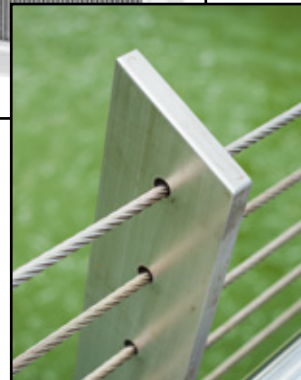
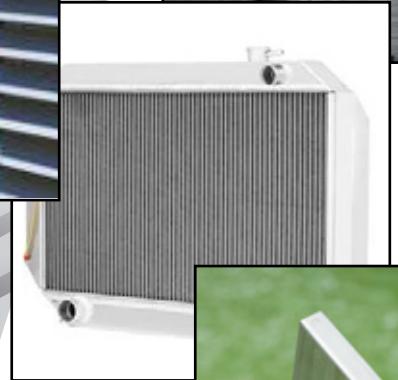
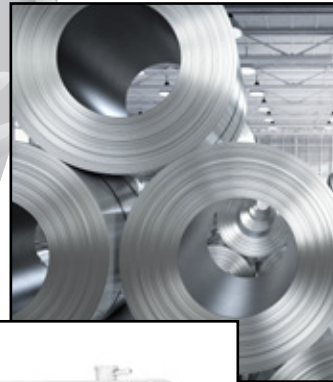
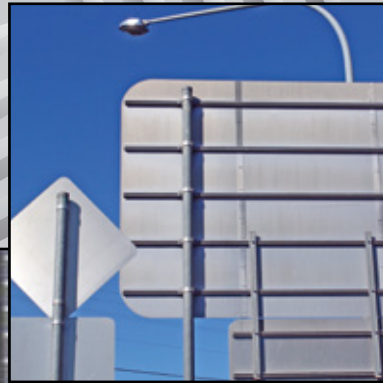
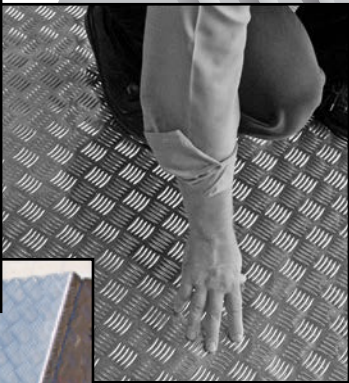


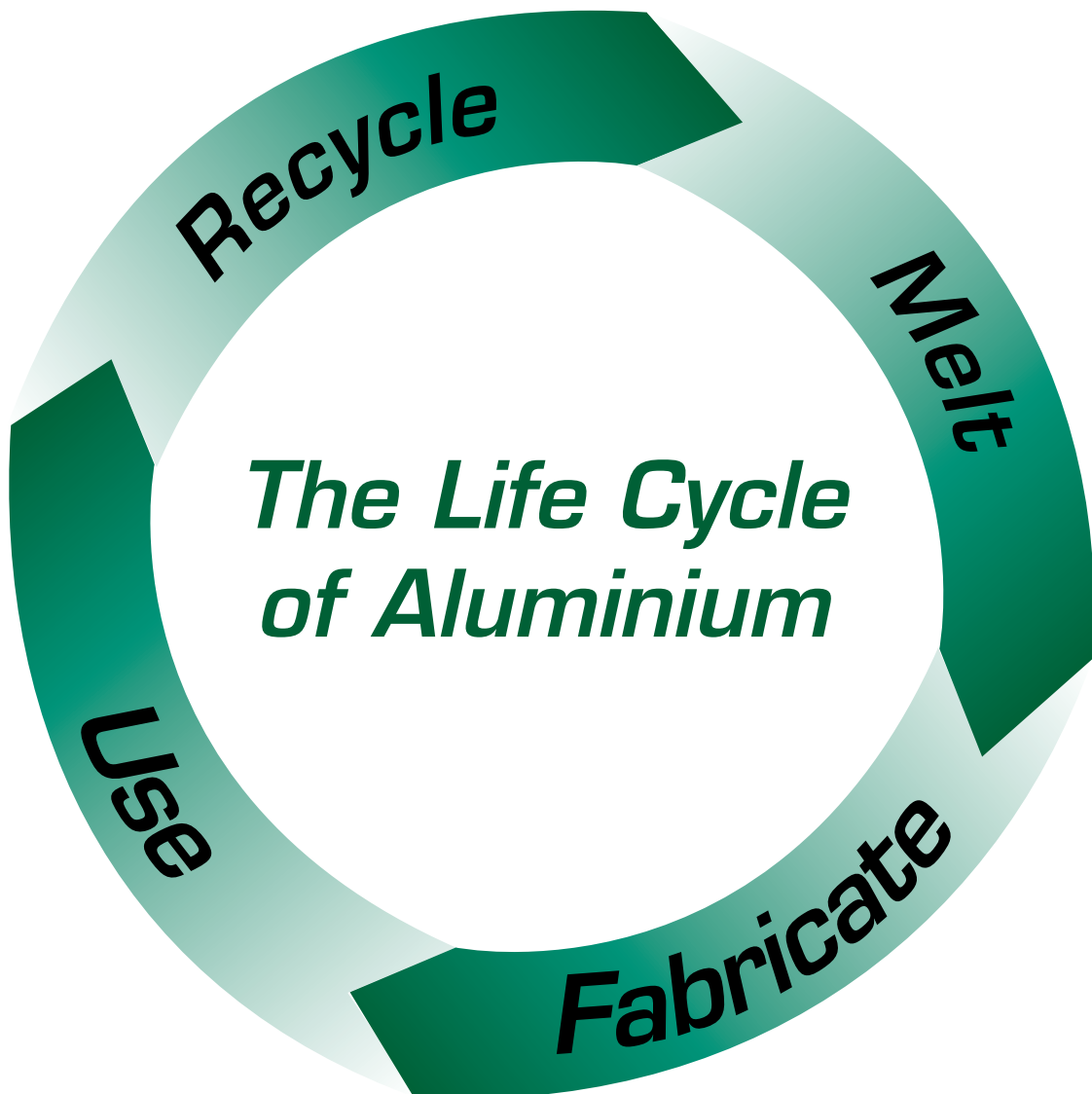
# **Austral Wright Metals** Aluminium



*at the cutting edge*

# ALUMINIUM

THE RIGHT MATERIAL FOR OUR ENVIRONMENT



**A complete life cycle material for the Consumer,  
Industry and the Environment.**

To ensure a high quality of life, the materials that we as consumers and manufacturers use, should meet not only technical performance standards, but have a long service life, be useable in a greater number of applications and be environmentally friendly. Once their service is complete, they should be 100% recyclable, thereby completing the life cycle to be used once again.

*Aluminium is such a material.*

*Welcome to*



Austral Wright Metals is the result of the merging, on 1st December 1997, of two long established well respected Australian owned metal distribution companies. Austral Bronze Crane Copper Limited (the metal distribution division of the Crane Group) and Wright and Company Pty Limited.

This brought together Australia's leaders in the distribution of:

Copper, brass and bronze – sheet, coil, bar, rod, extrusions and tube.

Stainless steel – sheet, coil, plate, bar, rod tube and fittings.

Aluminum – sheet, coil, plate and tread plate.

High Performance Alloys – including nickel based alloys, welding consumables and high technology metals.

Austral Bronze Crane Copper was incorporated in 1914 to manufacture non ferrous sheet, coil and extruded product. The business was restructured in 1990 to clearly focus on the distribution of non ferrous and specialty metals.

Incorporated in 1913, Wright and Company concentrated its efforts on the distribution of stainless steel and non ferrous alloys through its Australia wide warehouse network. In 1993, a state-of-the-art Metal Processing Centre was opened in Sydney.

Austral Wright Metals draws on nearly 100 years of experience in metal manufacturing and distribution to challenge industry standards and present a forward thinking, vibrant customer focused way to the future.

**We can offer:**

**World leading sources** in the supply of non ferrous metals and stainless steels.

**In house processing** for economical, speedy supply of customised product.

**Technical knowledge and co-operative service** from our employees.

**Australia wide supply** from our network of warehouses.

Austral Wright Metals is committed to fulfill its mission as your preferred business partner in the supply of Stainless Steel and Non Ferrous Metals and Alloys.



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# TABLE OF CONTENTS

## Aluminium

Sheet and Plate	9
Treadplate	12

## Standard Tolerances

Thickness Tolerances	13
Width Tolerances	13
Squareness Tolerances	14
Flatness Tolerances	14
Nominal Composition	15
Alloy Characteristics	15
Applications	15

## Aluminium Data Sheets

Aluminium 1100	16
Aluminium 3003	18
Aluminium 5005	20
Aluminium 5052	22
Aluminium 5083	24
Handling & Storing Aluminium	26
Sheet and Plate Bending Radii	27
Corrosion Ratings for Aluminium	28

