Austral Wright Metals
at the cutting edge

Austral Bronze Crane Copper Limited
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PRODUCT DATA SHEET

Stainless Steel

UNS S30100

Stainless Steels

Grade 301 is an austenitic stainless steel widely used in high strength applications such as railway rolling stock. It is available at high strength levels, which may be comparable to quenched and tempered carbon steels. It has corrosion resistance similar to grade 304, the most common stainless steel, which is adequate for atmospheric corrosion service conditions without surface protection.

Grade 304 can be used as an alternative to 301 for applications requiring the LT, DLT or ST tempers. This grade has equivalent properties to 301, and may be more readily available. Grade 304 is not readily available in the higher strength tempers.

Chemical Composition (ASTM A240)

	Chromium	Nickel	Carbon	Nitrogen	Silicon	Manganese
Minimum	16.00 %	6.00 %	-	-	-	-
Maximum	18.00 %	8.00 %	0.15 %	0.10 %	1.00 %	2.00 %

Mechanical Properties (ASTM A666)

Temper	0.2% Proof Stress minimum MPa	Tensile Strength minimum MPa	Elongation minimum %
Annealed	205	515	40
1/16 hard	310	620	40
1/8 hard	380	690	40
¼ hard	515	860	25
½ hard	760	1035	15
¾ hard	930	1205	10
Full hard	965	1275	8

Equivalent Specifications

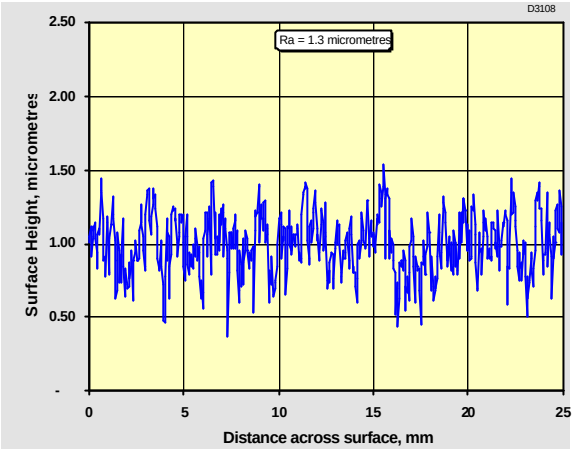
Country	Specification	Steel	Title
Japan	JIS G4305	SUS 301	Cold rolled stainless steel plates, sheets and strip
USA	ASTM A666	Type 301	Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
Europe	EN 10088-2	1.4310 X10CrNi18-8	Stainless steels Part 2. Technical delivery conditions for sheet/plate and strip for general purposes.
Germany	DIN 5512.3	X10CrNi18-8	Stainless steel flats for use in rail vehicle construction

Product Forms Available: Coil, sheet, strip, hollow sections.

Standard Widths: 1219, 1200, 1250 mm (in order of preference)

Standard Thickness: This product is made to order, so there are no standards for thickness, although mills prefer to supply a rational thickness. However, tempers are made by cold rolling, so the thickness range available is restricted by the cold rolling mill capability. Maximum thickness is 6 mm for LT and DLT, 5 mm for ST, 4.5 mm for MT, 4 mm for HT temper.

Size Availability



Sizes outside this envelope may be available on enquiry.

Thickness Tolerance Product may be ordered either to nominal or to minimum thickness. The thickness tolerance for product ordered to nominal thickness is approximately +/- 5%. The actual tolerances are given in the following table. For product ordered to minimum thickness, the tolerance is approximately - zero + 10%, i.e. twice the tolerance in the following table. Product is also available with a restricted thickness tolerance of approximately half these values, and is designated ET.

