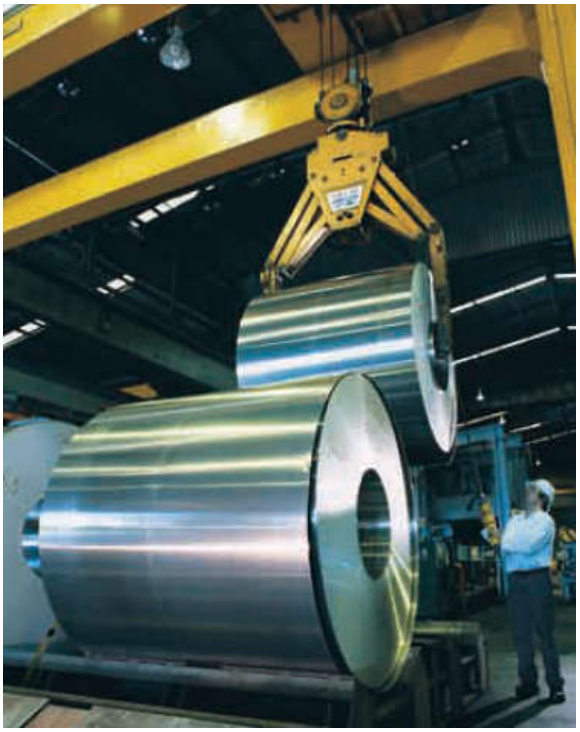
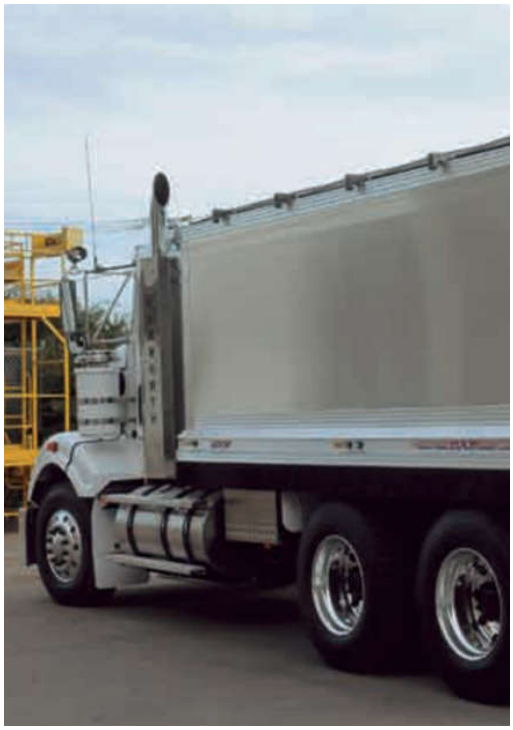
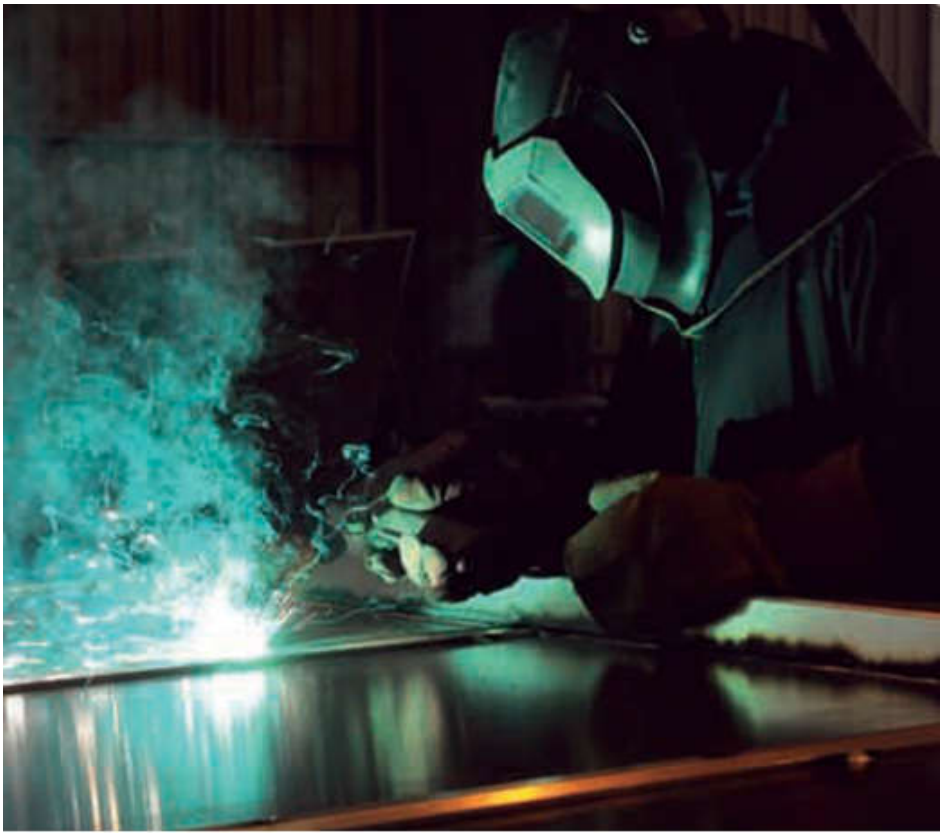
Aluminium Sheet, Coil, Plate, Treadplate & Extrusions







