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WROUGHT ALUMINIUM AND ALUMINIUM ALLOY FLAT SHEET, COILED SHEET, AND PLATE FOR GENERAL ENGINEERING PURPOSES

Revised 4.00

s/s H48 and H49.



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THE FOLLOWING SCIENTIFIC, INDUSTRIAL AND GOVERNMENTAL ORGANIZATIONS and departments were officially represented on the committee entrusted with the preparation of this standard:

**Aluminium Development Council
Aluminium Diecasters Association of Australia
Architectural Aluminium Fabricators Federation of Australia
Associated Chambers of Manufactures of Australia
Australian Association of Foundry Institutes
Australian and New Zealand Railways Conferences
Department of Supply
Metal Trades Industry Association of Australia
Royal Australian Institute of Architects
Society of Automotive Engineers—Australasia**

This standard, prepared under the direction of Committee MT/3, Aluminium and Aluminium Alloys, was approved on behalf of the Council of the Standards Association of Australia on 13 April 1971.

To keep abreast of progress in industry, Australian standards are regularly reviewed. Suggestions for improvements to published standards, addressed to the headquarters of the Association, are welcomed.

This standard was issued in draft form for public review as Doc. 1587.

AUSTRALIAN STANDARD SPECIFICATION

**WROUGHT ALUMINIUM
AND ALUMINIUM ALLOY
FLAT SHEET, COILED
SHEET, AND PLATE
FOR GENERAL ENGINEERING PURPOSES**

AS H48 — 1971

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P R E F A C E

This Australian standard was prepared by the Association's Committee on Aluminium and Aluminium Alloys, as a revision of two Australian standards—H48—1962, Wrought Aluminium and Aluminium Alloy Flat and Coiled Sheet for General Engineering Purposes, and H59—1963, Wrought Aluminium and Aluminium Alloy Plate for General Engineering Purposes. It is one of a series intended to satisfy the requirements of Australian industry for wrought aluminium and aluminium alloys in general use in Australia. In particular, this standard applies to sheet supplied in the form of coils and cut lengths, and plate, and provision is made for the supply of blanked and sheared sheet circles.

The system of nomenclature for wrought aluminium and aluminium alloys adopted in this standard is that currently in use in Australia. It replaces the several differing systems that existed in the past, and utilizes a letter-plus-four-digit designation, the four digits having the same significance as those used by the Aluminum Association (U.S.). Letter prefixes have been added to distinguish Australian alloys. An explanation of this new system is included as Appendix A. Related composition specifications for wrought aluminium alloys are given in Appendix B, where the relationship between alloys detailed in this standard and other systems of nomenclature are shown in terms of equivalents and deviations.

The temper designation system adopted is the same as that used in previous Australian standards on wrought aluminium alloys, and is based on the sequence of basic treatments usually used to produce the various tempers. The significance of the various tempers is given in Appendix C. Mechanical property limits for the various tempers and associated thickness are detailed in Part II.

In preparing this standard cognizance was taken of publications issued by The Aluminium Development Council of Australia (Ltd), namely 'Standards for Australian Aluminium Mill Products, Parts 1 and 2.'

British and metric unit equivalents are given in Appendix G. The values quoted in the text are to be regarded as standard. The conversions are approximate; more accurate conversions should be based on the tables in BS 350, Conversion Factors and Tables.

This standard requires reference to the following Australian, British and ASTM Standards:

AS A23 Tensile Testing of Metals

BS 1728 Methods for the Analysis of Aluminium and Aluminium Alloys

ASTM E34 Methods for Chemical Analysis of Aluminium and Aluminium Base Alloys

ASTM Methods for Emission Spectrochemical Analysis.

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard Specification for

WROUGHT ALUMINIUM AND ALUMINIUM ALLOY FLAT SHEET, COILED SHEET, AND PLATE FOR GENERAL ENGINEERING PURPOSES

PART 1. SCOPE AND GENERAL REQUIREMENTS

1.1 SCOPE OF STANDARD. This specification applies to wrought aluminium and aluminium alloy flat sheet, coiled sheet and plate for general engineering purposes.

NOTE: Provision has been made for the supply of blanked and sheared sheet circles to this specification.

1.2 DESIGNATION.

1.2.1 Alloy Designation. The material shall be given the appropriate alloy designation shown in column 1 of Table 1.1.

1.2.2 Temper Designation. The temper designation shall be used for all forms of wrought aluminium and aluminium alloys, and shall follow the alloy designation, the two being separated by a dash, e.g. A5005—H12.

1.3 DEFINITIONS. For the purpose of this specification the following definitions shall apply:

Plate—a rolled rectangular section of thickness 0.250 in or over with either sheared or sawn edges.

Sheet—a rolled rectangular section of thickness 0.006 in to 0.249 in with sheared, slit or sawn edges.