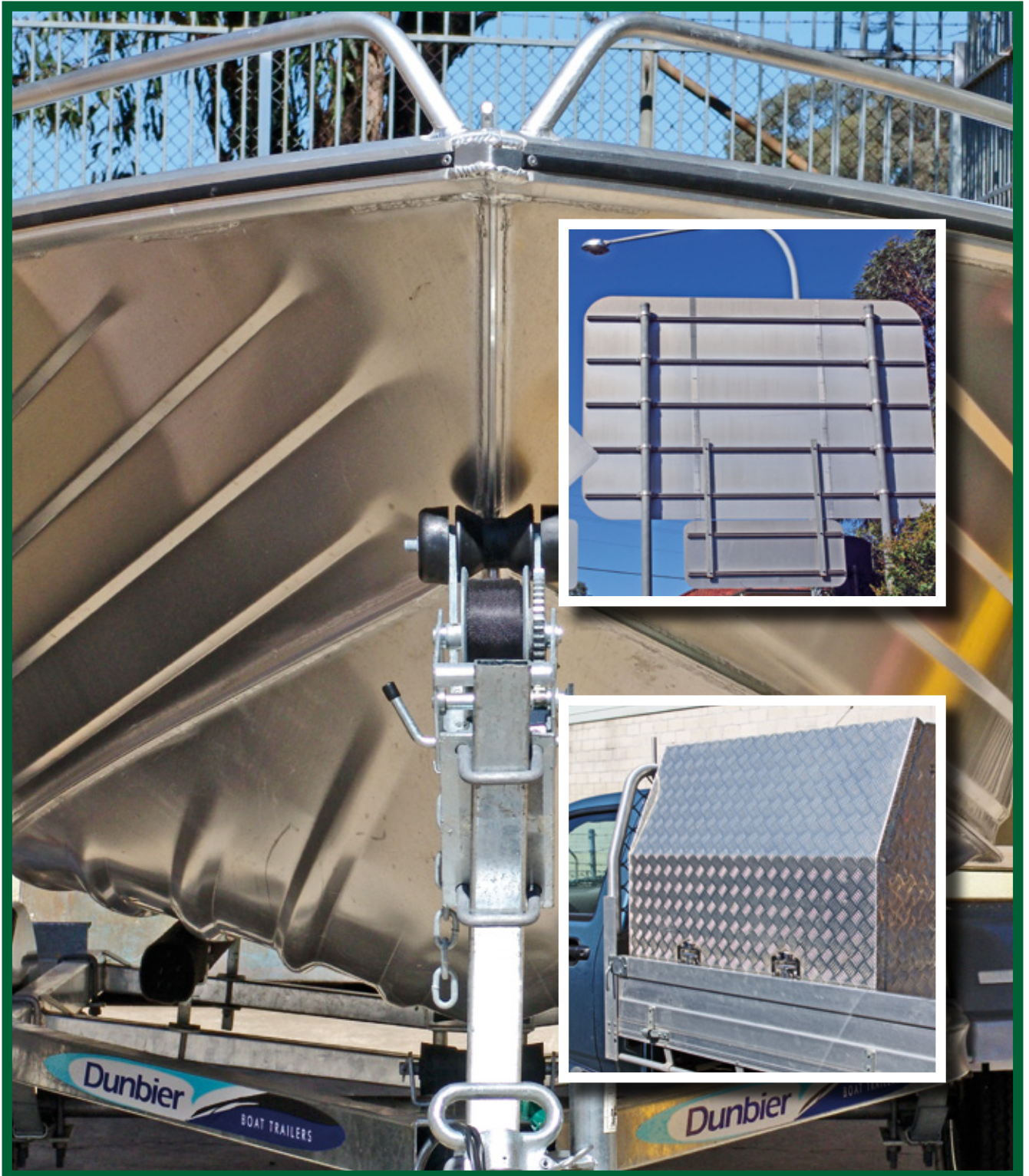
## AUSTRAL WRIGHT METALS WELCOME YOUR ENQUIRIES FOR ANY OF THE FOLLOWING MATERIALS:

<b>Aluminium</b>	Coil, sheet, bar, tubing, welding wire
<b>Aluminium Bronze</b>	Bar, plate, castings, welding consumables
<b>Aqualoy</b>	Aqualoy boat shafting
<b>Brass</b>	Coil, sheet plate, shim, bar, engraving, tube, wire
<b>Bearing Alloys</b>	Leaded gunmetal, phosphor bronzes, aluminium bronzes
<b>Bimetal</b>	Coil, sheet
<b>Beryllium Copper</b>	Bar, flat, plate, hollow, castings, master alloys, coil
<b>Cobalt</b>	Alloy powder, granules, oxides and salts
<b>Copper</b>	Coil, sheet, plate, shim, busbar, free machining bar, tube, wire
<b>Cupro Nickel</b>	Pipe, tube, fittings, plate, sheet and welding consumables (70/30 & 90/10)
<b>Hard Facing</b>	Cobalt, nickel and iron based welding products in all forms, Stellite* Alloys
<b>Heat Exchanger Tube</b>	Stainless steel, brass, aluminium brass, copper nickel to AS1569, ASTM, BS and JIS Standards
<b>Incoloy* Alloys</b>	Heat and corrosion resistant material in wrought forms, welding consumables
<b>Incomag*</b>	Material for foundry use for production of SG cast iron
<b>Inconel* Alloys</b>	Heat and corrosion resistant material in wrought forms, welding consumables
<b>Mumetal</b>	Nickel iron alloys for use in the transformer and shielding applications
<b>Molybdenum</b>	Bar, sheet, wire, components and molybdenum compounds
<b>Monel* Alloys</b>	Corrosion resisting nickel alloy in bar, flat, plate, sheet, coil, tube and wire, welding consumables
<b>Nickel</b>	Primary nickel shot, pellets, squares, powder, oxides and salts
<b>Nickel Alloys</b>	Corrosion and heat resisting material in all wrought forms and welding consumables
<b>Nickel Iron</b>	Controlled expansion and electrical alloys in all wrought forms
<b>Nickel Silver</b>	Coil, sheet, bar, wire, in soft, hard, spring hard tempers
<b>Nimonic Alloys</b>	Coil, sheet, rod, wire sections
<b>Nitronic*</b>	Nitronic* grades of stainless steel
<b>Phosphor Bronze</b>	Coil, sheet, rod, wire
<b>Powdered Metals</b>	Nickel, tungsten, cobalt, iron, molybdenum, selenium, tellurium
<b>Silicon Bronze</b>	Sheet, bar, welding consumables
<b>Stainless Steel</b>	Coil, sheet, flats, angles, bar, tube, pipe fittings, welding consumables, all grades
<b>Stellite*</b>	Wear and corrosion resistant products
<b>Tantalum</b>	Sheet, tube, rod, wire
<b>Titanium</b>	Sheet, tube, rod, wire, pipe, fittings and fasteners
<b>Tungsten</b>	Sheet, powder, wire, rod
<b>Tungsten-Copper</b>	Sintered bars
<b>Welding Materials</b>	Wire, electrode and fluxes for gas or electric welding nickel alloys, cupro-nickels, aluminium, bronzes, stainless steel, dissimilar metals.

\*Registered Trade Names



# ALUMINIUM



## AUSTRAL WRIGHT METALS CAN SOURCE ALL YOUR COIL NEEDS.

Austral Wright Metals is one of Australia's leading importers and distributor of rolled aluminium products. Austral Wright prides itself on sourcing Aluminium from world-leading mills to ensure minimum fuss and bother for fabricators and end users. With the technical knowledge and in house experience we can source all your Aluminium coil needs such as 1200mm wide coil, slit coil, wide coil, stucco, painted light gauge coil, 1000, 3000 and 6000 series.

**Not in the catalogue? Just ask us....**

Austral Wright Metals have the solutions to all your aluminium needs in sheet and coil.

Our extensive global network of mills enables us to provide a wide range of non-standard products. We would welcome your enquires on:

- Slit Coil
- Wide Sheet and Coil
- Painted Sheet and Coil
- Stucco embossed patterns
- Light gauge coil and foil
- 1000, 3000 and 6000 series alloys
- Plate





## ALUMINIUM SHEET AND PLATE

Size mm	Finish	Approx kg/sheet						
			5005-H34	5052-H32	5251-H32	5251-H34	5083- H116	5083- H321
0.5 x 900 x 1800	Mill	2.2	50024494					
0.6 x 1200 x 2400	Mill	4.7	50001738					
0.8 x 900 x 1800	Mill	3.5	50024495					
0.8 x 1200 x 2400	Mill	6.2	50001741					
0.8 x 1219 x 2489	Violetone PE 50	6.6	50111931					
1 x 900 x 1800	Mill	4.4	50024646					
1 x 1200 x 2400	Mill	7.8	50001742	50033802				
	PE 50		50001743					
	PE 2 sides		50103788					
1.2 x 900 x 1800	Mill	5.3	50001744					
1.2 x 1200 x 2400	Mill	9.3	50001787	50001761				
	PE 50		50010971					
	PE 50			50065548				
1.2 x 1200 x 3600	Mill	14.0	50110380					
	PE 50		50109003					
1.2 x 1500 x 3000	Mill	14.6	50132337					
1.6 x 900 x 1800	Mill	7.0	50024829					
1.6 x 900 x 2400	Mill	9.3	50098819					
1.6 x 1200 x 1800	Mill		50001747					
1.6 x 1200 x 2400	Mill	12.5	50001789	50001762				
	PE 50		50001788	50023810				
1.6 x 1200 x 3000	Mill	15.6	50104767					
	PE 50		50037109					
1.6 x 1200 x 3600	Mill	18.7	50099525					
1.6 x 1200 x 3600	PE 50	18.7	50136727					
1.6 x 1500 x 3000	Mill	19.5	50024909					
1.6 x 1500 x 3600	Mill	23.4	50001792					

Refer to your local Sales Office for availability of current stock and other sizes which are not listed.

## ALUMINIUM SHEET AND PLATE

Size mm	Finish	Approx kg/ sheet	Alloy – Temper						
			1100- H25	5005- H34	5052- H32	5251- H32	5251- H34	5083- H116	5083- H321
2 x 900 x 1800	Mill	8.8		50001748					
2 x 1200 x 1800	Mill	11.7		50011532					
2 x 1200 x 2400	Mill	15.6		50001790	50001764				
	PE 50			50001775	50023811				
2 x 1200 x 3000	Mill	19.5		50011534					
2 x 1200 x 3600	Mill	23.3		50109630					
2 x 1500 x 2400	PE 50	19.5		50125902					
2 x 1500 x 2400	Mill	19.5		50011558					
2 x 1500 x 3000	Mill	24.3		50011446					
2 x 1500 x 3600	Mill	29.2		50001774					
2.5 x 900 x 1800	Mill	11.0		50103910					
2.5 x 1200 x 2400	Mill	19.5		50001776	50001773				
	PE 50			50001777					
	PE 50				50118915				
2.5 x 1500 x 2400	Mill	24.3		50114781	50011634				
2.5 x 1500 x 3000	Mill	30.4		50024469	50066012				

Refer to your local Sales Office for availability of current stock and other sizes which are not listed.

## ALUMINIUM SHEET AND PLATE

Size mm	Finish	Approx kg/ sheet	Alloy – Temper					
			1100-H25	5005-H34	5052-H32	5251-H32	5083-H116	5083-H321
3 x 900 x 1800	Mill	13.1		50001751				
3 x 900 x 2400	Mill	17.5		50011530				
3 x 1200 x 1800	PE 50	17.5		50011533				
				50024804				
3 x 1200 x 2400	Mill	23.4		50001778	50001766			50097009
	PE 50			50001779				
	PE 80			50115149				
3 x 1200 x 3000	Mill	29.2		50095930				
	PE 50			50037180				
3 x 1200 x 3600	Mill	35.0		50104499				
	PE 50			50001752				
3 x 1500 x 3600	Mill	44		50025402				
3 x 1500 x 2400	Mill	29.2		50011535	50109148			
	PE 80			50115151				
3 x 1500 x 3000	Mill	36.5		50011635				
	PE 50			50110418				
4 x 1200 x 3600	Mill	46.8		50025403				
4 x 1500 x 3000	Mill	48.78		50025444				
4 x 1200 x 2400	Mill	31		50001753				50011559
5 x 1200 x 2400	Mill	39		50001754				50102844
6 x 1200 x 2400	Mill	46		50001758				50097836
8 x 1200 x 2400	Mill	63.31						50107238
10 x 1200 x 2400	Mill	77						50001772
12 x 1200 x 2400	Mill	92					50001797	

Refer to your local Sales Office for availability of current stock and other sizes which are not listed.



