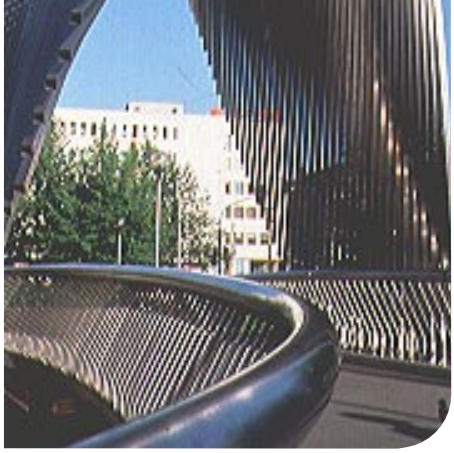
DESIGNER HANDBOOK

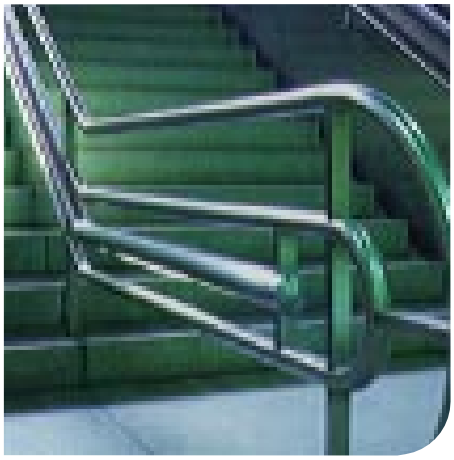
STAINLESS STEEL FOR HANDRAILS, RAILINGS & BARRIER APPLICATIONS

INCLUDED INSIDE:

Directory of Stainless Steel Railing Producers

TABLE OF CONTENTS





STAINLESS STEELS are iron-based alloys containing 10.5% or more chromium. Other elements are added and the chromium content increased to improve the corrosion and heat resisting properties, enhance mechanical properties, and/or improve fabricating characteristics.

Reference is often made to stainless steel in the singular sense as if it were one material. Actually there are well over 100 stainless steel alloys. Three general classifications are used to identify stainless steels. They are: 1. Metallurgical Structure. 2. The AISI numbering system: namely 200, 300, and 400 Series numbers. 3. The Unified Numbering System, developed by the American Society for Testing Materials (ASTM) and Society of Automotive Engineers (SAE), to apply to all commercial metals and alloys.

The various types of stainless steel are detailed in a designer handbook, *Design Guidelines for the Selection and Use of Stainless Steel* available from the Specialty Steel Industry of North America (SSINA). Several other publications are also available, including: *Stainless Steel for Residential Applications, The Care and Cleaning of Stainless Steel, Stainless Steel Finishes, Stainless Steel Specifications* and *Stainless Steel Architectural Facts*, to mention a few.

GENERAL INFORMATION ON STAINLESS STEEL

ALLOYS

The following grades of stainless steel are often used in structural applications:

304 has an austenitic metallurgical structure. It is the basic "18-8" alloy (18% chromium, 8% nickel UNS S30400), is the most readily available grade, and is often specified for "all-purpose" applications. It has excellent corrosion resistance and unusually good formability.

316 is basically a 304 grade with the addition of 2 to 3 percent molybdenum (UNS S31600). It has greater corrosion resistance than 304 and is usually preferred for long-term service in aggressive industrial, chemical and seacoast atmospheres.

409 has a ferritic metallurgical structure. It is a straight chrome alloy (11% to 12% chromium UNS S40900). It has good ductility and corrosion resistance. It is mainly used for internal applications.

410-3 is a dual phase alloy (UNS S41003) with micro alloy element control that permits welding in up to 1 1/4 inches (30mm).

2205 has a duplex structure which is typically about equal parts of austenite and ferrite (21% chromium, 4.5% nickel, 2.5% molybdenum UNS 32304). It has excellent corrosion resistance and exhibits about twice the yield strength as conventional grades.

CONDITION

Stainless steel is usually available in the "Hot Rolled and Annealed" condition and has a yield strength of about 42 ksi. The austenitic grades can be hardened by cold working the material. 301 (UNS S30100), a modification of 304, (with the chromium and nickel lowered slightly to increase the work hardening rate), can be supplied in various "tempers" up to full hard with a yield strength of 140 ksi.

