WHY 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.

WHAT IS STAINLESS STEEL?

Stainless steel is essentially a low carbon steel which contains chromium at 10% or more by weight. It is this 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 five classes. Each is identified by the alloying elements which affect their microstructure and for which each is named.

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

200/300 Series Austenitic — Typical grade: 304
Chromium (17-25%)/Nickel (8-25%), non-magnetic, not heat treatable. Can develop high strength by cold work. 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 (3-9%), martensitic or austenitic. Develop strength by precipitation hardening reaction during heat treatment. Typical use: Valves, gears, petro-chemical equipment

Duplex — Typical grade: 2205
Chromium (18-25%)/Nickel (4-7%) and up to 4% molybdenum. More resistant to stress corrosion cracking than austenitic, yet tougher than fully ferritic alloys. Typical use: Pipelines, pressure vessels, shafting

BENEFITS OF STAINLESS STEEL

Corrosion resistance
— lower alloyed grades resist corrosion in atmospheric and pure water environments, while high-alloyed grades can resist corrosion in most acids, alkaline solutions, and chlorine bearing environments, properties which are utilized in process plants.

Fire & heat resistance
— special high chromium and nickel-alloyed grades resist scaling and retain strength at high temperatures.

Hygiene
— the easy cleaning ability of stainless makes it the first choice for strict hygiene conditions, such as hospitals, kitchens, abattoirs and other 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, therefore 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, from elevated temperatures 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.

Stainless Steel — The Value Option®

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CLASSIFICATION OF STAINLESS STEEL PRODUCT FORMS*

Item	Description	Dimensions		
		Thickness	Width	Diameter or Size
Sheet	Coils and cut lengths: Mill finishes Nos. 1, 2D & 2B Pol. finishes Nos. 3, 4, 6, 7 & 8	under 3/16" (4.76mm) " " "	24" & over (609.6mm) all widths	—
Strip	Cold finished, coils or cut lengths Pol. finishes Nos. 3, 4, 6, 7 & 8	under 3/16" (4.76mm) " " "	under 24" (609.6mm) all widths	—
Plate	Flat rolled or forged	3/16" & over (4.76mm)	over 10" (254mm)	—
Bar	Hot finished rounds, squares, octagons and hexagons Hot finished flats Cold finished rounds, squares octagons and hexagons Cold finished flats	— 1/8" & over (3.18mm) — —	— 1/4" (6.35mm) to 10" incl. (254mm) 3/8" & over (953mm)	1/4" & over (6.35mm) — over 1/2" (12.7mm) —
Wire	Cold finishes only: Round, square, octagon, hexagon flat wire	(254mm) 0.010" to (0.254mm) under 3/16" (4.76mm)	1/16" to (1.59mm) under 3/8" (9.53mm)	1/2" & under (12.7mm)
Pipe & Tubing	Several different classifications, with differing specifications, are available. For information on standard sizes consult your local Steel Service Center or the SSIUS.			
Extrusions	Not considered "standard" shapes, but of potentially wide interest. Currently limited in size to approximately 6 1/2" (165.1mm) diameter circle, or structurals.			

*Ingots, Slabs and Hot Bands also available

STANDARD MECHANICAL SHEET FINISHES

Unpolished or Rolled Finishes:

No. 1 A rough, dull surface which results from hot rolling to the specified thickness followed by annealing and descaling.

No. 2D A dull finish which results from cold rolling followed by annealing and descaling, and may perhaps get a final light roll pass through unpolished rolls. A 2D finish is used where appearance is of no concern.

No. 2B A bright, cold rolled finish resulting in the same manner as No. 2D finish, except that the annealed and descaled sheet receives a final light roll pass through polished rolls. This is the general purpose, cold rolled finish that can be used as is, or as a preliminary step to polishing.

Polished Finishes:

No. 3 An intermediate polish surface obtained by finishing with a 100-grit abrasive. Generally used where a semifinished polished surface is required. A No. 3 finish usually receives additional polishing during fabrication.

No. 4 A polished surface obtained by finishing with a 120-150 mesh abrasive, following initial grinding with coarser abrasives. This is a general-purpose bright finish with a visible "grain" which prevents mirror reflection.

No. 6 A dull satin finish having lower reflectivity than No. 4 finish. It is produced by Tampico brushing the No. 4 finish in a medium of abrasive and oil. It is used for architectural applications and ornamentation where a high luster is undesirable, and to contrast with brighter finishes.

No. 7 A highly reflective finish that is obtained by buffing finely ground surfaces, but not to the extent of completely removing the "grit" lines. It is used chiefly for architectural and ornamental purposes.

No. 8 The most reflective surface obtained by polishing with successively finer abrasives and buffing extensively until all grit lines from preliminary grinding operations are removed. It is used for applications such as mirrors and reflectors.

CONDITIONS & FINISHES FOR BAR	
Conditions	**Surface Finishes***
1. Hot worked only	(a) Scale not removed (excluding spot conditioning) (b) Rough turned** (c) Pickled or blast cleaned and pickled
2. Annealed or otherwise heat treated	(a) Scale not removed (excluding spot conditioning) (b) Rough turned (c) Pickled or blast cleaned and pickled (d) Cold drawn or cold rolled (e) Centerless ground (f) Polished
3. Annealed and cold worked to high tensile strength***	(d) Cold drawn or cold rolled (e) Centerless ground (f) Polished

* Surface finishes (b), (e) and (f) are applicable to round bars only.

** Bars of the 4xx series stainless steels which are highly hardenable, such as Types 414, 420, 420F, 431, 440A, 440B and 440C, are annealed before rough turning. Other hardenable grades, such as Types 403, 410, 416 and 416Se, may also require annealing depending on their composition and size.

***Produced in Types 302, 303Se, 304 and 316.

CONDITIONS & FINISHES FOR PLATE	
Condition and Finish	**Description and Remarks**
Hot rolled	Scale not removed. Not heat treated. Plates not recommended for final use in this condition.*
Hot rolled, annealed or heat treated	Scale not removed. Use of plates in this condition is generally confined to heat resisting applications. Scale impairs corrosion resistance.*
Hot rolled, annealed or heat treated, blast cleaned or pickled	Condition and finish commonly preferred for corrosion resisting and most heat resisting applications.
Hot rolled, annealed descaled and temper passed	Smoother finish for specialized applications.
Hot rolled, annealed descaled cold rolled, annealed, descaled, optionally temper passed	Smooth finish with greater freedom from surface imperfections than the above.
Hot rolled, annealed or heat treated, surface cleaned and polished	Polished finishes: refer to sheet finishes.

*Surface inspection is not practical on plates which have not been pickled or otherwise descaled.