Stainless Steel Alloy Designation

Stainless Steel Description	
Stainless steel alloys are austenitic, ferritic, martensitic, precipitation hardened, and duplex metals that are available in a wide variety of grades, shapes, and sizes. Austenitic stainless steels have excellent corrosion resistance, unusually good formability, and increased strength due to cold working. They are non-magnetic or only slightly magnetic. Two hundred (200) series austenitic stainless steels contain chromium, nickel, and manganese. Three hundred (300) series austenitic stainless steels contain chromium and nickel. Ferritic stainless steels are straight-chromium, 400 series metals that cannot be hardened by heat treatment, and only moderately hardened by cold working. They are magnetic, have good ductility, and resist corrosion and oxidation. Martensitic stainless steels, another type of straight-chromium 400 series metals, are magnetic, fairly ductile, and resist corrosion in mild environments. Some products can be heated to tensile strengths that exceed 200,000 psi (1379 MPa). Precipitation hardened (PH) stainless steels are chromium-nickel metals, some of which contain alloying elements such as copper or aluminum. They can be hardened by solution treating and aged to high strength. Duplex stainless steel alloys have improved mechanical properties and consist of a combination of ferritic and austenitic phases.	
Stainless Steel Alloy Types	
Austenitic	200-series austenitic steels are stainless steels that contain chromium, nickel, and manganese. 300-series austenitic steels are stainless steels that contain chromium and nickel. The stainless steels in each austenitic group have different compositions and properties, but share many common characteristics. They can be hardened by cold working but not by heat treatment. In the annealed condition, all are essentially nonmagnetic; although, some may become slightly magnetic by cold working. They have excellent corrosion resistance, unusually good formability, and increased strength due to cold working. Type 304 or 18-8 stainless steel is the most widely used alloy in the 300-series austenitic group. It has a nominal composition of 18% chromium and 8% nickel. Type 316 stainless steel has an 18-8 composition modified with molybdenum to improve pitting corrosion resistance. Austenitic grades consist of 201, 301, 301, 303, 304, 304L, 305, 309, 310, 316, 316L, 317, 317L, 321, 347, and 348 as well as specialized or proprietary austenitic stainless steels.
Ferritic	Ferritic stainless steels are straight-chromium 400-series metals that cannot be hardened by heat treatment, and only moderately hardened by cold marketing. They are magnetic, have good ductility, and resistant against corrosion and oxidation. Ferritic stainless steels have chromium levels that range from 10.5% to 40% (typically 12% or more) and carbon levels less than 0.20%. Types 409, 430, 434, 430, 439, 442, and 446 belong in this category. Type 430 is a general-purpose ferritic stainless steel.
Martensitic	Martensitic stainless steels are straight-chromium 400-series metals that can be hardened by heat treatment. They are magnetic, resist corrosion in mild environments, and have fairly good ductility. Some can be heated to tensile strengths that exceed 200,000 psi (1379 MPa). Type 410 is a general-purpose alloy. Martensitic stainless steel grades include 410, 440, 440C, 403, 414, 416 and 420 as well as specialty and proprietary alloys.
Precipitation Hardening ((e.g., PH, 17-4)	Precipitation hardening alloys can be hardened by solution treating and aged to high strength. Precipitation hardening (PH) stainless steels are chromium-nickel metals, some of which contain alloying elements such as copper or aluminum. PH grades 17-7 (Type 631), 17-4 (Type 630), 13-8, 15-5, 15-7, as well as specialty and proprietary alloys. Many aluminum alloys are hardened or strengthened through a precipitation hardening process.
Duplex (e.g., 329, 2205)	The structure of duplex stainless steels consists of a combination of ferritic and austenitic phases. Duplex stainless steels have corrosion resistance properties that are equivalent to or better than austenitic stainless steels. Duplex stainless steels also have improved mechanical properties. AISI 329 and ASTM 2205 are examples of duplex grade stainless steels.
Stainless Steel Finishes	
1	A rough, dull surface that results from hot rolling to the specified thickness followed by annealing and descaling.
2D	A dull finish produced by cold rolling to gauge, then annealing and pickling in acid to remove scale and oxide from an open air anneal.
2B	A reflective cold tolled finish produced in the same manner at a 2D sheet finish, except that a light temper pass on polished rolls is performed on the annealed and pickled product. This is the general purpose cold rolled finish that can be used as is, or as a preliminary step to polishing.

Alloying Elements and their Functions	
Chromium	Forms a surface film of chromium oxide to make the stainless steel corrosion resistant. It also increases the scaling resistance at elevated temperatures.
Nickel	Stabilizes the austenitic structure and increases ductility, making stainless steel easier to form. It increases high temperature strength and corrosion resistance, particularly in industrial and marine atmospheres, chemical, food and textile processing industries.
Silicon	Increases scaling resistance by forming a tight initial scale, which will withstand cyclic temperature changes. It resists carburizing at high temperatures and slightly increases tensile strength and hardness. Small amounts of silicon are added to all grades of stainless for deoxidizing.
Manganese	Promotes the stability of austenite, at or near room temperature and improves hot working properties. Addition of up to 2% manganese has no effect on strength, ductility and toughness. Manganese is important as a partial replacement of nickel in 200 series stainless grades.
Molybdenum	Increases corrosion resistance, strength at elevated temperatures, and creep resistance. It expands the range of passivity and counteracts tendency to pit especially in chloride environments.
Aluminum	Is a very strong ferrite former and lowers the hardenability of stainless steel. It improves scaling resistance.
Carbon	Strengthens stainless steel but promotes the formation of precipitates harmful to corrosion resistance.
Columbium	Combines with carbon to reduce susceptibility to intergranular corrosion. It acts as a grain refiner and promotes the formation of ferrite.
Copper	Is added to stainless steels to increase their resistance to certain corrosive environments. It also decreases susceptibility to stress corrosion cracking and provides age-hardening effects.
Titanium	Combines with carbon to reduce susceptibility to intergranular corrosion. It acts as a grain refiner and promotes the formation of ferrite.