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Aluminium

Advantages of using Aluminium

- Light weight – approximately 1/3 the density of steel.
- Strength – some alloys can be substantially strengthened by work or by heat treatment.
- Workability – easy formability, machinability and readily welded.
- Corrosion resistance – varies depending on the alloy; the best resist marine exposure.
- Non-toxic – often used in contact with food.
- Non-magnetic and non-sparking.
- Electrical conductivity – very high; sometimes used for electrical conductors.
- Thermal conductivity – high.
- Reflectivity – bright finish options available.

Specifications

Flat rolled aluminium alloy products stocked by Atlas generally comply with ASTM B209M or ASTM B928M with dimensions in ANSI H35.2. There is very close agreement between these standards and Australian/New Zealand standard AS/NZS 1734 and again close agreement with European standard EN 573.

Aluminium Association publication “Aluminium standards and data” gives a very accessible summary of both specified data and useful information. Aluminium products are often cited as compliant with “AA specs” based on this.

Treadplate is specified in ASTM B632M but this does not cover the product well. Most mills produce to their own specifications and particularly to their own tread patterns. If tread pattern is important this should be discussed with Atlas staff prior to purchase.

Aluminium Alloy Compositions

Typical compositions of some common alloys. All values are percent.

Alloy	Al	Si	Cu	Mn	Mg	Cr	Others
1050	99.5 min						
1145	99.45 min						
1200	99.0 min						
2011	rem		5.5				Pb & Bi 0.4% each
2003	rem		0.12	1.2			
3004	rem			1.2	1.0		
3105	rem			0.6	0.50		
5005	rem				0.8		
5052	rem				2.5	0.25	
5083	rem			0.7	4.4	0.15	
5186	rem			0.4	4.3		
5251	rem			0.3	2.0		
5383	rem			0.8	4.6		
5454	rem			0.8	2.7	0.12	
6005	rem	0.8			0.5		
6060	rem	0.5			0.5		
6061	rem	0.6	0.28		1.0	0.20	
6063	rem	0.4			0.7		
6106	rem	0.4		0.1	0.6		
6262	rem	0.5	0.28		1.0	0.09	
6351	rem	1.0		0.6	0.6		

Only major alloying elements are listed.
Normal impurities are also present.
Refer to specifications for limits to both major elements and impurities

Alloy Characteristics and Forms

Alloy	Typical Application	Characteristics[1]				Commercial Form			
		Corrosion Resistace[4]	Machin-ability	Welda-bility[3]	Anodising[2]	Plate	Sheet	Coil	Extrusions
1050	Chemical & process plant & equipment	A,A	D,C	A,A	B,B	✓	✓	✓	
1145 & 1200	Commercial pure aluminium. Used in cooking utensils and for deep frying.	A,A	D,C	A,A	B,B		✓	✓	
2011	Screw machine products not requiring decorative anodizing	D,D	A,A	D,D	D,D				✓
3003	Chemical equipment, sheet metal work, rigid foil containers & closures	A,A	D,C	A,A	B,B		✓	✓	
3004	Sheet metal work, car bodies, seam welding tubing, roofing sheet	A,A	D,C	A,A	B,B		✓	✓	
3105	Painted sheet products	A,A	D,C	A,A	B,B		✓	✓	
5005	Appliances & utensils, general sheet metal work & high-strength foil	A,A	D,C	A,A	B,B	✓	✓	✓	
5052& 5251	Sheet metal work, appliances, marine applications	A,A	C,B	A,A	C,C	✓	✓	✓	
5083	High strength alloy used in transport, marine & structural applications	A,C	C,B	A,A	C,C	✓	✓		
5383	Specific to the marine industry with characteristics similar to 5083 with enhance weldability	A,C	C,B	A,A	C,C	✓	✓		
5454	Welded structures, pressure vessels for use at elevated temperatures, marine applications	A,A	C,B	A,A	C,C	✓	✓		
6005	Good strength for structural applications	A,A	B,C	A,A	B,B				✓
6061 & 6351	Structural applications where strength & corrosion resistance is needed. Used in transport applications.	B,B	B,C	A,A	B,B				✓
6063 & 6060	General purpose extrusion alloy for architectural applications where additional strength is required & for structural applications not involving welding	A,A	C,C	A,A	A,A				✓
6106	Medium strength alloy used for architectural applications where additional strength is required & for structural applications not involving welding.	A,A	C,C	A,A	A,A				✓
6262	Screw machining products suitable for decorative anodising	B,B	A,A	B,B	B,B				✓