## ALUMINIUM TREADPLATE

Size mm	Approximate kg/ sheet	Finish	Alloy-Temper	
			5052-O	3003 H22
1.6 x 1200 x 2400	13	Five Bar	50001782	
2 x 1200 x 2400	17	Five Bar	50001784	
2.5 x 1200 x 2400	21	Five Bar	50001785	
3 x 1200 x 2400	26	Five Bar	50001783	
3 x 1500 x 3000	40	Five Bar	50110490	
3 x 1500 x 3600	48	Five Bar	50129027	
5 x 1200 x 2400	40	Five Bar	50001786	
6 x 1200 x 2400	52	Five Bar	50117443	
1.6 x 1200 x 2400	13	Propellor		50010967
2 x 1200 x 2400	18	Propellor		50121647
3.0 x 1200 x 2400	24	Propellor		50010968



**Welding:** Aluminium treadplate can easily be welded with 5356 filler wire

**Please Note:** Aluminium treadplate is not referred to in Australian Standard AS1734 – Aluminium and Aluminium Alloys – Flat Sheet, Coiled Sheet and Plate

## STANDARD TOLERANCES

The following tolerances have been established to provide a uniform product standard for aluminium sheet and plate mill products available within Australia for general application in industry.

### THICKNESS TOLERANCES – SHEET AND PLATE

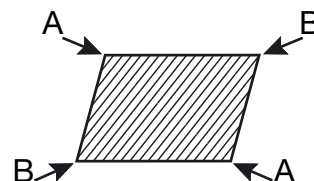
Specified Thickness (mm)		TOLERANCE (± mm) Specified Width (mm)								
Over	Up to	Over Up to	- 900	900 1,200	1,200 1,500	1,500 1,800	1,800 2,100	2,100 2,250	2,250 2,400	2,400 3,000
0.15	0.25		0.04	0.06	0.07					
0.25	0.45		0.04	0.06	0.08					
0.45	0.70		0.05	0.06	0.10					
0.70	0.90		0.05	0.06	0.13	0.10				
0.90	1.10		0.06	0.08	0.13	0.13				
						0.13				
1.10	1.80		0.08	0.10	0.15	0.15				
1.80	2.00		0.08	0.10	0.15	0.15				
2.00	2.50		0.09	0.10	0.15	0.15				
2.50	2.80		0.10	0.13	0.18	0.18				
2.80	3.00		0.11	0.13	0.18	0.18	0.20	0.41	0.46	0.51
3.00	3.50		0.11	0.13	0.18	0.30	0.36	0.41	0.46	0.51
3.50	4.50		0.15	0.20	0.23	0.36	0.41	0.43	0.48	0.58
4.50	5.00		0.18	0.25	0.28	0.41	0.43	0.43	0.56	0.66
5.00	6.00		0.23	0.28	0.33	0.46	0.46	0.46	0.61	0.71
6.00	8.00		0.33	0.33	0.38	0.51	0.51	0.51	0.64	0.76
8.00	11.00		0.48	0.48	0.51	0.58	0.64	0.64	0.66	0.84
11.00	16.00		0.64	0.64	0.64	0.64	0.76	0.76	0.89	0.89
16.00	22.00		0.76	0.76	0.76	0.76	0.94	0.94	1.14	1.14
22.00	28.00		0.89	0.89	0.89	0.89	1.14	1.14	1.40	1.40
28.00	35.00		1.02	1.02	1.02	1.02	1.32	1.32	1.65	1.65
35.00	40.00		1.14	1.14	1.14	1.14	1.52	1.52	1.91	1.91
40.00	50.00		1.32	1.32	1.32	1.32	1.78	1.78	2.24	2.24
50.00	60.00		1.52	1.52	1.52	1.52	2.03	2.03	2.54	2.54
60.00	70.00		1.91	1.91	1.91	1.91	2.54	2.54	3.18	3.18
70.00	80.00		2.29	2.29	2.29	2.29	3.05	3.05	3.81	3.81

### WIDTH TOLERANCES – FLAT SHEET AND PLATE

Specified Thickness (mm)		TOLERANCE (± mm) Specified Width (mm)										
Over	Up to	Over Up to	- 100	100 600	600 900	900 1,200	1,200 1,800	1,800 3,000	- 300	300 1,200	1,200 2,100	2,100 3,000
0.15	2.50		±1.0	±2.0	±2.0	±3.0	±4.0	±5.0				
2.50	6.00		±3.0	±3.0	±3.0	±5.0	±5.0	±6.0				
6.00	12.00		+10.0 -0.0	+10.0 -0.0	+10.0 -0.0	+10.0 -0.0	+10.0 -0.0	+10.0 -0.0				
12.00	80.00								+5.0 -0.0	+10.0 -0.0	+13.0 -0.0	+16.0 -0.0

## SQUARENESS TOLERANCES – FLAT SHEET AND PLATE

Specified Thickness (mm)		TOLERANCE ( $\pm$ mm) Allowable Difference, BB – AA, between diagonals	
		Specified Length (mm)	
Over	Up to	Up to 3,600	Over 3,600
-	300	3.0	5.0
300	600	5.0	8.0
600	1,200	8.0	11.0
1,200	1,500	11.0	14.0
1,500	1,800	13.0	18.0
1,800	2,100	14.0	21.0
2,100	2,400	16.0	23.0
2,400	2,700	19.0	25.0
2,700	3,600	22.0	29.0



## FLATNESS TOLERANCES – FLAT SHEET

Alloy	Specified Thickness (mm)		TOLERANCE ( mm) Longitudinal or Transverse Distance Centre to Centre of Buckles or Edge Waves <sup>7</sup> (mm)					
	Over	Up to	Over Up to	- 600	600 900	900 1,200	1,200 1,800	1,800 -
Group I	0.5 1.6	1.6 6.0	3.0 3.0	5.0 6.0	6.0 10.0	10.0 13.0	13.0 16.0	
Group II	0.5 1.6	1.6 6.0	5.0 5.0	6.0 10.0	10.0 13.0	13.0 16.0	16.0 19.0	

## GROUP I AND GROUP II ALLOYS - DEFINED

Group I Alloys	1080A 3105	1050 4343	1150 5005	1350 5050A	1100 5457	1200 5557	3102 8006	3003 8008	3203 8011	3005
Group II Alloys	2014 5252	2024 5154A	Alclad 2024 5454 5182		3004 5083	Alclad 3004 5086 6061		5251 7072	5052	



## NOMINAL COMPOSITION

Alloy AA	Description	Element, weight%				
		Mg	Mn	Cr	Cu	Al
1100	99.00% Aluminium – Low Strength					Rem
1200	99.00% Aluminium – Low Strength					Rem
3003	Manganese Aluminium – Medium Strength		1.2		0.12	Rem
5005	Magnesium Aluminium – Medium Strength	0.8				Rem
5052	Magnesium Aluminium – Medium Strength	2.5				Rem
5083	Magnesium Aluminium – High Strength	4.5	0.7	0.15		Rem



## ALLOY CHARACTERISTICS\*

Alloy	Standard Product				Corrosion Resistance	Machining	Anodising	Brazing
	Coil	Sheet	Plate	Treadplate				
1100	X	X			A	D	B	A
1200	X	X			A	C	B	A
3003	X	X	X		A	C	B	A
5005	X	X			A	C	B	B
5052	X	X	X	X	A	B	C	C
5083			X		A	B	C	D



## APPLICATIONS

Alloy	Applications
<b>1100</b>	Spinning, holloware, food handling & storage, general sheet metal work.
<b>1200</b>	Spinning, holloware, and general sheet metal work.
<b>3003</b>	Chemical equipment and sheet metal work.
<b>5005</b>	Architectural, sheet metal work, high strength foil.
<b>5052</b>	Boats, dinghies and other applications requiring resistance to marine corrosion.
<b>5083</b>	Marine, pressure vessels, cryogenics, and structure. Not to be used above 65°C.

\*Relative ratings in decreasing order of merit : A, B, C, D.  
Data from Aluminium Development Council of Australia.

## ALUMINIUM 1100

UNS A91100

## PRODUCT DATA SHEET

Aluminium Alloys

Aluminium alloy 1100 contains a minimum of 99.00% aluminium, and is sometimes known as 'commercially pure aluminium'. It has excellent electrical conductivity, good formability and high resistance to corrosion, and is used where high strength is not needed. It has the low density and excellent thermal conductivity common to all aluminium alloys.

**Typical Applications** General sheet metal work where moderate strength is adequate: lightly stressed panels, architectural flashings, name plates, heat exchangers, food and chemical handling and storage equipment, drawn or spun holloware, light reflectors, welded assemblies.

CHEMICAL COMPOSITION AS/NZS 1734 Aluminium and aluminium alloys - Flat sheet, coiled sheet and plate.	Element	%	Element	%
	Aluminium	99.00% min	Manganese	0.05 max
	Copper	0.05 – 0.20	Zinc	0.10 max
	Silicon + Iron	0.95 max	Others, each	0.05 max
			Others, total	0.15 max

SPECIFIED MECHANICAL PROPERTIES AS/NZS 1734 Aluminium and aluminium alloys - Flat sheet, coiled sheet and plate.	Temper	0.2% Proof Stress, MPa min†	Tensile Strength, MPa	Elongation %
	O (annealed)	25	75 – 105	15 – 26
	H12	75	95 – 130	3 – 10
	H14	95	110 – 145	1 – 8
	H24	95	110 max	1 – 8

† For information only, proof stress is not specified or measured except by prior agreement

### Equivalent specifications:

USA: AA1100; Japan: JIS A110P; France: NF 1100; ISO AI 99.0 Cu.

The properties in this data sheet meet Australian/New Zealand Standard AS/NZS 1734:1997 Aluminium and aluminium alloys - Flat sheet, coiled sheet and plate (equivalent to BS EN 573-1). The material also meets other national standards.