Alclad Sheet or Plate—composition sheet or plate having on both surfaces (if on one side only, Alclad One-side Sheet or Plate) a metallurgically bonded aluminium or aluminium alloy coating which is anodic to the core alloy to which it is bonded, thus electrolytically protecting the core alloy against corrosion.

NOTE: A method for the determination of cladding thickness is given in Appendix E.

Flat Sheet—sheet with sheared, slit or sawn edges, which has been flattened or levelled.

Coiled Sheet—sheet in coils with slit edges.

Lot—all material of the same alloy, temper, width, thickness and finish in a shipment. In respect of heat-treated sheet and plate, a lot shall consist of all material of the same alloy, temper, width, thickness and finish and from the same furnace load.

1.4 INFORMATION TO BE SUPPLIED BY THE PURCHASER.

1.4.1 General. The purchaser shall supply the following information:

- (i) Designation of alloy and temper (see Clause 1.2).
- (ii) Quantity (weight or number of pieces).
- (iii) Dimensions, including thickness and width, and length where applicable.
- (iv) Required finish (see Clause 1.6).
- (v) Any limitations in respect of weight of coils, or inside or outside diameters of coils.
- (vi) Whether the sheet is to be used to produce painted sheet, or other applied finishes.
- (vii) Whether a yield strength test is required (see Clause 1.10).
- (viii) Whether a single bend test is required (see Clause 1.12.2).
- (ix) Whether a cupping test is required (see Clause 1.12.3).
- (x) Whether a test certificate is required (see Clause 1.15).
- (xi) Any information concerning end use which the purchaser considers would assist the supplier (see Clause 1.4.2).
- (xii) Any exceptions to the specification and any special or supplementary requirements, e.g. special requirements in respect of packing, special flatness, or resquaring, special tolerances.
- (xiii) Whether it is the intention of the purchaser to inspect the material at the supplier's works (see Clause 1.16).

1.4.2 End Use. If possible the purchaser should indicate the purpose for which the material is to be used.

NOTE: A drawing and/or sample of the part in question is useful.

1.5 PROCESS OF MANUFACTURE. The process of manufacture shall be at the option of the supplier, who shall be responsible for the performance of all inspections and tests required by this specification, prior to shipment of material.

1.6 FINISH. The surface finish of the material shall be as agreed between purchaser and supplier.

1.7 CHEMICAL COMPOSITION.

1.7.1 General. Unless otherwise agreed between the purchaser and supplier, the material shall conform to the chemical composition limits specified in Table 1.1 for the alloy specified by the purchaser. Conformance shall be determined by the supplier by analysing samples taken at the time the ingots are poured, or samples taken from the finished or semi-finished product. If the supplier has determined the chemical composition of the material during the course of manufacture, he shall not be required to sample and analyse the finished product.

1.7.2 Residual Elements. Elements not quoted in the relevant specification shall not be intentionally added to the material without the agreement of the purchaser other than for the purpose of finishing the heat. Such elements shall not be present in sufficient quantities to be detrimental to the subsequent working or end use of the material.

1.7.3 Check Analysis. Any subsequent analytical checks shall take into consideration the heterogeneity normal to the type of material and shall not be used as a basis for rejection unless the supply of an incorrect alloy is indicated.

1.8 FREEDOM FROM DEFECTS.

1.8.1 General. The material shall be free from defects and contaminants detrimental to its subsequent processing and to its end use. The degree or amount of surface defects in coils will be expected to be more than in cut lengths because of the impracticability of inspection and the impossibility of rejecting portions of the coil.

NOTE: All incoming shipments should be inspected promptly, since suppliers generally have a time limit in which damage claims will be honoured.

Notwithstanding the fact that material has been passed as complying with this specification, if faults in manufacture are revealed in subsequent processing of the material it may then be deemed not to comply.

1.8.2 Surface Dressing. Plates may be conditioned by the supplier for the removal of scratches or minor surface imperfections by localized grinding or abrasive disc operation, provided that thickness tolerances are maintained. Since the repaired area will generally exhibit a surface appearance differing from a mill finish, texture may be controlled by the selection of the abrasive grit size, which shall be as agreed between purchaser and supplier.

1.9 MARGINS OF MANUFACTURE. Unless closer tolerances are required as agreed between purchaser and supplier, the margins of manufacture shall be in accordance with those given in Part III, as appropriate.

1.10 MECHANICAL PROPERTIES. The mechanical properties shall be determined on test pieces prepared from samples selected and prepared as specified in Clause 1.11 and tested as specified in Clause 1.12.

The tensile test shall comply with the requirements of Part II for the alloy specified by the purchaser.

When specifically requested by the purchaser, yield strength or proof stress (0.2% offset) shall be determined on material as indicated in Part II.

The cupping test shall be applied only when required by the purchaser.