[1] Relative ratings in decreasing order of merit = A B C D (where A = most applicable). Two ratings e.g. AC are for annealed and hardest tempers.
[2] Rating indicates suitability of alloy for decorative quality anodizing; all aluminium alloys can be anodized for increased corrosion and wear resistance. See separate note "Anodising Quality".
[3] Weldability rating quoted is for arc welding. Some alloys have lesser weldability by gas processes.
[4] General corrosion resistance rating. Resistance to stress corrosion cracking can be less.

Understanding an Alloy Code

An alloy code is made up of 4 digits, e.g:

5 ↑ Major alloying element

0 ↑ Indicates changes to minor alloying elements

52 ↑ Alloy identification number

Therefore 5052 means:

5 = Magnesium is the major alloying element

0 = No changes to original alloy since it was introduced

52 = Identifies the chemical composition of this alloy

Alloy Systems

Alloy series	Major allying element	Heat Treatable or Not
1??? =	Pure aluminium (99.0% min. and greatest)	Non–heat treatable
2??? =	Copper is major addition	Heat treatable
3??? =	Manganese is major addition	Non–heat treatable
4??? =	Silicon is major addition	Non–heat treatable
5??? =	Magnesium is major addition	Non–heat treatable
6??? =	Magnesium and Silicon are major additions	Heat treatable
7??? =	Zinc is major addition	Heat treatable
8??? =	Alloys not covered above	-

Non-heat treatable alloys can only be hardened by cold work. The degree of work hardening is designated by the Temper. Heat treatable alloys (the 2000, 6000 and 7000 series) are able to be solution treated and then age-hardened. These have “T” tempers.

“H” Temper designation systems Strain hardened alloys	
O	Soft (annealed)
H?2	¼ hard
H?4	½ hard
H?6	¾ hard
H?8	Hard

Where “?” can be:
1 = As rolled – - strain hardened only e.g. H12
2 = Strain hardened and then partially annealed (200^{O}C – 260^{O}C) e.g. H24
3 = Strain hardened and then stabilised (150^{O}C) e.g. H36
Temper F – “as fabricated” temper with no special control over conditions and no mechanical property limits.

Three-Digit H Tempers

Plate Temper Codes

Code	Description
H111	Minor strain hardening so the product does not comply with annealed properties but also not enough hardening to comply with H11.
H112	Product strain hardened at elevated temperatures. Strength only slightly higher than annealed Temper O.
H116	5xxx series alloys for marine applications. Final operation is strain hardening. Strength equivalent to H32. Product is tested for intergranular and exfoliation corrosion resistance.
H321	5xxx series alloys for marine applications. Strain hardened and then thermally stabilised. Strength equivalent to H32. Product is tested for intergranular and exfoliation corrosion resistance.
H114	Treadplate in Alloys 3003 or 5052 rolled from Temper O.
H224	Treadplate in Alloys 3003 or 5052 rolled from Temper H21.

Note: Plate tempers generally restricted to ½ hard maximum owing to heavy gauge – cannot get sufficient cold work for higher tempers.

Plate and Sheet Standards

Standard	Description
ASTM B209	Product for a non-marine applications where additional corrosion testing is not required. This is typically applied to plate for the transport industry where surface finish and bright levels are critical. Material is ordered to a standard "H" temper e.g. H32. The material does not require identification line marking from the manufacturer.
ASTM B928	Typically a marine standard requiring additional testing for exfoliation and inter-granular corrosion resistance. Material for marine application is ordered as tempers H116 or H321 and possibly reference to an international recognised testing authority such as DNV. All material to this standard is line marked with manufacturing traceability.
DNV	Plate for marine applications can be supplied with testing certified by Det Norske Veritas (DNV).