Temper	Condition		
O	Annealed (soft)		
H1x	Strain hardened only		
H2x	Strain hardened then partially annealed		
H3x	Strain hardened and then stabilised (i.e. low temperature heat treated to pre-empt natural ageing, by reducing strength and increasing ductility)		
Second digit: (x)			
8	Full hard	4	Half hard
6	Three quarter hard	2	Quarter hard

**Description** Aluminium 1100 is commercial purity aluminium with a controlled content of copper. It can be hardened by cold work: it is not heat treatable to higher strength. It has excellent ductility, up to 30% in annealed material of 1.3 to 6.0 mm thickness. The ductility is more limited in the H14 and H24 tempers.

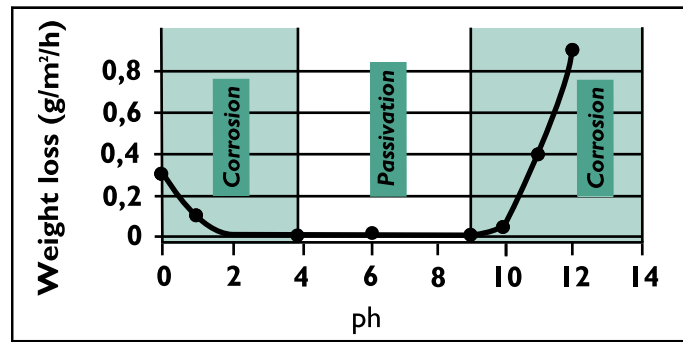
**Austral Wright Metals** can supply this alloy as plate, sheet and strip. See Austral Wright Metals Catalogue for normal stock sizes and tempers.

**Pressure Vessels** AS1210 Pressure Vessels prequalifies alloy 1100 for pressure service for temperatures up to 200°C in the O, H12, H14 & H112 tempers.

The technical advice and recommendations made in this Product Data Sheet should not be relied or acted upon without conducting your own further investigations, including corrosion exposure tests where needed. Please consult current editions of standards for design properties.

Austral Wright Metals assumes no liability in connection with the information in this Product Data Sheet.

**Corrosion Resistance** The '1xxx' series alloys have the best resistance to general corrosion of all the aluminium alloys. Resistance is excellent in aqueous solutions in the pH range 4 – 9.



The corrosion resistance of aluminium alloys relies on a protective surface oxide film, which when damaged is readily repaired by the rapid reaction between aluminium and oxygen. However, the high reactivity of the base metal can give rapid corrosion if the film cannot be repaired, so aluminium alloys are not suitable for use with reducing media. Alloy 1100 can be anodised to improve the corrosion resistance by thickening the protective surface film.

Since aluminium is a reactive metal, it may corrode more quickly when in electrical contact with most other metals. The prediction of galvanic corrosion is complex; please consult Austral Wright Metals for specific advice.

#### Physical Properties

Property	at	value	unit	Property	at	value	unit
Density	20°C	2,710	kg/m³	Mean Coefficient of Expansion	20°C	23.6	X 10 <sup>-6</sup> /°C
Weight	20°C	2.71 x thickness in mm		Thermal Conductivity	25°C	222	W / m . °C
Melting Range		643-657	°C	Electrical Resistivity	20°C	0.292	micro-ohm . m
Modulus of Elasticity				Electrical Conductivity			
Tension	20°C	69	GPa	O Temper (annealed)	20°C	59	%IACS
Torsion	20°C	26	GPa	H18 Temper	20°C	57	%IACS

**Fabrication** Aluminium 1100 is very readily cold formable in the annealed condition, as it is ductile. Forming loads and tool & press wear are generally less than with carbon steel. For piercing and blanking the punch to die clearance should be about 5% of the thickness per side for temper O, 6% for H12 & H14.

Characteristics			
Corrosion Resistance	Very good	Anodising	Very good
Formability	Excellent	Machinability	Poor
Weldability	Excellent	Brazeability	Excellent

**Welding** Alloy 1100 is readily welded by the TIG and MIG processes. Commonly used filler alloys are 4043 and 1050. 4043 gives a greater weld strength, but if the assembly is to be anodised, 1050 filler metal will give a closer colour match.

1100 may also be gas welded or resistance welded, but the resulting joints are not as strong or as corrosion resistant as the inert gas welded joints. Gas welding could result in excessive heat distortion and thinner gauges may burn through. Aluminium must be very dry & clean to avoid contamination & porosity of the weld. It is essential that all traces of flux used in welding or brazing are removed by scrubbing with hot water.

**Heat Treatment** Alloy 1100 is annealed at 350°C, time at temperature and cooling rate are unimportant. Stress relief is rarely required, but can be carried out at about 220°C. If loss of strength is of concern, stress relief tests should be conducted.



## ALUMINIUM 3003

### UNS A93003

## PRODUCT DATA SHEET

### Aluminium Alloys

Aluminium alloy 3003 contains about 1.25% manganese and 0.1% copper, which increase the strength above the 1000 series aluminium grades. It is a medium strength alloy, hardenable only by cold work – it is not heat treatable. It has good weldability, formability and corrosion resistance.

**Typical Applications** General sheet metal work requiring greater strength than is provided by 1000 series alloys; profiled building sheet (roofing and siding); insulation panels; holloware; food and chemical handling and storage equipment.

CHEMICAL COMPOSITION AS/NZS 1734: 1997 Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate..	Element	%	Element	%
	Aluminium	Remainder	Silicon	0.6 max
	Manganese	1.0 – 1.5	Iron	0.7 max
	Copper	0.05 – 0.20	Zinc	0.10 max
	Silicon	0.6 max	Others, each	0.05 max
	Iron	0.7 max	Others, total	0.15 max

SPECIFIED MECHANICAL PROPERTIES AS/NZS 1734:1997 Aluminium and aluminium alloys - Flat sheet, coiled sheet and plate.	Temper	0.2% Proof Stress, MPa min†	Tensile Strength, MPa	Elongation %
	O (annealed)	35	95-130	14-21
	H12	80	115-160	3-8
	H14	115	135-180	1-8
	H16	145	165-205	1-4
	H18	165	185 min	1-4

† For information only, proof stress is not specified or measured except by prior agreement

KEY TO TEMPERS	Temper	Condition		
	O	Annealed (soft)		
	H1x	Strain hardened only		
	H3x	Strain hardened and then stabilised (i.e. low temperature heat treated to pre-empt natural ageing, by reducing strength and increasing ductility)		
	Second digit: (x)			
	8	Full hard	4	Half hard
	6	Three quarter hard	2	Quarter hard

**Description** Aluminium 3003 is a general purpose alloy with medium strength and corrosion resistance. It is not recommended for decorative applications: anodising should be for surface protection only. Special qualities are available for porcelain enamelling, deep drawing & spinning; general purpose qualities should not be used for these operations.

**Austral Wright Metals** can supply this alloy as plate, sheet and strip. See Austral Wright Metals Catalogue for normal stock sizes and tempers.

**Equivalent Designations:** Germany: DIN AlMnCu; Europe: EN AW-3003; Japan: JIS A3003P; France: NF A 3003 (formerly A-M1).

The technical advice and recommendations made in this Product Data Sheet should not be relied or acted upon without conducting your own further investigations, including corrosion exposure tests where needed. Please consult current editions of standards for design properties. Austral Wright Metals assumes no liability in connection with the information in this Product Data Sheet.

**Corrosion Resistance** 3003 has very high resistance to general corrosion, similar to the 1000 series aluminium alloys. 3003 can be used in marine atmospheres and in seawater.

Since aluminium is a reactive metal, it may corrode more quickly when in electrical contact with most other metals. The prediction of galvanic corrosion is complex; please consult Austral Wright Metals for specific advice.

**Pressure Vessels** AS1210 Pressure Vessels and AS4041 Pressure Piping prequalify the alloy for pressure service for temperatures up to 200°C.

#### Physical Properties

Property	at	value	unit	Property	at	value	unit
Density	20°C	2,730	kg/m <sup>3</sup>	Melting Range		643-654	°C
Modulus of Elasticity				Mean Coefficient of Expansion	20°C	21.5	x 10 <sup>-6</sup> / °C
Tension	20°C	68.9	GPa	Thermal Conductivity	25°C	193	W / m . °C
Shear	20°C	25	GPa	Electrical Resistivity	20°C	0.034	micro-ohm . m
Poisson's ratio	20°C	0.33		Electrical Conductivity	20°C	50	% IACS

**Fabrication** Aluminium 3003 is not generally hot worked. It is very readily cold formable in the annealed condition, as it is ductile. Forming loads and tool & press wear are generally less than with carbon steel. For piercing and blanking the punch to die clearance should be about 7% of the thickness per side for the H32 & H34 tempers. Sharp tools are required.

**Bend Radii** Minimum recommended internal bend radii for 90° cold bends at right angles to the rolling direction (good way). See table on bend radii on page 27.

**Welding** 3003 is readily welded by the TIG and MIG processes. Commonly used filler alloys are 4043 and 1100. 4043 gives greater weld strength, but if the assembly is to be anodised, 1100 filler metal will give a closer colour match. 3003 may also be gas welded or resistance welded, but the resulting joints are not as strong or as corrosion resistant as the inert gas welded joints. Gas welding could give excessive heat distortion and thinner gauges may burn through. All traces of welding or brazing flux must be removed by scrubbing with hot water upon completion.

**Heat Treatment** Anneal at 415°C ± 5°C, until all parts have reached the annealing temperature. Stress relief is rarely required, but can be carried out at about 220°C. If loss of strength is of concern, stress relief tests should be conducted.

ASTM PRODUCT SPECIFICATIONS	Specification	Title
	B209	Aluminium and Aluminium Alloy Sheet and Plate
	B210	Aluminium and Aluminium Alloy Drawn Seamless Tubes
	B483	Aluminium and Aluminium Alloy Drawn Tubes for General Purpose Applications

CHARACTERISTICS	Corrosion Resistance	Very Good	Machinability	Poor (10%)
	Anodising	Very Good*	Weldability	Very Good
	Formability	Very Good	Brazeability	Excellent

\* (for surface protection only)

## ALUMINIUM 5005

UNS A95005

## PRODUCT DATA SHEET

Aluminium Alloys

Aluminium alloy 5005 contains nominally 0.8% magnesium. It has medium strength, good weldability, and good corrosion resistance in marine atmospheres. It also has the low density and excellent thermal conductivity common to all aluminium alloys. It is the most commonly used grade of aluminium in sheet and plate form.