NOTE: No mechanical property limits are specified for material ordered to F temper.

1.11 SELECTION AND PREPARATION OF TEST SAMPLES FOR MECHANICAL TESTS. Material shall be grouped in lots. A sample of sufficient size to allow the preparation of the necessary test pieces shall be taken to represent the following:

- (a) *Plate.* One sample from each 4000 lb or part thereof in a lot, but not more than one sample from a plate even though cut into two or more pieces.
- (b) *Sheet.* One sample from each 2000 lb or part thereof in a lot, but not more than one sample from a mill coil even though slit into narrower coils or cut into shorter coils or into flat sheet, providing that further fabrication does not change the temper.

The sample shall not, except for the necessary straightening, be mechanically worked or be heat treated before testing.

1.12 MECHANICAL TESTS.

1.12.1 Tensile Test.

1.12.1.1 Method. The tensile test shall be carried out in accordance with AS A23* on a test piece having a gauge length of four times the square root of the original cross-sectional area of the test piece (S_0) or on a non-proportional rectangular test piece as specified in Clause 6 of that standard on a 2-in gauge length.

Yield strength or proof stress (0.2% offset) shall be determined by the offset method described in Appendix D.

NOTE: The Association's Committee on Aluminium and Aluminium Alloys, under whose direction this standard was prepared, has endorsed the decision of Technical Committee 79, Light Metals and Their Alloys, of the International Organization for Standardization (ISO), that 5.65 times the square root of the original cross-sectional area (S_0) be adopted as the international preferred proportional gauge length.

As an interim measure, elongation values for a gauge length of four times the square root of the original cross-sectional area (S_0), the proportional gauge length hitherto most commonly used in Australia, are prescribed in Part II.

1.12.1.2 Tensile Test Pieces. The tensile test piece shall be cut parallel to or transverse to the direction of final rolling, and taken as follows:

- (a) *For Plate over 1.500 in Thick.* Test piece of circular cross-section, machined from material taken midway between the centre and surface.
- (b) *For Plate 0.500 in up to 1.500 in Thick.* Test piece of circular cross-section, machined from material taken midway between the two plate surfaces.
- (c) *For Plate and Sheet less than 0.500 in Thick.* Test piece of rectangular cross-section. Material less than 0.750 in in width shall be tested in full section, in which case elongation shall not be determined.

*AS A23, Tensile Testing of Metals

1.12.2 Single Bend Test. The single bend test shall be carried out in accordance with the requirements of BS 1639*.

The test piece shall be cut such that the axis of bend is parallel to the direction of final rolling. If the width of material is such that a test piece of standard dimensions cannot be prepared, the test piece shall be cut such that the axis of bend is at right angles to the direction of final rolling.

For thicknesses greater than 0.375 in, the width of test piece shall be as agreed between purchaser and supplier, but shall not be less than 1½ in.

The test piece shall be bent to a radius as agreed between purchaser and supplier, and then examined for compliance with BS 1639.

1.12.3 Cupping Test. The method of test and the values for acceptance shall be agreed between the purchaser and the supplier.

1.13 RETESTS. Should any test piece first selected fail to pass the relevant test specified in Clause 1.10, one or both of the following procedures shall be adopted at the option of the supplier:

- (a) The material represented by the test piece which failed shall either be withdrawn or be set aside for further testing and two further test samples shall be taken from the remainder of the same material. Should the test pieces from these additional samples pass, the remainder of the lot shall be deemed to comply with this specification. If one or both of these additional samples fail, the lot shall be deemed not to comply with this specification. At the option of the supplier, each individual piece may be tested, and compliance with this specification will depend on the results of each individual test.
- (b) The lot shall be reprocessed and retested in accordance with this specification.

1.14 FACILITIES FOR TESTING. The supplier shall provide and prepare the necessary material and supply labour and appliances for such testing as may be carried out on his premises in accordance with this specification. Unless otherwise agreed, material for testing shall remain the property of the supplier. Failing facilities at his own works for making the prescribed tests, the supplier shall be responsible for making the tests elsewhere.

1.15 TEST CERTIFICATE. Where tests, as agreed between the purchaser and the supplier, have been performed by the manufacturer for the purpose of establishing compliance with this specification, the supplier shall provide a certificate showing such test results as may be required by agreement between the purchaser and the supplier.

1.16 INSPECTION. The purchaser shall notify the supplier, when placing his order, if it is his intention to inspect the material at the supplier's works.

*BS 1639, Methods for Bend Testing of Metals.

The supplier shall afford the purchaser all reasonable facilities to satisfy himself that the material is in accordance with this specification. For this purpose, the purchaser or his representative may, by prior arrangement, attend to inspect the material, to select and identify the test samples for testing, and to witness the tests being made, provided that this is carried out in a manner which will not interfere unnecessarily with the operation of the works.

