N1, 316(L), 316Ti, 316LN, 317L, 321, 347 etc

**Applications:** Pressure Vessel for Storage & Tank, Flange, Industrial Construction, Desalinization Facilities, Sea-water Structure, Large Diameter Pipes, LNG Facility and Carrier, Food Processing Facilities.



## Titanium Alloys

**Specification:** Titanium ASTM A335 is High corrosion Resistance with surface stably oxidized, they can be used for the applications that require high corrosion resistance such as heat exchangers using seawater and major piping materials in chemical plants. High Strength-to-Weight Ratio despite a 60% level of steel gravity, superior strength is maintained not only at normal temperature but also at high and low temperatures, thus drawing the attention from the industry as the future high-tech materials. Standard Specification for Seamless and Welded Titanium and Titanium Alloy Tubes for Condensers and Heat Exchangers

**Grades:** Grade 2, Grade 2H, Grade 3, Grade 12, Grade 16H, Grade 35, Grade 38 etc

**Applications:** Titanium alloy is used in Plants, Buildings, Aerospaces, Valves, Leisure-sports, Submersibles, Golf heads, Watches, Hip Liplant



## PIPES:

ASTM A312



STM A358



ASTM A249/450



ASTM A240S31803



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