**Typical Applications** Architectural applications, general sheet metal work, high strength foil.

CHEMICAL COMPOSITION AS/NZS 1734 Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate.	Element	%	Element	%
	Aluminium	Balance	Manganese	0.20 max
	Magnesium	0.50 – 1.10	Chromium	0.10 max
	Silicon	0.30 max	Zinc	0.25 max
	Iron	0.07 max	Others, each	0.05 max
	Copper	0.20 max	Others, total	0.15 max

SPECIFIED MECHANICAL PROPERTIES AS/NZS 1734 Aluminium and aluminium alloys - Flat sheet, coiled sheet and plate.	Temper	0.2% Proof Stress, MPa min <sup>†</sup>	Tensile Strength, MPa	Elongation %
	O (annealed)	35	105 – 145	12 – 22
	H12	95	125 – 165	2 – 8
	H14	115	145 – 185	1 – 6
	H16	135	165 – 205	1 – 3
	H18	-	> 185	1 – 3
	H32	85	115 – 160	3 – 9
	H34	105	135 – 180	2 – 7
	H36	125	160 – 200	1 – 4
	H38	-	> 180	1 – 4

† For information only, proof stress is not specified or measured except by prior agreement

KEY TO TEMPER	Temper	Condition		
	O	Annealed (soft)		
	H1x	Strain hardened only		
	H3x	Strain hardened and then stabilised (i.e. low temperature heat treated to pre-empt natural ageing, by reducing strength and increasing ductility)		
	Second digit: (x)			
	8	Full hard	4	Half hard
	6	Three quarter hard	2	Quarter hard

**Description** Aluminium 5005 is a lean aluminium magnesium alloy which can be hardened by cold work: it is not heat treatable to higher strength.

**Austral Wright Metals** can supply this alloy as plate, sheet and strip. See Austral Wright Metals Catalogue for normal stock sizes and tempers.

**Corrosion Resistance** 5005 has the same high resistance to general corrosion as other non heat treatable aluminium alloys. It also has the higher resistance to slightly alkaline conditions common to the 5000 series alloys. The atmospheric corrosion resistance of 5005 is similar to that of 3003. When anodised to improve corrosion resistance, the film on 5005 is clearer than on 3003, and gives better colour match with 6063 architectural extrusions. The corrosion resistance of aluminium alloys relies on a protective surface oxide film, which when damaged is readily repaired by the rapid reaction between aluminium and oxygen. However, the high reactivity of the base metal can give

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Austral Wright Metals assumes no liability in connection with the information in this Product Data Sheet.



rapid corrosion if the film cannot be repaired, so aluminium alloys are not suitable for use with reducing media.

Since aluminium is a reactive metal, it may corrode more quickly when in electrical contact with most other metals. The prediction of galvanic corrosion is complex, please consult Austral Wright Metals for specific advice.

**Pressure Vessels** AS1210 Pressure Vessels and AS4041 Pressure Piping do not prequalify the alloy for pressure service.

#### Physical Properties

Property	at	value	unit	Property	at	value	Unit
Density	20°C	2,700	kg/m <sup>3</sup>	Specific Heat	20°C	900	J/kg . °C
Melting Range		632 - 655	°C	Mean Coefficient of Expansion	20°C	23.75	x 10 <sup>-6</sup> / °C
Modulus of Elasticity				Thermal Conductivity	25°C	201	W / m . °C
Tension	20°C	68.2	GPa	Electrical Resistivity	20°C	0.033	micro-ohm . m
Torsion	20°C	25.9	GPa	Electrical Conductivity			
Compression	20°C	69.5	GPa	Equal volume	20°C	52	% IACS
				Equal weight	20°C	172	% IACS

**Fabrication** Aluminium 5005 is not generally hot worked. It is readily cold formable in the annealed condition, as it is a relatively soft and ductile alloy. Forming loads and tool & press wear are generally less than with carbon steel. For piercing and blanking the punch to die clearance should be about 6% of the thickness per side for the H32 & H34 tempers. Sharp tools are required.

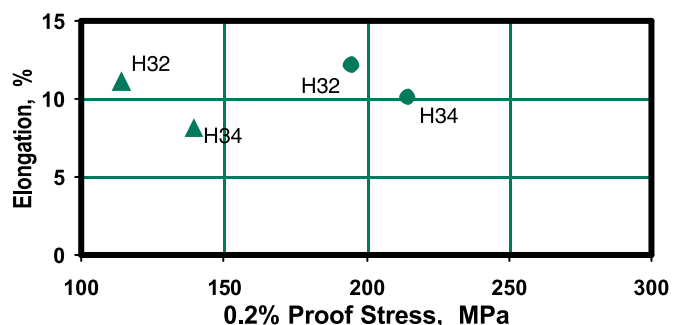
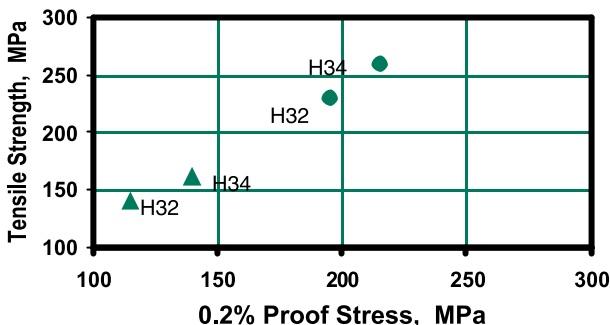
**Machinability** 5005 is readily machinable by conventional methods. It should be machined at high speed with copious lubrication to avoid thermal distortion of the workpiece. Sharp tools are essential. High speed steel or tungsten carbide may be used. Cuts should be deep and continuous, with high cutting speeds. Woodworking machinery may be suitable for short runs.

**Welding** 5005 is readily weldable by standard techniques. It is frequently welded with GTAW (TIG) or GMAW (MIG). Aluminium must be very dry & clean to avoid contamination & porosity of the weld. Filler metals 1100, 4043 or 4047 are used. 4043 is the most crack tolerant. Best colour match is obtained with 1188 filler metal. Shielding gas must be dry & free of hydrogen.

**Heat Treatment** Aluminium 5005 is annealed at 345°C, time at temperature and cooling rate are unimportant. Stress relief is rarely required, but can be carried out at about 220°C. If loss of strength is of concern, stress relief tests should be conducted.

ASTM PRODUCT SPECIFICATIONS	Specification	Title
	B209	Aluminium and Aluminium Alloy Sheet and Plate
	B316	Aluminium and Aluminium Alloy Rivet & Cold Heading Wire & Rods
	B210	Aluminium and Aluminium Alloy Drawn Seamless Tubes
	B483	Aluminium and Aluminium Alloy Drawn Tubes for General Purpose Applications

#### Typical strength and ductility of alloys 5005 & 5052 in the H32 & H34 tempers



## ALUMINIUM 5052

### UNS A95052

## PRODUCT DATA SHEET

### Aluminium Alloys

Aluminium alloy 5052 contains nominally 2.5% magnesium and 0.25% chromium. It has good workability, medium static strength, high fatigue strength, good weldability, and very good corrosion resistance, especially in marine atmospheres. It also has the low density and excellent thermal conductivity common to all aluminium alloys. It is commonly used in sheet, plate and tube form.

**Typical Applications** Architecture, general sheet metal work, heat exchangers.

CHEMICAL COMPOSITION AS/NZS 1734 Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate.	Element	%	Element	%
	Aluminium	Balance	Copper	0.10 max
	Magnesium	2.2 – 2.8	Manganese	0.10 max
	Chromium	0.15 – 0.35	Zinc	0.10 max
	Silicon	0.25 max	Others, each	0.05 max
	Iron	0.40 max	Others, total	0.15 max

SPECIFIED MECHANICAL PROPERTIES AS/NZS 1734 Aluminium and aluminium alloys - Flat sheet, coiled sheet and plate.	Temper	0.2% Proof Stress, MPa min <sup>†</sup>	Tensile Strength, MPa	Elongation %
	O (annealed)	65	170 – 215	14 – 20
	H32	160	215 – 265	4 – 10
	H34	180	235 – 285	3 – 8
	H36	200	255 – 305	2 – 4
	H38	220	270 min	2 – 4

† For information only, proof stress is not specified or measured except by prior agreement

KEY TO TEMPERS	Temper	Condition		
	O	Annealed (soft)		
	H1x	Strain hardened only		
	H3x	Strain hardened and then stabilised (i.e. low temperature heat treated to pre-empt natural ageing, by reducing strength and increasing ductility)		
	Second digit: (x)			
	8	Full hard	4	Half hard
	6	Three quarter hard	2	Quarter hard

**Description** Aluminium 5052 is an aluminium magnesium alloy which can be hardened by cold work: it is not heat treatable to higher strength. It is about mid way through the series of aluminium magnesium alloys for alloying content and strength. It has excellent fatigue properties, with an endurance limit of 115 MPa in the H32 temper and 125 MPa in the H34 temper.

**Austral Wright Metals** can supply this alloy as plate, sheet and strip. See Austral Wright Metals Catalogue for normal stock sizes and tempers.

**Corrosion Resistance** 5052 has the same high resistance to general corrosion as other non heat treatable aluminium alloys. It also has the higher resistance to slightly alkaline conditions common to the 5000 series alloys. The resistance of 5052 to corrosion in marine atmospheres is excellent, hence the frequent use of 5052 in marine applications.

The corrosion resistance of aluminium alloys relies on a protective surface oxide film, which when damaged is readily repaired by the rapid reaction between aluminium and oxygen. However, the high reactivity of the base metal can give rapid corrosion if the film cannot be repaired, so aluminium alloys are not suitable for use with reducing media. 5052 can be anodised to improve the corrosion resistance by thickening the protective surface film.

The technical advice and recommendations made in this Product Data Sheet should not be relied or acted upon without conducting your own further investigations, including corrosion exposure tests where needed. Please consult current editions of standards for design properties. Austral Wright Metals assumes no liability in connection with the information in this Product Data Sheet.

Since aluminium is a reactive metal, it may corrode more quickly when in electrical contact with most other metals. The prediction of galvanic corrosion is complex; please consult Austral Wright Metals for specific advice.

**Pressure Vessels** AS1210 Pressure Vessels and AS4041 Pressure Piping prequalify the alloy for pressure service for temperatures up to 200°C.