The purchaser shall be at liberty to take samples from the material and have them tested. The cost of such testing shall be borne by the purchaser, and the results communicated to the supplier if they are not in accordance with this specification.

1.17 INDEPENDENT TESTS. Should there be a dispute about the compliance of the material with the requirements of this specification, the supplier and the purchaser shall have the right to have the material tested by an approved independent testing authority. The results obtained by the approved independent testing authority shall be accepted as final.

NOTE: Facilities for such testing are afforded by laboratories registered by the National Association of Testing Authorities, Australia for the field and class of testing concerned.

If the material does not comply with this specification the cost of independent testing shall be borne by the supplier; if the material complies with this specification the cost shall be borne by the purchaser.

The methods of sampling for analysis and the methods of analysis shall be not less accurate than those prescribed in BS 1728*, ASTM E34†, or ASTM Methods for Emission Spectrochemical Analysis.

1.18 IDENTIFICATION. Each coil or shipping unit shall be marked or tagged with the lot number, or other identification number, material size, alloy and temper, and the manufacturer's name or trademark, to enable it to be identified with this specification. On flat sheet and plate, markings shall appear at each end. Alternative methods of identification shall be subject to agreement between purchaser and supplier.

1.19 PACKAGING. Unless otherwise agreed between the supplier and purchaser, the type of packing and gross weight of containers shall be at the discretion of the supplier, who shall provide adequate protection during normal handling and transportation, and shall ensure each package shall contain only one size, alloy, temper and finish of material.

1.20 ROUNDING OF NUMBERS. For the purpose of deciding whether a particular requirement of this specification is complied with, the determined value, observed or calculated, expressing the result of a mechanical test or a chemical analysis shall be rounded off in accordance with Appendix F. The number of significant places retained in the rounded-off value shall be the same as that of the specified value in this specification.

*BS 1728 Methods for the Analysis of Aluminium and Aluminium Alloys.

†ASTM E34 Methods for Chemical Analysis of Aluminium and Aluminium Base Alloys.

TABLE 1.1. CHEMICAL COMPOSITION LIMITS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Alloy	Chemical Composition (per cent) ^a																
	Silicon		Iron	Copper		Manganese		Magnesium		Chromium		Zinc		Titanium	Other Elements ^b		Aluminum
															Each	Total	
	min.	max.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	max.	max.	max.	min.
B1080	—	0.15	0.15	—	0.02	—	0.02	—	0.02	—	—	—	0.03	0.02	0.02	—	99.80 ^c
A1050	—	0.25	0.40	—	0.05	—	0.05	—	0.05	—	—	—	0.05	0.03	0.03	—	99.50 ^c
A1145 ^f	Si+Fe:0.55 max.			—	0.05	—	0.05	—	—	—	—	—	—	—	0.03	—	99.45 ^c
A1150	Si+Fe:0.50 max.			—	0.20	—	0.04	—	—	—	—	—	—	—	0.05	—	99.50 ^c
A1100	Si+Fe:1.0 max.			0.05	0.20	—	0.05	—	—	—	—	—	0.10	—	0.05	0.15	99.00 ^c
B1200	—	0.40	0.60	—	0.05	—	0.05	—	—	—	—	—	0.10	—	0.05	0.15	99.00 ^c
A2024	—	0.50	0.50	3.8	4.9	0.30	0.90	1.2	1.8	—	0.10	—	0.25	—	0.05	0.15	Rem.
Alclad A2024	— Alloy A2024 clad with A1145																
A3003	—	0.6	0.7	0.05	0.20	1.0	1.5	—	—	—	—	—	0.10	—	0.05	0.15	Rem.
A3203	—	0.6	0.7	—	0.05	1.0	1.5	—	—	—	—	—	0.10	—	0.05	0.15	Rem.
A3004	—	0.30	0.7	—	0.25	1.0	1.5	0.8	1.3	—	—	—	0.25	—	0.05	0.15	Rem.
Alclad A3004	— Alloy A3004 clad with D7072																
D3005	—	0.6	0.7	—	0.20	1.0	1.5	0.20	0.50	—	0.05	—	0.10	0.05	0.05	0.15	Rem.
A4343 ^d	6.8	8.2	0.8	—	0.25	—	0.10	—	—	—	—	—	0.20	—	0.05	0.15	Rem.
B4047 ^e	11.0	13.0	0.6	—	0.10	—	0.15	—	0.10	—	—	—	0.20	—	0.05	0.15	Rem.
A5005	—	0.40	0.7	—	0.20	—	0.20	0.50	1.1	—	0.10	—	0.25	—	0.05	0.15	Rem.
D5050	—	0.40	0.7	—	0.20	—	0.30	1.1	1.8	—	0.10	—	0.25	—	0.05	0.15	Rem.
A5052	Si+Fe:0.45 max.			—	0.10	—	0.10	2.2	2.8	0.15	0.35	—	0.10	—	0.05	0.15	Rem.
C5152	—	0.6	0.50	—	0.10	—	0.50	1.7	2.8	—	0.25	—	0.25	0.15	0.05	0.15	Rem.
A5252	—	0.08	0.10	—	0.10	—	0.10	2.2	2.8	—	—	—	—	—	0.03	0.10	Rem.
C5154	—	0.6	0.50	—	0.10	—	0.6	2.8	4.0	—	0.25	—	0.25	0.15	0.05	0.15	Rem.
A5454	Si+Fe:0.40 max.			—	0.10	0.50	1.0	2.4	3.0	0.05	0.20	—	0.25	0.20	0.05	0.15	Rem.
A5457	—	0.08	0.10	—	0.20	0.15	0.45	0.8	1.2	—	—	—	—	—	0.03	0.10	Rem.
A5557	—	0.10	0.12	—	0.15	0.10	0.40	0.40	0.8	—	—	—	—	—	0.03	0.10	Rem.
A5657	—	0.08	0.10	—	0.10	—	0.03	0.6	1.0	—	—	—	0.03	—	0.02	0.05	Rem.