The American Society of Civil Engineers (ASCE) has a standard ANSI/ASCE 8–90, "Specification for the Design of Cold Formed Stainless Steel Structural Members," which details the design information on "cold formed" stainless steel.

PRODUCT FORMS

The forms of stainless steel used in structural applications are: plate and sheet (often fabricated into structural shapes), extrusions, forgings, preformed products (tubes and angles), bar and rod, wire, and castings.

PLATE Plate is defined as material that has a thickness of 3/16" or greater (Table 1). It is usually available in widths of 48, 60, 72 and 96 inches. It can be supplied as individual flat plates or in "coil" form (some limits on thickness and width). Many structural shapes are produced by fabricating the plate into beams, angles and other components.

SHEET Sheet is defined as material that has a thickness of less than 3/16" (Table 1), and is usually supplied in either 48 or 60 inch wide coils.

Table 1 **CLASSIFICATION OF STAINLESS STEEL PRODUCT FORMS***

ITEM	DESCRIPTION	DIMENSIONS		
		Thickness	Width	Diameter or Size
Sheet	Coil and cut lengths: Hot Rolled No. 1	under 0.1875" (4.76mm)	24.000" (609.6mm) and over	—
	Cold Rolled No. 2D, 2B, Bright Annealed, TR	under 0.1875" (4.76mm)	24.000" (609.6mm) and over	
	Polished No. 3, 4, 6, 7 & 8	under 0.1875" (4.76mm)	24.000" (609.6mm) and over	
Strip	Coils and cut lengths: Hot Rolled No. 1	under 0.1875" (4.76mm)	under 24.000" (609.6mm)	—
	Cold Rolled No. 2D, 2B, Bright Annealed, TR	under 0.1875" (4.76mm)	under 24.000" (609.6mm)	
	Polished No. 3, 4, 6, 7 & 8	under 0.1875" (4.76mm)	under 24.000" (609.6mm)	
Plate	Coils and cut lengths: Hot Rolled, annealed & pickled	0.1875" (4.76mm) and over	over 10.000" (254mm)	—
	Polished available for special applications	0.1875" (4.76mm) and over	over 10.000" (254mm)	
Bar	Straight lengths: Hot finished rounds, squares, octagons and hexagons	—	—	0.250" (6.35mm) and over
	Hot finished flats	0.125" (3.18mm) and over	0.250" (6.35mm) to 10.000" (254mm)	—
	Cold finished rounds, squares, octagons and hexagons	—	—	0.062" (1.59mm) and over
	Cold finished flats	—	0.375" (9.53mm) and over	—
Rod	Hot Rolled coils may be annealed and/or descaled	—	—	0.200" (5.54mm) and over
Wire	Cold finishes only: Rounds, squares, octagons and hexagons	—	—	0.500" (12.7mm) and under
	Flat wire (coils only)	0.010" (0.254mm) to under 0.185" (4.76mm)	0.062" (1.59mm) to under 0.375" (9.53mm)	
Pipe & Tube	Several different classifications with differing specifications are available. For information on standard sizes, consult your local Steel Service Center or the SSINA.			
Extrusions	Not considered "standard" shapes, but available. Currently limited in size to approximately 6.50" (165.1mm) diameter circle, or structural to 5.00" (127mm) diameter.			

* *Ingots, Slabs, Hot Bands, Angles and Rolled Shapes are also available*

EXTRUSIONS Stainless steel can be extruded into several complex shapes as detailed in the Designer Handbook *The Selection and Use of Stainless Steel*. Also contact:
Al Tech Specialty Steel Corporation
(716-366-1000)
Plymouth Tube Company
(1-800-323-9506)

FORGING Stainless steel forgings are also available in several shapes.

PREFORMED PRODUCTS Angles are available as a hot rolled product.