#### Physical Properties

Property	at	value	unit	Property	at	value	Unit
Density	20°C	2,680	kg/m <sup>3</sup>	Mean Coefficient of Expansion	20°C	23.75	x 10 <sup>-6</sup> / °C
Melting Range		607 – 650	°C	Thermal Conductivity	25°C	138	W / m . °C
Modulus of Elasticity				Electrical Resistivity	20°C	0.050	micro-ohm . m
Tension	20°C	69.3	GPa	Electrical Conductivity			
Torsion	20°C	25.9	GPa	Equal volume	20°C	35	% IACS
Compression	20°C	70.7	GPa	Equal weight	20°C	116	% IACS

**Fabrication** Aluminium 5052 is not generally hot worked. It is very readily cold formable in the annealed condition, as it is ductile. Forming loads and tool & press wear are generally less than with carbon steel. For piercing and blanking the punch to die clearance should be about 7% of the thickness per side for the H32 & H34 tempers. Sharp tools are required.

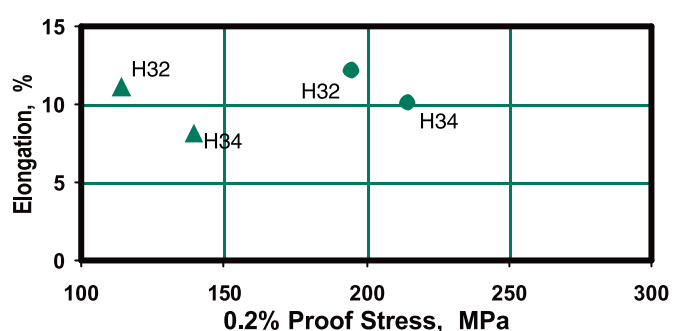
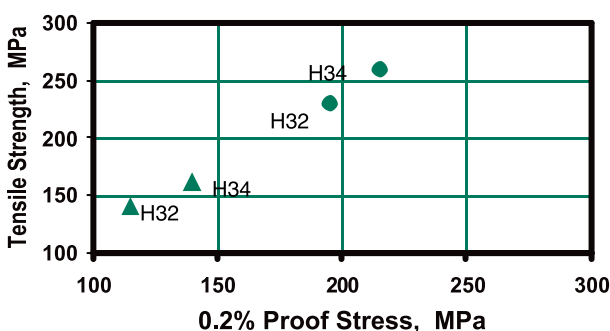
**Machinability** 5052 is readily machinable by conventional methods. It should be machined at high speed with copious lubrication to avoid thermal distortion of the workpiece. Sharp tools are essential. High speed steel or tungsten carbide may be used. Cuts should be deep and continuous, with high cutting speeds. Woodworking machinery may be suitable for short runs.

**Welding** 5052 is readily weldable by standard techniques. It is frequently welded with GTAW (TIG) or GMAW (MIG). Aluminium must be very dry & clean to avoid contamination & porosity of the weld. Filler metals 1100, 4043 or 4047 are used. 4043 is the most crack tolerant. Best colour match is obtained with 1188 filler metal. Shielding gas must be dry & free of hydrogen.

**Heat Treatment** Aluminium 5052 is annealed at 345°C, time at temperature and cooling rate are unimportant. Stress relief is rarely required, but can be carried out at about 220°C. If loss of strength is of concern, stress relief tests should be conducted.

ASTM PRODUCT SPECIFICATIONS	Specification	Title
	B209	Aluminium and Aluminium Alloy Sheet and Plate
	B316	Aluminium and Aluminium Alloy Rivet & Cold Heading Wire & Rods
	B210	Aluminium and Aluminium Alloy Drawn Seamless Tubes
	B483	Aluminium and Aluminium Alloy Drawn Tubes for General Purpose Applications

#### Typical strength and ductility of alloys 5005 & 5052 in the H32 & H34 tempers



## ALUMINIUM 5083

### UNS A95083

Aluminium alloy 5083 contains nominally 4.5% magnesium, 0.6% manganese and 0.1% chromium. In the tempered condition, it is strong, and retains good formability due to excellent ductility. 5083 has high resistance to corrosion, and is used in marine applications. It has the low density and excellent thermal conductivity common to all aluminium alloys.

**Typical Applications** require a weldable alloy of high to moderate strength, with good corrosion resistance. Marine applications, unfired welded pressure vessels, TV towers, drilling rigs, transportation equipment, armour plate.

CHEMICAL COMPOSITION AS/NZS 1734 Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate.	Element	%	Element	%
	Aluminium	Remainder	Silicon	0.40 max
	Magnesium	4.0 – 4.9	Iron	0.40 max
	Manganese	0.40 – 1.0	Copper	0.10 max
	Chromium	0.05 – 0.25	Others, each	0.05 max
			Others, total	0.15 max

SPECIFIED MECHANICAL PROPERTIES AS/NZS 1734 Aluminium and aluminium alloys - Flat sheet, coiled sheet and plate.	Temper	0.2% Proof Stress, MPa min <sup>†</sup>	Tensile Strength, MPa	Elongation % min <sup>‡</sup>
	O (annealed)	125 – 200	275 – 350	14
	H112	125	275	10
	H116	215	305	10
	H321	215 – 295	305 – 385	10

<sup>†</sup> For information only, proof stress is not specified or measured except by prior agreement

<sup>‡</sup> Minimum elongation, actual value depends on thickness – thicker gauges have higher elongation

Equivalent specifications:

USA: AA 5083; UK: BS 5083; Germany: DINAlMg4.5Mn; Europe: EN AW-A 5083; Japan: JIS A5083P; France: NF A5083; ISO: Al Mg4.5Mn0.7.

The properties in this data sheet meet Australian/New Zealand Standard AS/NZS 1734:1997 Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate (equivalent to BS EN 573-1). Alloy 5083 can be supplied to meet other national standards.

KEY TO TEMPERS	Temper	Condition		
	O	Annealed (soft)		
	H1x	Strain hardened only		
	H2x	Strain hardened then partially annealed		
	H3x	Strain hardened and then stabilised (i.e. low temperature heat treated to pre-empt natural ageing, by reducing strength and increasing ductility)		
	Second digit: (x)			
	8	Full hard	4	Half hard
	6	Three quarter hard	2	Quarter hard

**Description** Aluminium 5083 is a strong magnesium-manganese-chromium-aluminium alloy. It can be hardened by cold work, but is not heat treatable to higher strength. It has good ductility for the strength level, better than most other 5000 series alloys (see figure).

**Austral Wright Metals** can supply this alloy as plate, sheet and strip. See Austral Wright Metals Catalogue for normal stock sizes and tempers.

**Pressure Vessels** AS1210 Pressure Vessels prequalifies alloy 5083 for pressure service for temperatures up to 65°C in the O, H112 & H321 tempers.

The technical advice and recommendations made in this Product Data Sheet should not be relied or acted upon without conducting your own further investigations, including corrosion exposure tests where needed. Please consult current editions of standards for design properties. Austral Wright Metals assumes no liability in connection with the information in this Product Data Sheet.

**Corrosion Resistance** Alloy 5083 has excellent resistance to general corrosion, and is used in marine applications. Resistance is excellent in aqueous solutions in the pH range 4 – 9.

The corrosion resistance of aluminium alloys relies on a protective surface oxide film, which when damaged is readily repaired by the rapid reaction between aluminium and oxygen. However, the high reactivity of the base metal can give rapid corrosion if the film cannot be repaired, so aluminium alloys are not suitable for use with reducing media. Alloy 5083 can be anodised to improve the corrosion resistance by thickening the protective surface film.

Alloy 5083 can be susceptible to exfoliation corrosion in severe applications. Material in the H116 temper is least susceptible, and passes the ASTM G66 Exfoliation Susceptibility Test (ASSET Test). AS 1734 suggests alloy 5083 should not be used above 65°C.

Since aluminium is a reactive metal, it may corrode more quickly when in electrical contact with most other metals. The prediction of galvanic corrosion is complex; please consult Austral Wright Metals for specific advice.

### Physical Properties

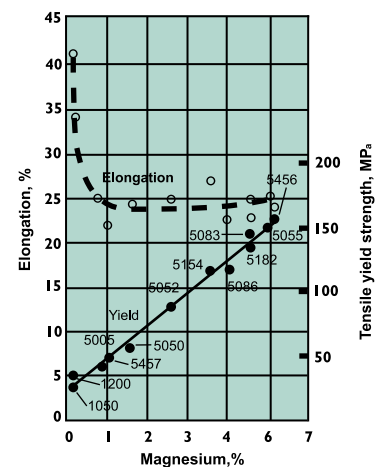
Property	at	value	unit	Property	at	value	Unit
Density	20°C	2,660	kg/m <sup>3</sup>	Melting Range		574 – 638	°C
Weight		2.66 x thickness in mm		Mean Coefficient of Expansion	20°C	24.2	x 10 <sup>-6</sup> / °C
Modulus of Elasticity				Thermal Conductivity	25°C	120	W / m . °C
Tension	20°C	70.3	GPa	Electrical Resistivity	20°C	0.060	micro-ohm . m
Torsion	20°C	26.4	GPa	Electrical conductivity (all tempers)	20°C	29	% IACS
Compression	20°C	71.7	GPa				

**Fabrication** Aluminium 5083 is readily cold formable, as it is ductile. Forming loads and tool & press wear are generally less than with carbon steel. For piercing and blanking the punch to die clearance should be about 7% of the thickness per side for temper O, 7.5% for other tempers.

**Welding** Alloy 5083 is readily welded by the TIG and MIG processes using 5183, 5356 or 5556 filler alloys. Welding the H116 temper will reduce the tensile and yield strengths in the heat affected zone to those of the annealed condition. Aluminium must be very dry & clean to avoid contamination & porosity of the weld. It is essential that all traces of flux used in welding or brazing are removed by scrubbing with hot water.

**Heat Treatment** Alloy 5083 is annealed at 350°C, time at temperature and cooling rate are unimportant. Stress relief is rarely required, but can be carried out at about 220°C. If loss of strength is of concern, stress relief tests should be conducted.

Summary of Characteristics	
Corrosion resistance	Very Good
Formability	Good (H116)
Weldability	Very Good
Anodising	Fair
Machinability	Fair
Brazeability	Poor
5083 is anodised for corrosion protection only	



Comparison of yield strength & elongation with magnesium content for commercial alloys – annealed temper.



## HANDLING AND STORING ALUMINIUM

Aluminium is one of the easiest materials to keep in good condition. It has a high natural resistance to corrosive conditions normally encountered during shipment and storage and a little care will maintain its original appearance for a long time. Aluminium is often used for its appearance, so it is worth the effort to maintain the surface, which is much more cost effective than restoring it. The principal things to guard against are surface abrasion and water stains.