TABLE 1.1 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Alloy	Chemical Composition (per cent) ^a																
	Silicon		Iron	Copper		Manganese		Magnesium		Chromium		Zinc		Titanium	Other Elements ^b		Aluminum
															Each	Total	
	min.	max.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	max.	max.	max.	min.
B5083	—	0.40	0.40	—	0.10	0.50	1.0	4.0	4.9	0.05	0.25	—	0.25	0.15	0.05	0.15	Rem.
A5086	—	0.40	0.50	—	0.10	0.20	0.7	3.5	4.5	0.05	0.25	—	0.25	0.15	0.05	0.15	Rem.
A6061	0.40	0.8	0.7	0.15	0.40	—	0.15	0.8	1.2	0.04	0.35	—	0.25	0.15	0.05	0.15	Rem.
D7072 ^c	Si + Fe: 0.7	max.	—	—	0.10	—	0.10	—	0.10	—	—	0.8	1.8	—	0.05	0.15	Rem.

FOOTNOTES TO TABLE 1.1:

^aStandard limits for alloying elements and impurities are expressed to the following places:Less than $\frac{1}{1000}$ % 0.000X $\frac{1}{1000}$ % to less than $\frac{1}{100}$ % 0.00X $\frac{1}{100}$ % to less than $\frac{1}{10}$ %

Unalloyed aluminium made by a refining process 0.0XX

Alloys and unalloyed aluminium not made by a refining process 0.0X

 $\frac{1}{10}$ % up to $\frac{1}{2}$ % 0.XXOver $\frac{1}{2}$ % 0.X, X.X, etc^bAnalysis is regularly required only for the elements for which specific limits are shown, except for unalloyed aluminium. If, however, the presence of other elements is suspected, or indicated in the course of routine analysis, further analysis is required to determine that these other elements are not present in excess of the amount specified.^cThe aluminium content for unalloyed aluminium not made by a refining process is the difference between 100.00% and the sum of all other metallic elements present in amounts of 0.010% or more, each expressed to the second decimal.^dBrazing filler strip (no properties specified).^eBrazing or welding filler (no properties specified).^fCladding alloy only (Alclad), with composition as applied during the course of manufacture. Samples from finished sheet or plate are not required to conform to these limits.

PART II. MATERIAL SPECIFICATIONS

2.1 ALLOY B1080.

2.1.1 General. The material shall comply with the general requirements of Part I and shall have the following chemical composition and mechanical properties.

2.1.2 Chemical Composition.

Silicon	.. .. .	0.15 per cent max.
Iron	.. .. .	0.15 per cent max.
Copper	.. .. .	0.02 per cent max.
Manganese	.. .. .	0.02 per cent max.
Magnesium	.. .. .	0.02 per cent max.
Zinc	.. .. .	0.03 per cent max.
Titanium	.. .. .	0.02 per cent max.
<i>Others</i>		
Each	.. .. .	0.02 per cent max.
Aluminium	99.80 per cent min.	

2.1.3 Mechanical Properties.

1	2	3	4	5	6
Temper	Specified Thickness in		Tensile strength lb/in ²		Elong. in 2 in, 4√S ₀ % min.
	from	up to & incl.	min.	max.	
O	0.006	0.019	—	11 200	15
	0.020	0.031	—	11 200	20
	0.032	0.050	—	11 200	25
	0.051	0.101	—	11 200	30
	0.102	0.249	—	11 200	35
H14*	0.009	0.012	13 400	16 800	1
	0.013	0.019	13 400	16 800	2
	0.020	0.031	13 400	16 800	3
	0.032	0.050	13 400	16 800	4
	0.051	0.101	13 400	16 800	5
H18	0.102	0.249	13 400	16 800	8
	0.006	0.019	17 900	—	1
	0.020	0.031	17 900	—	2
	0.032	0.050	17 900	—	3
	0.051	0.101	17 900	—	4
H112	0.102	0.128	17 900	—	5
	0.250	1.000	8 000	—	30
	1.001	2.000	8 000	—	28

*For the corresponding —H2 temper, limits for maximum tensile strength do not apply.