Anodising Quality Aluminium Sheet

Atlas standard stock is not classified as "anodizing quality" and as such is not guaranteed to give acceptable anodizing appearance in any particular conditions. Much of this standard stock has been shown by considerable production experience to anodize well, particularly in smaller items and where exact colour consistency is not required. The acceptability of anodizing outcomes should be established by trial on a case by case basis with this product. Alloy 5005 is the usual choice for decorative anodized finishing. Other alloys can be anodized and this will improve corrosion resistance but the visual appearance may not be "decorative". Trial anodising of any new alloy or source is always recommended.

Atlas can source "anodising quality" aluminium sheet, usually in grade 5005. Where exact colour matching is required across a batch or even between batches this should be discussed with Atlas sales staff.

Product Range

Aluminium Sheet

Note: Through external processing facilities all sheet product can be slit and cut to length for specific requirements. Linishing is also available.

Alloys	5005, 5052, 5251
Tempers	O, H32, H34, H38, H116, H321
Thickness range (mm)	0.15 to less than 6
Width range (mm)	900, 1200, 1500
Length range (mm)	1800, 2400, 3000, 3600

Other grades available on request.

Aluminium Coil/Strip

Note: Through external processing facilities, all coil product can be slit and cut to length for specific requirements. Linishing is also available.

Alloys	3003, 3004, 3105, 5005, 5052, 5251
Tempers	O, H32, H34, H38, H116, H321
Thickness range (mm)	0.15 to less than 6
Width range (mm)	25 to 1525

Aluminium Plate

Note: Through external processing facilities, all plate product can be slit and cut to length for specific requirements.

Alloys	5083, 5005, 5052, 5454, 5186
Tempers	H32, H34, H116, H321
Thickness range (mm)	6 to 25
Width range (mm)	1200 to 2500
Length range (mm)	2400 to 12000

Aluminium Treadplate

Note: Mill orders can be supplied to a customer's desired width and length.

Alloys (Commonly stocked)	5052, 3003
Tempers	O, H112, H114, H224
Finish	Standard 5 bar Mill Finish (Alloy 5052 Temper O, H114, H224)
	Propeller Pattern Bright (Alloy 3003 Temper H114, H224)
Thickness range (mm)	1.6 to 8
Width range (mm)	1200 to 1525
Length range (mm)	2400 to 6100

Aluminium Extrusions Product Range

Flat Bar

Alloys	6060, 6063
Tempers	T5
Thickness	1.6mm to 10mm
Width	12mm to 100mm

Angle

Alloys	6060
Tempers	T5
Thickness	1.6mm to 3mm
Width	20 x 20mm to 50 x 50mm

Channel

Alloys	6060, 6063
Tempers	T5
Thickness	1.6mm to 3mm
Width	16 x 16mm to 50 x 25mm and 50 x 50mm

Square and Rectangular Hollow Sections

Alloys	6005, 6060, 6063
Tempers	T5
Thickness	1.6mm to 3mm
Width	20 x 20mm to 50 x 50mm, 25 x 40mm to 50 x 150mm

Non Standard Product Range

Aluminium product can be sourced outside the standard stock range nominated above. For such enquiries please contact the local Atlas sales office.

Finishes

Aluminium Plate

- Elval Bright Transport Plate: this material is sourced from a select mill. Atlas market and stock this quality of plate in Alloy 5083, Temper H32.
- Mill Finish: this refers to plate supplied ex mill with a commercial finish. This material is typically used in the marine industry, general engineering and transport industry where bright plate is not critical.

Tread Plate

Pattern – 5 Bar
Available in Alloy 5052

Pattern – Propeller or 1 Bar
available in Alloy 3003

If tread pattern is critical this should be discussed with Atlas prior to purchase.

Mass per Square Metre (based on theoretical density of 2700kg/m^3)

Thickness (mm)	Sheet/Plate	Thickness (mm)	Sheet/Plate	Treadplate	Thickness (mm)	Sheet/Plate	Treadplate
0.3	0.81	1.6	4.3		8	21.6	22.3
0.45	1.22	2	5.4		10	27.0	27.7
0.55	1.49	2.5	6.8	7.4	12	32.4	33.1
0.8	2.16	3	8.1		16	43.2	43.9
0.9	2.43	3.2	8.6	9.3	20	54.0	
1.0	2.70	4	10.8	11.5	25	67.5	
1.2	3.24	5	13.5	14.2	30	81.0	
1.5	4.05	6	16.2	16.9	40	108	

Bending Radius Chart

Recommended minimum inside bending radii for 90 degree cold forming of sheet and plate [123], bending transverse to rolling direction. Bending along the rolling direction may require a larger bend radius.