Austral Wright Metals always pack aluminium to prevent traffic or rub marks during shipment and to keep it dry. All incoming shipments should be inspected promptly. Traffic marks may appear as scratches, surface abrasions, or a condition resembling cinders embedded in the metal. They result from mechanical abrasion and subsequent oxidation of the abraded areas. Their principal disadvantage is their unsightliness and their effect on finishing operations.

To avoid traffic marks AWM pack the metal to prevent undue flexing or twisting and items rubbing against each other. Products are usually packed on skids or in timber boxes. Paper or cardboard is used where necessary for cushioning thin or soft metal. Strapping is used to reinforce skids and boxes and to bind wrapped bundles, but never contacts the product directly.

Water stains look non-metallic and are usually whitish, but may be iridescent, depending on the alloy and degree of oxidation. They are caused by moisture trapped between the surfaces of closely packed sheets. The purer aluminium alloys are more resistant to water stain, and the most susceptible are the high magnesium 5xxx and 6xxx series alloys. Water stain is superficial and the mechanical properties are not affected. If aluminium does get wet, it should be thoroughly dried before storing – by evaporation in air or by dry air currents. When the moisture is removed soon after the metal gets wet, no stain will result. Even if staining has started, when the aluminium is dried the stain will not develop further. The metal should not be stored near water sources such as steam and water pipes, and it should be kept at reasonable distance from open doors and windows.

Condensation is the most common cause of water stains. Under severe conditions, condensation may also cause fairly uniform surface deterioration, which may only become apparent if the material is subsequently etched and anodised. Condensation will be prevented by keeping the temperature of the metal above the dew point of the air. So it is important to avoid a sudden fall in temperature or increase in humidity in the storage area.

Aluminium in original boxes should never be left in the open – greater variations in temperature and humidity outdoors increase the possibility of condensation. Even if the package is “waterproof”, the seal will not

be perfect and outdoor storage is highly undesirable. Waterproof packages are designed to protect the metal during shipment and are not meant for extended exposure to the weather.

Where water stains have occurred, the degree of staining may be judged by the relative roughness of the stained area. If the surface is reasonably smooth, the stain is superficial and the appearance can be improved by mechanical or chemical treatments. Scratch-brushing or rubbing with stainless steel wool and oil is effective in removing water stain. Alternatively, a chemical dip in 10% sulphuric + 3% chromic acid at 80°C will brighten the surface without undue etching.

When storing aluminium avoid contact with other metals, which will cause scratches or other marks. Racks and bins faced with plastic or wood are recommended. It is also good practice to keep chemicals such as acids, alkalis, caustics, nitrates and phosphates away from aluminium.

Oldest stock should always be used first. Occasional checking of the stock on hand will help to prevent any serious corrosion and assist with the problem of age hardening.

## WORKING AND SHAPING ALUMINIUM

The cleanest possible working conditions and good housekeeping are a must to prevent contamination of surfaces by metal swarf and/or dust. Physical damage to the surface should be avoided for best corrosion resistance.

Use a hard pencil lead for scribing – steel scribing tools should not be used. Rinsing fabricated and welded parts with nitric acid (at least 15%) gives a clean surface and proper restoration of the protective natural oxide film.

Welding to recognised good practice includes scrupulous cleaning and drying of the surfaces before welding to avoid cracking.

Grease can be used to protect or seal spaces and openings forming part of removable items (bolted or screwed assemblies). On no account should the grease contain graphite or molybdenum disulphide, as these will promote corrosion.

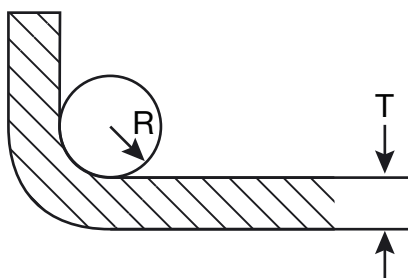
For bonded assemblies, the adhesive should be chosen both for strength and also to avoid deleterious side effects (eg. decomposition of the adhesive caused by moisture).

The need for care and maintenance of natural, anodised or prepainted surfaces depends on the environment and the type of exposure. These factors determine the frequency of washing. Detergents etc should be checked for harmful action on the surface concerned. For applications involving food, cleaning products complying with current regulations must be used.

## SHEET AND PLATE BENDING RADII

Cold Bend Radii 90°,  $t$  = thickness

Alloy	Temper	Material Thickness							
		0.4mm	0.8mm	1.6mm	3.0mm	4.0mm	6.0mm	10.0mm	12.0mm
1050	H12	0t	0t	0t	0t	0t	0.5t	1t	1.5t
1100	O	0t	0t	0t	0t	0t	0.5t	1t	1.5t
1200	H12	0t	0t	0t	0.5t	1t	1t	1.5t	2t
	H14	0t	0t	0t	1t	1t	1.5t	2t	2.5t
	H16	0t	0.5t	1t	1.5t				
	H18	1t	1.5t	2t	3t				
3003	O	0t	0t	0t	0t	0.5t	1t	1t	1.5t
5005	H32	0	0	0	0.5t	1t	1t	1.5t	2t
	H34	0	0	0	1t	1t	1.5t	2t	2.5t
5052	H32	0t	0t	1t	1.5t	1.5t	1.5t	1.5t	2t
5083	H321/116	0	1.5t	1.5t	2t	2t	2t	2.5t	3t
5251	H32	0t	0t	1t	1.5t	1.5t	1.5t	1.5t	2.0t
	H34	1t	1t	1.5t	2t	2t	2.5t	2.5t	3t
	H36	1t	1t	1.5t	2.5t				
	H38	0t	1.5t	2.5t	3t				
5454	H32	0.5t	0.5t	1t	1.5t	1.5t	2t	2.5t	3.5t
	H34		1t	1.5t	2t	2.5t	3t	3.5t	4t
	H112						2t	2.5t	3t



Sheet and plate are capable of being bent cold through an angle of 90 deg. around a pin having a radius equal to N times the thickness of the sheet without cracking.

$R$  is the bending radius  
 $T$  is the thickness of the sheet

## CORROSION RATINGS FOR ALUMINIUM

These corrosion tables apply specifically to the 1000 and 5000 series of wrought alloys, but may be applied to the 4000 and 6000 series of wrought alloys and to Casting Alloys 135, 160 Q, 123, 360, 320, 340 and 360.

Anodising improves the resistance because of the more perfect and thicker oxide film and because of its scratch and abrasion resistance.

Powder Coating has excellent resistance to natural weathering that provides good chemical and corrosion resistance.

- A Excellent Resistance (corrosion so slight as to be harmless).
- B Good Resistance (satisfactory service expected).
- C Fair Resistance (satisfactory service only under specific conditions; aluminium not recommended without additional data).
- D Poor Resistance (satisfactory for temporary service only; aluminium should not be used without test experiment).

Note : The following guide list indicates in a very general way the resistance of commercially pure aluminium to attack by chemicals and other common substances. Because the chemical behaviour of aluminium is dependent upon conditions of service, environment, the actual composition of the metal etc., engineers should always be consulted in cases of doubt.

Test Solution	Corrosion Resistance	Test Solution	Corrosion Resistance
<b>A</b>		Benzoic Acid	A
Acetaldehyde	A	Benzol (Benzel alcohol)	A
Acetanilide	A	Benzoyl Chloride (dry & below 200°F)	B
Acetic Acid, Glacial, 95% & higher	A	Bitumen	A
Acetic Acid, Dilute (elevated temp)	C	Bituminous Compounds	A
Acetic Anhydride	A	Borax	B
Acetone	A	Boric Acid	A
Acetylene (dry)	A	Brandy	B
Acrylonitrile (dry)	A	Bromine	D
Acrylonitrile (wet)	B	Bromoform	C
Adipic Acid	A	Buttermilk	A
Albumen	A	Butyl Acetate	A
Aluminium Chloride	C	Butyraldehyde	A
Aluminium Formate	A	Butyric Acid	B
Aluminium Nitrate (no free nitric acid)	A		
Aluminium Sulphate	B	<b>C</b>	
Ammonia (dry)	A	Calcium Carbide (dry)	A
Ammonium Acid Fluoride	D	Calcium Carbonate	B
Ammonium Aluminium Sulphate	B	Calcium Chloride	C
Ammonium Bicarbonate	A	Calcium Hydrosulphide	A
Ammonium Bromide	C	Calcium Hydroxide	C
Ammonium Carbonate	B	Calcium Hypochlorite	C
Ammonium Fluoride	C	Calcium Nitrate	A
Ammonium Hydroxide	B	Calcium Oxalate	C
Ammonium Lactate	B	Calcium Sulphate	B
Ammonium Nitrate	A	Calcium Sulphide	B
Ammonium Phosphate (up to 3%)	B	Camphor	B
Ammonium Sulphate (no free sulphuric acid)	B	Carbolic Acid (phenol) below 100°C	A
Ammonium Sulphate	B	Carbon Black	B
Ammonium Thiocyanate (pure)	A	Carbon Dioxide	A
Amyl Acetate	A	Carbon Disulphide	A
Aniline (liquid)	C	Carbonic Acid (dilute)	A
Aniline Hydrochloride	C	Carbon Monoxide	A
Aniline Sulphate	B	Carbon Tetrachloride (dry)	B
Aniline (vapours)	A	Castor Oil	A
Animal Oils	A	Cellulose	A
Anthracene	A	Cellulose Acetate	A
Anthranilic Acid	D	Cement, Wet	B
Anthraquinone	A	Cement, Dry	A
Apple Juice	B	Ceresine	A
Arsenic Iodide	B	Cereals (dry)	A
Asphalt	A	Cerium Nitrate	A
		Chalk (dry)	A
<b>B</b>		Cheese	B
Barium Chloride	C	Chloride of lime (Calcium Hypochlorite)	C
Barium Hydroxide	D	Chlorine (dry)	A
Beer	A	Chlorine (v.c. with water)	D
Benzaldehyde	A	Chloroform (boiling)	C
Benzene	A	Chloroform (room tem-dry)	B