2.2 ALLOY A1050.

2.2.1 General. The material shall comply with the general requirements of Part I and shall have the following chemical composition and mechanical properties.

2.2.2 Chemical Composition.

Silicon	..	..	..	0.25 per cent max.
Iron	..	..	..	0.40 per cent max.
Copper	..	..	..	0.05 per cent max.
Manganese	..	..	..	0.05 per cent max.
Magnesium	..	..	..	0.05 per cent max.
Zinc	..	..	..	0.05 per cent max.
Titanium	..	..	..	0.03 per cent max.

Others

Each	..	..	..	0.03 per cent max.
Aluminium	99.50 per cent min.			

2.2.3 Mechanical Properties.

1	2	3	4	5	6
Temper	Specified Thickness in		Tensile strength lb/in ²		Elong. in 2 in, 4√S ₀ % min.
	from	up to & incl.	min.	max.	
O	0.006	0.019	—	13 400	15
	0.020	0.031	—	13 400	20
	0.032	0.050	—	13 400	25
	0.051	0.249	—	13 400	30
H12*	0.010	0.019	12 000	15 600	4
	0.020	0.031	12 000	15 600	5
	0.032	0.050	12 000	15 600	6
	0.051	0.101	12 000	15 600	8
	0.102	0.249	12 000	15 600	12
H14*	0.009	0.012	14 600	17 900	2
	0.013	0.019	14 600	17 900	3
	0.020	0.031	14 600	17 900	4
	0.032	0.050	14 600	17 900	5
	0.051	0.101	14 600	17 900	6
	0.102	0.500	14 600	17 900	8
H16*	0.006	0.019	16 500	20 000	2
	0.020	0.031	16 500	20 000	3
	0.032	0.050	16 500	20 000	4
	0.051	0.162	16 500	20 000	5
H18*	0.006	0.019	19 100	—	1
	0.020	0.031	19 100	—	2
	0.032	0.050	19 100	—	3
	0.051	0.101	19 100	—	4
	0.102	0.128	19 100	—	5
H112	0.250	1.000	9 000	—	30

*For the corresponding H2 temper, limits for maximum tensile strength do not apply.

2.3 ALLOY D1150.

2.3.1 General. The material shall comply with the general requirements of Part I and shall have the following chemical composition and mechanical properties.

2.3.2 Chemical Composition.

Silicon plus Iron	.. ..	0.50 per cent max.
Copper	.. ..	0.20 per cent max.
Manganese	.. ..	0.04 per cent max.

Others

Each	.. ..	0.05 per cent max.
Aluminium	99.50 per cent min.	

2.3.3 Mechanical Properties.

1	2	3	4	5	6
Temper	Specified Thickness in		Tensile strength lb/in ²		Elong. in 2 in, 4√S ₀ % min.
	from	up to & incl.	min.	max.	
O	0.006	0.019	—	15 000	15
	0.020	0.031	—	15 000	20
	0.032	0.050	—	15 000	25
	0.051	0.249	—	15 000	30
H12*	0.010	0.019	12 000	17 000	3
	0.020	0.031	12 000	17 000	4
	0.032	0.050	12 000	17 000	6
	0.051	0.101	12 000	17 000	8
	0.102	0.249	12 000	17 000	9
H14*	0.009	0.012	14 000	19 000	1
	0.013	0.019	14 000	19 000	2
	0.020	0.031	14 000	19 000	3
	0.032	0.050	14 000	19 000	4
	0.051	0.101	14 000	19 000	5
	0.102	0.249	14 000	19 000	6
H16*	0.006	0.019	17 000	22 000	1
	0.020	0.031	17 000	22 000	2
	0.032	0.050	17 000	22 000	3
	0.051	0.101	17 000	22 000	4
	0.102	0.162	17 000	22 000	5
H18	0.006	0.019	20 000	—	1
	0.020	0.031	20 000	—	2
	0.032	0.050	20 000	—	3
	0.051	0.128	20 000	—	4

*For the corresponding H2 temper, limits for maximum tensile strength do not apply.

2.4 ALLOY A1100.

2.4.1 General. The material shall comply with the general requirements of Part I and shall have the following chemical composition and mechanical properties.