- Hot rolled and cold rolled shapes, as well as cold-drawn "shapes" can also be made from stainless steel as detailed in the Designer Handbook *The Selection and Use of Stainless Steel*.
- Tubular products are commonly used for structural applications either in round or square sections. Further information is available from the Specialty Tubing Group (202-342-8400).
- Bar and Rod: Bar is defined as hot finished or cold finished rounds, squares, octagons and hexagons and flats (Table 1).

WIRE Wire is cold finished only, produced in coils, as round, square, octagon, hexagon, and flat wire (Table 1).

CASTINGS Stainless steel casting can be produced for structural applications. For information, contact the Steel Founders' Society of America (847-299-9160).

STANDARD MECHANICAL SHEET FINISHES (ASTM A480)

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, matte 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 often used for roofing.

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 "gain" which prevents mirror reflection.

No. 6 A dull, satin finish having lower reflectivity than No. 4 finish. Generally not available.

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.

BRIGHT ANNEALED A bright, cold-rolled, highly reflective finish retained by final annealing in a controlled-atmosphere furnace.

TR FINISH (TENSILE ROLLED) The finish of products resulting from cold-working an annealed and descaled or bright-annealed product sufficiently to obtain mechanical properties higher than that normally obtained. Appearance will vary depending upon the amount of cold work required and the alloy ordered.

APPLICATIONS for Railings and Handrails

COMMERCIAL

Churches
Balconies
Hospitals
Guard towers
Schools
Diving towers
Hotels
Theaters
Theme parks
Boats
Office buildings

INDUSTRIAL

Wastewater treatment plants
Oil and chemical tanks
Airport towers
Observation towers

RESIDENTIAL

Homes
Basements
Attics
Decks
Lofts
Fire escapes
Spas
Modular homes
Pools

FABRICATED RAILINGS AND HANDRAILS

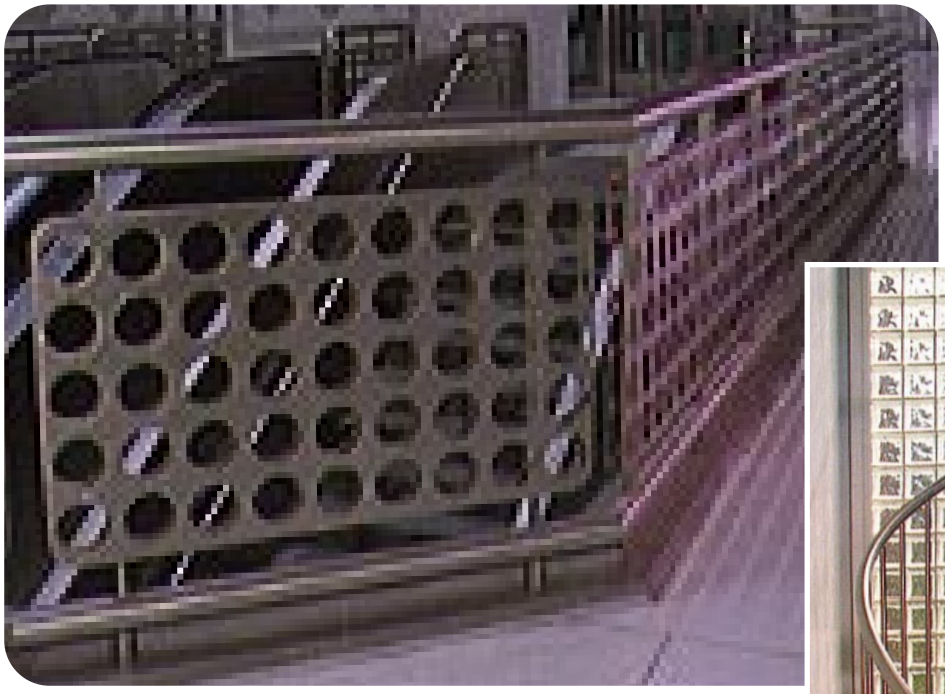


PHOTO CREDIT THIS PAGE
ARTIST *James Carpenter Design Associates*
FABRICATION *Tripyramid Structures, Inc.*
ENGINEERING (STRUCTURAL) *Dewhurst MacFarlane and Partners*
PHOTOGRAPHY *Brian E. Gulick*©