Radii for various thickness expressed in terms of thickness t									
Alloy	Temper	t=0.4mm	t=0.8mm	t=1.6mm	t=3.0mm	t=4.0mm	t=6.0mm	t=10.0mm	t=12.0mm
1050	O	0t	0t	0t	0t	0t	0.5t	0.5t	1t
1350	H12	0t	0t	0t	0t	0t	0.5t	1t	1.5t
1150	H14	0t	0t	0t	0.5t	0.5t	1t	1.5t	2t
	H16	0t	0t	0.5t	1t				
	H18	0.5t	1t	1.5t	2t				
1100	O	0t	0t	0t	0t	0t	1t	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	1.5t	2.5t	3t	4t
	H18	1t	1.5t	2t	3t				
2024[2]	O	0t	1t	1t	1t	1t	1t	2.5t	4t
	T42	2.5t	3t	4t	5t	5t	6t	7t	8t
3033	O	0t	0t	0t	0t	0.5t	1t	1t	1.5t
3203	H12	0t	0t	0t	0.5t	1t	1t	1.5t	2t
3005	H14	0t	0t	0t	1t	1t	1.5t	2t	2.5t
5005	O	0	0	0	0	0.5t	1t	1t	1.5t
	H12	0	0	0	0.5t	1t	1t	1.5t	2t
	H14	0	0	0	1t	1.5t	1.5t	2t	2.5t
5005	H16	0.5t	1t	1t	1.5t				
	H18	1t	1.5t	2t	3t				
	H32	0t	0t	0t	0.5t	1t	1t	1.5t	2t
	H34	0t	0t	0t	1t	1.5t	1.5t	2t	2.5t
	H36	0.5t	1t	1t	1.5t	2.5t	3t	3.5t	4t
	H38	1t	1.5t	2t	2.5t	3.5t	4.5t	5.5t	6.5t
3004	O	0t	0t	0t	0.5t	1t	1t	1t	1.5t
	H32	0t	0t	0.5t	1t	1t	1.5t		
	H34	0t	1t	1t	1.5t	1.5t	2.5t		
	H36	1t	1t	1.5t	2.5t				
	H38	1t	1.5t	2.5t	3t				
5050	O	0t	0t	0t	0.5t	1t	1t	1t	1.5t
	H32	0t	0t	0t	1t	1t	1.5t		
	H34	0t	0t	1t	1.5t	1.5t	2t		
	H36	1t	1t	1.5t	2t				
	H38	1t	1.5t	2.5t	3t				
5052	O	0t	0t	0t	0.5t	1t	1t	1.5t	1.5t
5251	H32	0t	0t	1t	1.5t	1.5t	1.5t	1.5t	2t
	H34	0t	1t	1.5t	2t	2t	2.5t	2.5t	3t
	H36	1t	1t	1.5t	2.5t	3t	3.5t	4t	4.5t
	H38	1t	1.5t	2.5t	3t	4t	5t	5.5t	6.5t
5154	O	0t	0t	0.5t	1t	1t	1t	1.5t	1.5t
5454	H32	0t	0.5t	1t	1.5t	1.5t	2t	2.5t	3.5t
	H34	0.5t	1t	1.5t	2t	2.5t	3t	3.5t	4t
	H112						2t	2.5t	3t
5083	O			0.5t	1t	1t	1t	1.5t	1.5t
	H32			1t	1.5t	1.5t	1.5t	2t	2.5t
	H321			1t	1.5t	1.5t	1.5t	2t	2.5t
5086	O	0t	0t	1.5t	1t	1t	1t	1.5t	1.5t
	H32	0t	1.5t	1.5t	2t	2t	2t	2.5t	3t
	H34	0.5t	1t	1.5t	2t	2.5t	3t	3.5t	4t
	H36				3t	3.5t			
	H112[3]					1.5t	2t	2t	2.5t
6061[2]	O	0t	0t	0t	1t	1t	1t	1.5t	2t
	T4 & T42	0t	0.5t	1t	1.5t	2.5t	3t	3.5t	4t
	T6 & T62	1t	1t	1.5t	2.5t	3t	4t	4.5t	5t

Notes

[1] The radii listed are the minimum recommended for bending sheets and plates without fracturing in a standard press break with air bend dies. Other types of bending operations may require larger radii or permit smaller radii. The minimum permissible radii will also vary with the design and condition of tooling.

[2] Heat-treatable alloys can be formed over appreciably smaller radii immediately after solution heat treatment.

[3] The H112 temper (applicable to non-heat treatable alloys) is supplied in the as-fabricated condition without special property control, but usually can be formed over radii applicable to the H14 (or H34) temper or smaller.