2.4.2 Chemical Composition.

Silicon plus Iron	.. ..	1.0 per cent max.
Copper	0.05 per cent min.	0.20 per cent max.
Manganese	.. ..	0.05 per cent max.
Zinc	.. ..	0.10 per cent max.

Others

Each	.. ..	0.05 per cent max.
Total	.. ..	0.15 per cent max.

Aluminium 99.00 per cent min.

2.4.3 Mechanical Properties.

1	2	3	4	5	6	7
Temper	Specified thickness in		Tensile strength lbf/in ²		Yield strength† (0.2% offset) lbf/in ² min.	Elong. in 2 in, 4√S ₀ % min.
	from	up to & incl.	min.	max.		
O	0.006	0.019	—	15 500	—	15
	0.020	0.031	—	15 500	—	20
	0.032	0.050	—	15 500	—	25
	0.051	0.249	—	15 500	—	30
	0.250	3.000	11 000	15 500	3 500	28
H12*	0.017	0.019	14 000	19 000	—	3
	0.020	0.031	14 000	19 000	—	4
	0.032	0.050	14 000	19 000	—	6
	0.051	0.113	14 000	19 000	—	8
	0.114	0.249	14 000	19 000	—	9
	0.250	0.499	14 000	19 000	11 000	9
	0.500	2.000	14 000	19 000	11 000	12
H14*	0.009	0.012	16 000	21 000	—	1
	0.013	0.019	16 000	21 000	—	2
	0.020	0.031	16 000	21 000	—	3
	0.032	0.050	16 000	21 000	—	4
	0.051	0.113	16 000	21 000	—	5
	0.114	0.249	16 000	21 000	—	6
	0.250	0.499	16 000	21 000	14 000	6
	0.500	1.000	16 000	21 000	14 000	10
H16*	0.006	0.019	19 000	24 000	—	1
	0.020	0.031	19 000	24 000	—	2
	0.032	0.050	19 000	24 000	—	3
	0.051	0.162	19 000	24 000	—	4
H18	0.006	0.019	22 000	—	—	1
	0.020	0.031	22 000	—	—	2
	0.032	0.050	22 000	—	—	3
	0.051	0.128	22 000	—	—	4
H112	0.250	0.499	13 000	—	7 000	9
	0.500	2.000	12 000	—	5 000	14
	2.001	3.000	11 500	—	4 000	20

*For the corresponding H2 temper, limits for maximum tensile strength do not apply.

†Yield strength (0.2% offset) not determined or guaranteed unless specifically requested.

2.5 ALLOY B1200.

2.5.1 General. The material shall comply with the general requirements of Part I and shall have the following chemical composition and mechanical properties.

2.5.2 Chemical Composition.

Silicon	..	..	..	0.40 per cent max.
Iron	..	..	..	0.6 per cent max.
Copper	..	..	..	0.05 per cent max.
Manganese	..	..	..	0.05 per cent max.
Zinc	..	..	..	0.10 per cent max.

Others

Each	..	..	..	0.05 per cent max.
Total	..	..	..	0.15 per cent max.

Aluminium 99.00 per cent min.

2.5.3 Mechanical Properties.

1	2	3	4	5	6	7
Temper	Specified thickness in		Tensile strength lb/in ²		Yield strength† (0.2% offset) lb/in ² min.	Elong. in 2 in, 4√S ₀ % min.
	from	up to & incl.	min.	max.		
O	0.006	0.019	—	15 500	—	15
	0.020	0.031	—	15 500	—	20
	0.032	0.050	—	15 500	—	25
	0.051	0.249	—	15 500	—	30
	0.250	3.000	11 000	15 500	3 500	28
H12*	0.017	0.019	14 000	19 000	—	3
	0.020	0.031	14 000	19 000	—	4
	0.032	0.050	14 000	19 000	—	6
	0.051	0.113	14 000	19 000	—	8
	0.114	0.249	14 000	19 000	—	9
	0.250	0.499	14 000	19 000	11 000	9
	0.500	2.000	14 000	19 000	11 000	12
H14*	0.009	0.012	16 000	21 000	—	1
	0.013	0.019	16 000	21 000	—	2
	0.020	0.031	16 000	21 000	—	3
	0.032	0.050	16 000	21 000	—	4
	0.051	0.113	16 000	21 000	—	5
	0.114	0.249	16 000	21 000	—	6
	0.250	0.499	16 000	21 000	14 000	6
	0.500	1.000	16 000	21 000	14 000	10
H16*	0.006	0.019	19 000	24 000	—	1
	0.020	0.031	19 000	24 000	—	2
	0.032	0.050	19 000	24 000	—	3
	0.051	0.162	19 000	24 000	—	4
H18	0.006	0.019	22 000	—	—	1
	0.020	0.031	22 000	—	—	2
	0.032	0.050	22 000	—	—	3
	0.051	0.128	22 000	—	—	4
H112	0.250	0.499	13 000	—	7 000	9
	0.500	2.000	12 500	—	5 000	14
	2.001	3.000	11 500	—	4 000	20

*For the corresponding H2 temper, limits for maximum tensile strength do not apply.