Nominal Thickness, mm	Width			
	Normal Tolerance		Restricted Thickness Tolerance (ET)	
	Up to 1249 mm	1250 mm	Up to 1249 mm	1250 mm
0.30 - 0.59	+/- 0.05	+/- 0.08	+/- 0.04	NA
0.60 - 0.79	+/- 0.07	+/- 0.09	+/- 0.05	NA
0.80 - 0.99	+/- 0.09	+/- 0.10	+/- 0.06	+/- 0.07
1.00 - 1.24	+/- 0.10	+/- 0.12	+/- 0.07	+/- 0.08
1.25 - 1.59	+/- 0.12	+/- 0.15	+/- 0.08	+/- 0.10
1.60 - 1.99	+/- 0.15	+/- 0.17	+/- 0.10	+/- 0.11
2.00 - 2.49	+/- 0.17	+/- 0.20	+/- 0.11	+/- 0.12
2.50 - 3.14	+/- 0.22	+/- 0.25	+/- 0.12	+/- 0.13
3.15 - 3.99	+/- 0.25	+/- 0.30	+/- 0.13	+/- 0.15
4.00 - 4.99	+/- 0.35	+/- 0.40	NA	NA
5.00 - 5.99	+/- 0.40	+/- 0.45	NA	NA

Surface Finishes

Finish	Description
2B	Bright, moderately reflective finish resulting from temper rolling and/or skin passing after annealing and acid pickling. Note that the reflectivity increases as the temper increases, and as the thickness decreases. Only material of the same thickness and temper will match. This finish cannot be matched with hand tools.
No 4	Polished finish produced by grinding with abrasive belts. After fabrication, this finish can be matched with hand tools to remove marks. The appearance of the finish is determined mainly by the abrasive grits used, and is approximately the same for all thicknesses and tempers. The finish is available for 0.7 to 2.0 mm thickness by up to 1250 mm width. This finish requires extra operations and is slightly more expensive than 2B.
Dull Finish	Matt, non-reflective decorative finish produced by finish rolling on rough rolls. Available in LT, DLT and ST tempers only. This finish cannot be repaired by hand tools. It has been used extensively for rail cars, including Tangarra cars for State Rail Authority, NSW, Australia and subsequent generations of cars.

Metallurgical Description Grade 301 belongs to the most commonly used family of stainless steels, known as 18/8, which have an austenitic structure at room temperature. This group is resistant to atmospheric corrosion, and in atmospheric corrosion conditions in all but severe marine environments its clean appearance can be retained indefinitely with little maintenance. The steels are highly ductile and formable, and have very high toughness. Grade 301 is formulated to allow the generation of high strength levels by temper rolling to partially transform the structure to martensite. The small proportion of martensite is intimately mixed with the austenite matrix, and high strength levels at very high ductility can be achieved.

Another grade, 301L has been developed from grade 301 by restricting the carbon content to 0.03% or below. This ensures freedom from sensitisation of the heat affected zone of welds, a phenomenon that can result from carbide precipitation at higher carbon contents in welded heavy sections. Sensitisation can result in loss of corrosion resistance at grain boundaries, which in turn may result in stress corrosion cracking in some environments. However all grade 301 stainless steel supplied to the Australian Rail Industry before 1993 was the higher carbon grade 301, not 301L, and there have been no reported problems of sensitisation or stress corrosion cracking in service.

Grade 301 is available in a series of different tempers, of increasing strength. These tempers are achieved by increasing amounts of cold rolling reduction in the stainless steel mill, and the strength will be retained provided the steel is not heated to the annealing temperature, which is in excess of 600^{o}C. Such high temperatures will be encountered in all welding methods. Use of low heat input to minimise the volume of the softened heat affected zone retains much of the base metal strength in the structure, and spot welding is often used. Demonstration of the strength level achieved in a joint welded by spot welding or a fusion technique may be required by some design codes (e.g. ENV 1993-1-4:1996 Eurocode 3: Design of steel structures - Part 1-4: General rules - Supplementary rules for stainless steels).