Test Solution	Corrosion Resistance	Test Solution	Corrosion Resistance
Chromic Nitrate	B	Fly Ash	C
Chromic Sesquioxide	A	Forest Products	B
Cider	B	Formaldehyde	B
Citric Acid	B	Freon 11	B
Clay	A	Freon 22	A
Coal, Coke	A	Freon 113	B
Coal, Gas	B	Fruit Juices	B
Cobaltous Chloride	D	Fuels, Liquid	A
Cod Liver Oil	A	Furfural	A
Cognac	B		
Copal	A	<b>G</b>	
Cork (dry)	A	Gallic Acid	A
Cork (wet)	C	Gas, illuminating	A
Cottonseed Oil	A	Gases, Argon, Helium, Hydrogen, Nitrogen, Oxygen, LPG, others	A
Cream of Tartar	B	Gasoline (anhydrous)	A
Creosote	B	Gelatine	A
Cresol (below 100°C)	A	Gin	B
Crotonaldehyde	A	Gluconic Acid	A
Crude Petroleum	A	Glucose	A
Cupric Acetate	D	Glue (neutral)	B
Cupric Chloride	D	Glycerine (pure)	A
Cupric Nitrate	D	Glyceryl Phosphate	A
Cupric Sulphate	D	Grape Sugar (glucose)	A
Cyanoacetic Acid	B		
<b>D</b>		<b>H</b>	
Dairy Products	A	Hexamethylenetetramine	A
Diammonium Hydrogen Phosphate	C	Hydrobromic Acid	D
Dichlorodifluoromethane (Freon-E-12)	A	Hydrochloric Acid	D
Dichloroethylene (dry)	B	Hydrocyanic Acid	A
Dichloromonofluoromethane (Freon F-21)	B	Hydrofluoric Acid	D
Dichlorotetrafluoromethane (Freon F-114)	A	Hydrogen Peroxide (30% and higher)	A
Diethyl Ether	A	Hydrogen Peroxide (dilute)	B
Dialcylol Acid	C	Hydrogen Sulphide	A
Dipetene	A	Hydroquinone	A
Diphenyl Ether	A		
Distilled Water	A	<b>I</b>	
Dried Bulk Vegetables	A	Ice	A
Dyestuffs (acid or direct)	B	Indole	A
Dynamite	A	Ink	C
		Iodine	C
<b>E</b>		<b>K</b>	
Eau de Cologne	C	Kerosene	A
Edible Fats	A		
Edible Oils	A	<b>L</b>	
Essential Oils	A	Lacquers	A
Ethers	A	Lactic Acid	B
Ethyl Alcohol (not anhydrous)	A	Lactose	A
Ethyl Chloride (dry)	A	Lard Oil	A
Ethylene Bromide	C	Latex	A
Ethylene Glycol	B	Lead Acetate, Basic	C
Ethyl Oxalate	A	Lead Acetate, Primary	C
Eucalyptus Oil	A	Lead Acetate, Secondary	C
		Lead Arsenate	B
<b>F</b>		Lemon Juice	B
Fats	A	Levulinic Acid	A
Fatty Acids	A	Lignite Wax	A
Ferric Chloride	D	Lime, Dry	A
Ferric Nitrate	C	Lime, Wet	C
Ferrous Ammonium Sulphate	B	Linseed Oil	A
Ferrous Carbonate (up to 10% conc.)	B	Liquid Fuels	A
Ferrous Sulphate	B	Liquors	B
Flour, other Milled Products	A	Lithium Hydroxide	C
Fluoboric Acid	D	Lubricating Oils	A
Fluorine Gas (dry)	A		
Fluorspar	A		

Test Solution	Corrosion Resistance	Test Solution	Corrosion Resistance
M		Ores, Bauxite, Zinc, Lead, Nickel	A
Madder Lacquer	A	Ores, Copper, Mercury	C
Magnesium Acetate (up to 10% conc.)	A	Organic Amines	B
Magnesium Chloride	C	Oxalic Acid	C
Magnesium Formate (up to 1% conc.)	B	Oxygen	A
Magnesium Nitrate (up to 10% conc.)	B	Ozone (dry)	A
Magnesium Perchlorate	A	Ozone (wet)	A
Magnesium Sulphate	B		
Maleic Anhydride	C	<b>P</b>	
Malic Acid	B	Paints, Oil Base	A
Mannitol	A	Paints, Copper Mercury	C
Margarine	A	Palmitic Acid	B
Meat, Unsalted	A	Palm Oil	A
Mercury	D	Paraffin	A
Menthol	A	Paraldehyde	B
Mercuric Chloride	D	Paste	A
Mercury Fulminate	D	Peanut Oil	A
Mercury Salts	D	Perchloroethylene (dry)	A
Metaldehyde	A	Perlite	A
Methylamine	A	Petroleum (chloride free)	A
Methyl Chloride	D	Petroleum Products, refined	A
Methyl Cyclohexamine	A	Phosphate Fertilisers	C
Methyl Formate	A	Phosphate Rock	C
Methyl Salicylate	A	Phosphoric Acid	C
Milk	A	Pickles	C
Milk Sugar	A	Plaster	B
Mineral Oils	A	Phenol (up to 100°C)	A
Molasses, Blackstrap or Residual	B	Phloroglucinol	A
Molasses, Refined	A	Phosphorus (dry)	A
Moulds	A	Phosphorus Pentoxide (dry)	A
Methyl Ethyl Ketone	A	Phosphorus Sesquisulphide (dry)	A
Monoethanolamine	A	Phthalic Acid (pure)	A
		Picric Acid	A
<b>N</b>		Pinene	A
Naphthalene	B	Pine Oil	A
Naphthenic Acid (up to 82°C)	A	Plastic Pellets, Polyethylene Polyvinyl Chloride	A
		Polypropylene, Polystyrene	
Naphthol	A	Potassium Bicarbonate	A
Naphthylamine	C	Potassium Bichromate	A
Naval Stores	A	Potassium Bitartrate	B
Nickel Acetate (up to 10% conc.)	B	Potassium Bromide	B
Nickel Ammonium Sulphate (up to 10% conc.)	C	Potassium Carbonate	C
Nickel Chloride	D	Potassium Chlorate	A
Nickel Nitrate (up to 10% conc.)	C	Potassium Chloride	B
Nickel Sulphate (up to 10% conc.)	C	Potassium Chromate	A
Nicotine	A	Potassium Cyanide	C
Nicotine Sulphate	A	Potassium Dichromate	A
Nitric Acid (dilute)	D	Potassium Ferricyanide	A
Nitric Acid (concentrated over 80%)	A	Potassium Hydroxide	D
Nitrogen	A	Potassium Nitrate	A
Nitrogen Fertilisers	A	Potassium Nitrite	A
Nitroglycerine	A	Potassium Permanganate	A
Nitrous Acid	B	Potassium Phosphate	C
Nitrous Oxide (dry)	A	Potassium Silicate	B
Nitrous Oxide (wet)	C	Potassium Sulphate	A
		Potassium Thiocyanate	A
<b>O</b>		Propionic Acid (conc.)	B
Oils, Fuels & Lube	A	Propionic Acid (dilute)	C
Oils, Transformer	A	Propylene Glycol	A
Oils, Animal	A	Pyridine	B
Oils, Edible	A	Pyrogallol	A
Oils, Mineral	A	Pyroligneous Acid	B
Oils, Vegetable	A		
Oleic Acid	A	<b>R</b>	
Olive Oil	A	Rayon	A
Onion Juice	B	Refrigerants	B
Orange Juice	B		



Test Solution	Corrosion Resistance	Test Solution	Corrosion Resistance
Resins	A	Sulphuric Acid, below 98%	D
Resorcinol	A	Sulphuric Ether	A
Rice	A	Sulphurous Acid	C
Rosin	A	Sulphuryl Chloride (dry)	B
Rubber Products, Crude, Natural, Synthetic	A	Synthetic Resins	B
		Synthetic Rubbers	A
<b>S</b>		<b>T</b>	
Salicylic Acid	A	Tanners Bate	B
Salted Herring	C	Tannic Acid (pure)	A
Salt, Wet or Dry	C	Tars	A
Sand, Gravel	A	Tartaric Acid	B
Sea Foods, Fish	A	Tetrachlorethylene (dry)	B
Selenic Acid	A	Tetralin	B
Selenous Acid	A	Tetramine	A
Semolina	A	Thorium Nitrate	C
Sewage	B	Tobacco	A
Shellac	A	Toluene	A
Silica Gel	A	Transformer Oil	A
Silicon Tetrachloride (dry)	A	Triocetin	B
Silk	A	Tichloroacetic Acid	D
Silver Salts	D	Tichlorethylene (dry)	B
Soap	C	Tichlorotyfluorethane (F-113)	B
Soda Ash	C	Triethonolamine	B
Soda Water	B	Tripoly Phosphate	C
Sodium Acetate	A	Tripotassium Phosphate	C
Sodium Bichromate	B	Turpentine	A
Sodium Bicarbonate (dry)	B		
Sodium Bisulphate	C	<b>U</b>	
Sodium Bisulphite	B	Ultramarine	A
Sodium Bitartrate	B	Urea	A
Sodium Borate	B		
Sodium Chlorate	B	<b>V</b>	
Sodium Chloride	C	Valeric Acid (up to 50% conc)	A
Sodium Chromate	A	Varnish	A
Sodium Cyanide	C	Vegetable Oils, linseed, cottonseed, soy bean, peanut etc	A
Sodium Fluosilicate (up to 1% conc)	A		
		<b>W</b>	
Sodium Fluoride, Acid	C	Water, Distilled	A
Sodium Hydrogen Sulphate	C	Water, industrial	C
Sodium Hydroxide	D	Water, Rain	A
Sodium Lactate	C	Water, Sea	C
Sodium Nitrate	A	Water, Tap	C
Sodium Nitrite	A	Waxes	A
Sodium Oxalate	B	Wheat, corn and other grains	A
Sodium Peroxide	C	Whisky	B
Sodium Phosphate	C	Wine	B
Sodium Silicate	B		
Sodium Sulphite	B	<b>X</b>	
Sodium Sulphate	A	Xylene	A
Sodium Sulphocyanide	A		
Sodium Thioarsenate	B	<b>Z</b>	
Sodium Thiosulphate	B	Zinc Acetate (up to 10% conc)	A
Stannous Bromide	D	Zinc Chloride	D
Stannous Chloride	D	Zinc Oxide (up to 10% conc)	B
Stannous Sulphate	D	Zinc Sulphate (up to 10% conc)	C
Starch	A		
Steam, Low Pressure	A		
Stearic Acid	A		
Strontium Acetate (up to 10% conc)	A		
Succinic Acid	A		
Sugar	A		
Sugar Solutions	A		
Sugar Syrup	A		
Sulphur Dioxide (dry)	A		
Sulphur, Liquid, Solid, Vapour	A		
Sulphur Trioxide (dry)	A		
Sulphuric Acid, in excess of 98%	A		

## NOTES

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