†Yield strength (0.2% offset) not determined or guaranteed unless specifically required.

2.6 ALLOY A2024.

2.6.1 General. The material shall comply with the general requirements of Part I and shall have the following chemical composition and mechanical properties.

2.6.2 Chemical Composition.

Silicon	.. .. .	0.50 per cent max.
Iron	.. .. .	0.50 per cent max.
Copper	3.8 per cent min.	4.9 per cent max.
Manganese	0.30 per cent min.	0.9 per cent max.
Magnesium	1.2 per cent min.	1.8 per cent max.
Chromium	.. .. .	0.10 per cent max.
Zinc	.. .. .	0.25 per cent max.

Others

Each	.. .. .	0.05 per cent max.
Total	.. .. .	0.15 per cent max.
Aluminium		Remainder.

2.6.3 Mechanical Properties.

1	2	3	4	5	6	7	8
Temper	Specified thickness in		Tensile strength lbf/in ²		Yield strength (0.2% offset) lbf/in ²		Elong. in 2 in, 4√S ₀
	from	up to & incl.	min.	max.	min.	max.	% min.
O*†	0.010	0.499	—	32 000	—	14 000	12
	0.500	1.750	—	32 000	—	—	12
T42†‡	0.010	0.020	62 000	—	38 000	—	12
	0.021	0.249	62 000	—	38 000	—	15
	0.250	0.499	62 000	—	38 000	—	12
	0.500	1.000	61 000	—	38 000	—	8
	1.001	1.500	60 000	—	38 000	—	7
	1.501	2.000	60 000	—	38 000	—	6
	2.001	3.000	58 000	—	38 000	—	4

*Annealed (—O temper) material shall upon heat treatment be capable of developing the mechanical properties applicable to —T42 temper material.

†Properties listed are those which can usually be obtained by the user when the material is properly heat-treated from the O (annealed) or F (as fabricated) temper.

‡Properties attained by the user may be lower than those listed if the material has been formed or otherwise cold or hot worked, particularly in the annealed temper, prior to solution heat treatment.

2.7 ALLOY ALCLAD A2024.

2.7.1 General. The material shall comply with the general requirements of Part I and shall have the following chemical composition and mechanical properties.

2.7.2 Chemical Composition. Alloy Alclad A2024 shall be Alloy A2024 clad with alloy A1145. The cladding thickness per side shall be as specified in column 4 below. No chemical composition limits shall be applicable to this composite material.

2.7.3 Mechanical Properties.

1	2	3	4	5	6	7	8	9
Temper	Specified thickness in		Cladding thickness per side per cent	Tensile strength lbf/in ²		Yield strength (0.2% offset) lbf/in ²		Elong. in 2 in, 4√S ₀ % min.
	from	up to & incl.		min.	max.	min.	max.	
O*†	0.008	0.009	5	—	30 000	—	14 000	10
	0.010	0.032	5	—	30 000	—	14 000	12
	0.033	0.062	5	—	30 000	—	14 000	12
	0.063	0.187	2.5	—	32 000	—	14 000	12
	0.188	0.499	2.5	—	32 000	—	14 000	12
	0.500	1.750	2.5	—	32 000§	—	—	12
T42†‡	0.008	0.009	5	55 000	—	34 000	—	10
	0.010	0.020	5	57 000	—	34 000	—	12
	0.021	0.062	5	57 000	—	34 000	—	15
	0.063	0.187	2.5	60 000	—	36 000	—	15
	0.188	0.249	2.5	60 000	—	36 000	—	15
	0.250	0.499	2.5	60 000	—	36 000	—	12
	0.500	1.000	2.5	61 000§	—	38 000§	—	8
	1.001	1.500	2.5	60 000§	—	38 000§	—	7
	1.501	2.000	2.5	60 000§	—	38 000§	—	6
	2.001	3.000	2.5	58 000§	—	38 000§	—	4

*Annealed (—O temper) material shall upon heat treatment be capable of developing the mechanical properties applicable to —T42 temper material.

†Properties listed are those which can usually be obtained by the user when the material is properly heat treated from the O (annealed) or F (as fabricated) temper.

‡Properties attained by the user may be lower than those listed if the material has been formed or otherwise cold or hot worked, particularly in the annealed temper, prior to solution heat treatment.

§For plate 0.005 in and over in thickness, the properties listed are applicable to the core material only, since the cladding material is removed during preparation of the test specimen. It should be noted that tensile strength and yield strength (0.2% offset) of the composite plate are usually slightly lower depending on the thickness of the cladding.