Welding

Grade 301 can be welded by spot and seam welding, and by most fusion techniques. Spot welding, gas metal arc (GMAW) and gas tungsten arc welding (GTAW) are in common use for the grade. (The latter two techniques are also known as MIG and TIG). Practices and procedures for welding of structures and railway equipment in stainless steels are detailed in:

Australian Standard AS/NZS 1554.6:1994 Welding stainless steels for structural purposes

Manual of Standards and Recommended Practices, Mechanical Division, Association of American Railroads (AAR)

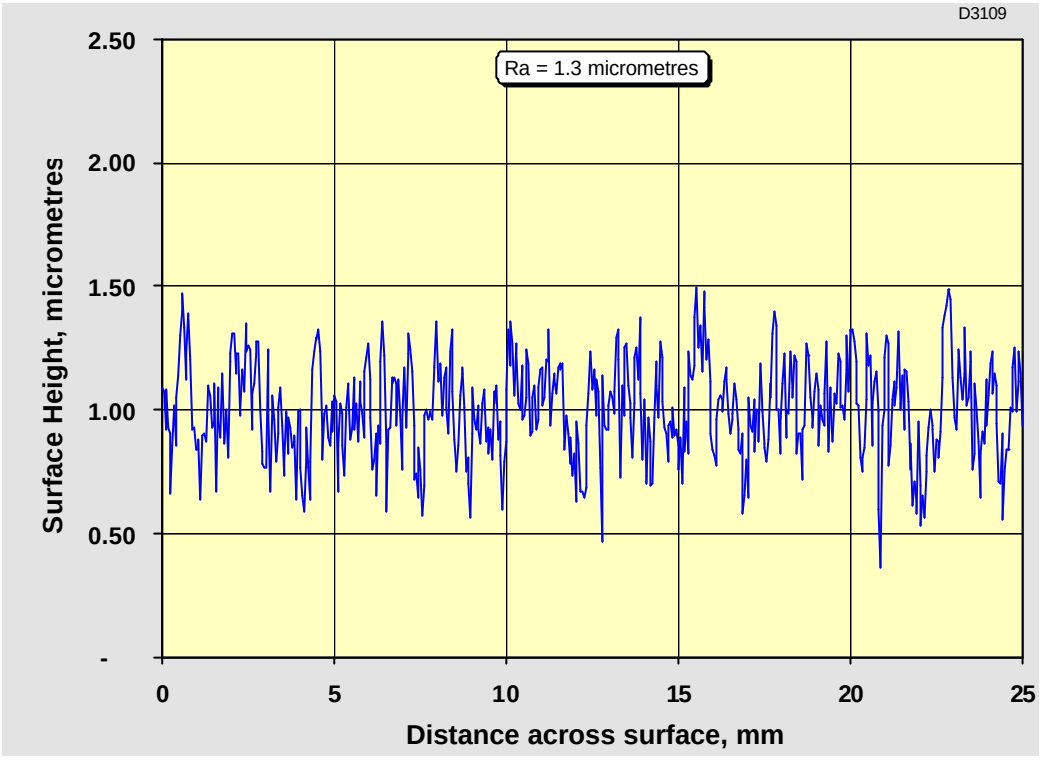
ANSI/AWS D1.1 Structural Welding Code - Steel (American Welding Society)

Physical Properties

Property	Unit	Value
Density	Kg/m^3	7,900
Melting Range	^oC	1400 - 1450
Specific Heat	J/kg. ^oC	500
Curie Temperature	^oC	< -196
Relative Magnetic Permeability (annealed)		1.02
Coefficient of Expansion, 20-100^oC	/ ^oK	16.0
Coefficient of Expansion, 20-300^oC	/ ^oK	17.0
Coefficient of Expansion, 20-500^oC	/ ^oK	18.0
Thermal Conductivity, 20^oC	W/m . ^oK	15
Electrical Resistivity, 20^oC	Micro ohm . m	0.73
Modulus of Elasticity, 20^oC	GPa	200
Shear Modulus, 20^oC	GPa	76.9
Poisson's Ratio		0.30

Typical Surface Roughness Traces from Dull Finish Material

(a) Longitudinal Direction



(b) Transverse Direction