Austral Wright Metals
at the cutting edge

Austral Bronze Crane Copper Limited
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PRODUCT DATA SHEET

NITRONIC 60

UNS S21800

Stainless Steel

Nitronic 60 is a nitrogen strengthened austenitic stainless steel, with outstanding strength and resistance to wear and galling. It has corrosion resistance better than 304, and pitting resistance better than 316. It is also available in bar as a high strength version, Nitronic 60 HS.

Chemical Composition, % (ASTM A276, Bars & shapes)

Carbon (max)	Manganese	Phosphorus (max)	Sulphur (max)	Silicon	Chromium	Nickel	Nitrogen
0.10	7.00 – 9.00	0.060	0.030	3.50 – 4.50	16.00 – 18.00	8.00 – 9.00	0.08 – 0.18

Room Temperature Mechanical Properties (Bar)

Grade		Diameter mm	0.2% Proof Stress MPa	Tensile Strength MPa	Elongation %	Reduction of Area %	Hardness (maximum)
60	ASTM A276 , minimum		345	655	35	55	241HB
	Typical		415	710	64	74	200HB
60 HS	Manufacturer's	63.5 – 127	620	760	20	45	RC20
	Specification, minimum	128 – 152	485	760	20	45	RC20
	Typical		640	825	21	27	-

Typical Applications Chain link conveyer belts and other components; chain drives; bolts, nuts and other fasteners; valve stems, seats and trim; fittings for pumps and valves in chemical processing industries; bridge pins; pins, bushings and roller bearings; aerospace applications.

Description. **Nitronic 60** stainless steel provides a significantly lower cost solution to wear and galling problems than cobalt bearing and high nickel alloys. It is a high strength austenitic stainless steel strengthened by nitrogen. It differs from more familiar austenitic stainless steels in containing 8% manganese and 4% silicon. The alloy has better uniform corrosion resistance than type 304 in most media. The chloride pitting resistance is superior to type 316, with room temperature yield strength nearly twice that of 304 and 316. In addition Nitronic 60 has excellent high temperature oxidation resistance and good low temperature impact resistance.

Austral Wright Metals can supply Nitronic 60 as bar, plate, wire, castings and forging stock.

Physical Properties (Annealed)

Property	At	Value	Unit	Property	At	Value	Unit
Density	24°C	7,622	Kg / m^3	Relative magnetic permeability		1.003	
Electrical conductivity	24°C	1.7%	IACS	Coefficient of expansion	24 – 93	15.8	$x10^{-6}$ / °C
Electrical resistivity	24°C	0.982	Microhm . m		24 – 316	17.3	$x10^{-6}$ / °C
					24 - 538	18.0	$x10^{-6}$ / °C
Poisson's ratio		0.298					
Modulus of elasticity, tension	24°C	180	GPa	Modulus of elasticity, torsion	24°C	57	GPa

Corrosion Resistance The uniform corrosion resistance of Nitronic 60 falls between grades 304 and 316. However, in a wear system, galling or seizure occurs first, then dimensional loss by wear, and finally corrosion. Galling and wear are the first concerns in design. Although the uniform corrosion resistance of Nitronic 60 is not quite as good as 316, it offers better pitting resistance to chlorides, stress corrosion cracking resistance and crevice corrosion resistance than grade 316.

Wear and Galling Properties

Wear Compatibility of self-mated stainless steels

Grade	Hardness	Weight Loss	
	Rockwell	Mg / 1000 cycles	
		105 rpm	415 rpm
Nitronic 60	**B95**	**2.79**	**1.58**
Grade 440C	C57	3.81	0.54
Nitronic 50	B99	9.95	4.60
Grade 310	B72	10.40	6.49
Grade 316	B91	12.50	7.32
Grade 304	B99	12.77	7.59
Grade 2205	B99	17.40	4.02
17-4 PH	C43	52.80	12.13
Grade 303	B98	386.10	50.47

Wear Compatibility of self-mated wrought alloys

Alloy	Hardness	Weight Loss	
	Rockwell	Mg / 1000 cycles	
		105 rpm	415 rpm
D2 Tool steel	C61	0.46	0.34
Aluminium bronze (10.5 Al)	B87	2.21	1.52
Nitronic 60	**B95**	**2.79**	**1.58**
Si bronze	B93	5.57	4.18
Ti-6Al-4V	C36	7.64	4.49
Inconel 625	B96	11.34	3.49
H13 Tool steel	C45	20.74	10.15
AISI 4130	C32	257.59	262.64

Unlubricated Galling Resistance of Stainless Steels (Threshold Galling Stress, MPa)

Grade	Condition	Hardness HB	410	416	430	440C	303	304	316	17-4 PH	Nitronic 32	Nitronic 60
410	HSR*	352	21	28	21	21	28	14	14	21	317	+
416	HSR	342	28	90	21	145	62	165	290	14	310	+
430	Annealed	159	21	21	14	14	14	14	14	21	55	248
440C	HSR	560	21	145	14	76	34	21	255	21	+	+
303	Annealed	153	28	62	14	34	14	14	21	21	+	+
304	Annealed	140	14	165	14	21	14	14	14	14	207	+
316	Annealed	150	14	290	14	255	21	14	14	14	21	262
17-4 PH	H950	415	21	14	21	21	14	14	14	14	+	+
Nitronic 32	Annealed	235	317	310	55	+	+	207	21	+	207	+
Nitronic 60	Annealed	205	+	+	248	+	+	+	262	+	+	+

HSR – Hardened & stress relieved

\+ – did not gall at stresses up to 345 MPa

Dynamic Coefficient of Friction (Tested in water, self mated)

	Test Stress Level, MPa					
	0.8	**5.6**	**14.0**	**28.0**	**56.0**	**112.0**
Nitronic 60	0.50	0.35	0.38	0.44	0.44	0.44
Stellite 6B	0.30	0.60	0.63	–	–	–
Nitronic 32	–	–	0.45	0.53	0.65	0.58

Fabrication Nitronic 60 can be hot forged. After forging the workpiece must be solution annealed.

Machinability The alloy is difficult to machine, rated at 50% of 304 and 23% of the free cutting carbon steel AISI B1112. Sharp, rigid, carbide tipped tools and well powered machines are recommended, with the use of heavy cuts and slow speeds.

Heat Treatment Nitronic 60 is fully austenitic and can not be strengthened by heat treatment. Solution annealing is carried out at 1060°C, followed by water quenching

Welding Nitronic 60 is readily welded by all conventional processes. Autogenous GTAW welds are sound, with wear characteristics approximating to the base metal. GTAW welds in heavy sections are also sound and weld tensile strength is slightly higher than base metal. Wear properties are near but below base metal. Pure argon is used as shielding gas and AWS A5.9 ER 218 filler metal is used. Pre-heating and post heating are not needed.

ASTM Specifications

Specification	Title
A193	Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service (Grade B8S)
A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service (Grade 8S)
A240	Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels
A276	Stainless Steel Bars and Shapes
A314	Stainless Steel Billets and Bars for Forging
A479	Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels
A351	Castings, Austenitic, Austenitic-Ferritic(Duplex), for Pressure Containing Parts (Grade CF10SMnN)
A7430	Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application (Grade CF10MnN)