



Design and installation of sheet roof and wall cladding

Part 1: Metal



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 - Australian Building Codes Board
 - Australian Garage Door Association
 - Australian Steel Association
 - Australian Steel Institute
 - Bureau of Steel Manufacturers of Australia
 - Consult Australia
 - Curtin University of Technology
 - Cyclone Testing Station, James Cook University
 - Housing Industry Association
 - Insulated Panels Council Australasia
 - Insurance Council of Australia
 - Metal Roofing & Cladding Association
 - Queensland University of Technology
-

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Australian Standard®

Design and installation of sheet roof and wall cladding

Part 1: Metal

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PREFACE

This Standard was prepared by the Standards Australia Committee BD-014, Metal Cladding, to supersede AS 1562.1—1992.

This Standard is part of a series on sheet roof and wall cladding which comprises the following:

AS

- 1562 Design and installation of sheet roof and wall cladding
- 1562.1 Part 1: Metal (this Standard)
- 1562.3 Part 3: Plastic

AS/NZS

- 1562 Design and installation of sheet roof and wall cladding
- 1562.2 Part 2: Corrugated fibre-reinforced cement

The objective of this Standard is to provide designers and installers with clear information to determine the minimum requirements for the correct and safe design and installation of sheet metal roof and wall cladding, based on the best available evidence and current industry practice.

The main technical changes to the Standard are the following:

- (a) Revision of the design section to align with current versions of AS/NZS 1170 series.
- (b) Revision of the installation section to provide flashing requirements to minimize the risk of water ingress, and to highlight the importance of fixing ancillary equipment to the roof structure rather than just the roof cladding.
- (c) Revision of the testing section to align it with current practice whereby roof cladding for cyclonic areas must withstand a Low-Hi-Low test regime.
- (d) Alignment with HB 39 and relevant Australian Standards including AS/NZS 1170 series and AS 4040 series.
- (e) Clarification of the design aspects such as rainwater capacity, adjacent metal suitability, and minimum fixing requirements for flashings have been clarified.
- (f) Incorporation of factors for variation of repeat load testing have to align with current practice.
- (g) Requirements to fix flashing of wall and roof joints and ridge capping with screw connectors at a minimum spacing of either 300 mm for some flashing edges and 600 mm for others.
- (h) Improved presentation of design documentation and test report for the performance verification of cladding systems.

In this Standard, notes are for information and guidance only. Statements expressed in mandatory terms in notes to tables or figures are deemed to be requirements of this Standard.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE.....	4
1.2 NORMATIVE REFERENCES	4
1.3 DEFINITIONS.....	5
SECTION 2 MATERIALS	
2.1 SHEETS, ROLLED SECTIONS AND EXTRUSIONS USED FOR THE MANUFACTURE OF CLADDING AND ACCESSORIES	8
2.2 SHEET FASTENINGS.....	8
SECTION 3 DESIGN	
3.1 SCOPE.....	10
3.2 LOADING	10
3.3 ROOF DRAINAGE	11
3.4 PROTECTION AGAINST CORROSION	12
3.5 DESIGN DOCUMENTATION.....	13
SECTION 4 INSTALLATION	
4.1 OVERVIEW	14
4.2 SUPPORTING MEMBERS	14
4.3 LAYING THE SHEETING	15
4.4 FASTENING	17
4.5 CLADDING LAPS	17
4.6 PROTECTION OF CLADDING DURING INSTALLATION	17
4.7 PROJECTIONS THROUGH THE CLADDING.....	18
4.8 FLASHINGS	18
SECTION 5 TESTING	
5.1 GENERAL.....	20
5.2 TEST SPECIMEN	20
5.3 DERIVATION OF DESIGN VALUES	20
5.4 RESISTANCE TO CONCENTRATED LOADS	22
5.5 RESISTANCE TO WIND PRESSURES FOR NON-CYCLONE REGIONS.....	22
5.6 RESISTANCE TO WIND PRESSURES FOR CYCLONE REGIONS.....	23
APPENDICES	
A ROOF VENTILATION, WATER VAPOUR AND CONDENSATION	24
B WATER PENETRATION	26
C MATERIAL PROPERTIES	27
D ROOF PITCH CALCULATION FOR WATER DRAINAGE	30
E BRACING	32
BIBLIOGRAPHY.....	33

STANDARDS AUSTRALIA

Australian Standard**Design and installation of sheet roof and wall cladding****Part 1: Metal**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out requirements for the design and installation of self-supporting metal roof and wall cladding subjected to out-of-plane external actions and in-plane thermally induced actions, permanent actions on walls and steep roofs and frictional drag of wind and snow actions.

NOTES:

- 1 The term 'metal roof' is considered to include metal tiles.
- 2 Stressed-skin design (diaphragm action) is not covered in this Standard. Design and installation of cladding for stressed-skin buildings should be undertaken using relevant manuals such as EN 1993-1-3. Information on evaluating bracing capacity of cladding is given in Appendix E.
- 3 Some of the design and testing provisions in this Standard may apply to metal faced structural insulated panels although some of the material specifications for these products are not covered in this Standard.

1.2 NORMATIVE REFERENCES

The following are the normative documents referred to in this Standard:

NOTE: Documents referenced for informative purposes are listed in the Bibliography.

AS	
1397	Continuous hot-dip metallic coated steel sheet and strip—Coatings of zinc and zinc alloyed with aluminium and magnesium
1566	Copper and copper alloys—Rolled flat products
1789	Electroplated zinc (electrogalvanized) coatings on ferrous articles (batch process)
2179	Specifications for rainwater goods, accessories and fasteners
2179.1	Part 1: Metal shape or sheet rainwater goods, and metal accessories and fasteners
2334	Steel nails—Metric series
AS	
3566	Self-drilling screws for the building and construction industries
3566.1	Part 1: General requirements and mechanical properties
4040	Methods of testing sheet roof and wall cladding
4040.1	Part 1: Resistance to concentrated loads
4040.2	Part 2: Resistance to wind pressures for non-cyclone regions
4040.3	Part 3: Resistance to wind pressures for cyclone regions
4055	Wind loads for housing

AS	
4397	Electroplated coatings of zinc on steel fasteners with imperial threads
AS/NZS	
1170	Structural design actions
1170.0	Part 0: General principles
1170.1	Part 1: Permanent, imposed and other actions
1170.2	Part 2: Wind actions
1170.3	Part 3: Snow and ice actions
1214	Hot dipped galvanized coatings on threaded fasteners (ISO metric coarse thread series) (ISO 10684:2004, MOD)
1734	Aluminium and aluminium alloys—Flat sheet, coiled sheet and plate
2728	Prefinished/prepainted sheet metal products for interior/exterior building applications—Performance requirements
3500	Plumbing and drainage
3500.3	Part 3: Stormwater drainage
ASTM	
A240	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
A276	Standard Specification for Stainless Steel Bars and Shapes
A666	Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
D2000	Standard Classification system for rubber products in automotive applications
ISO	
3506	Mechanical properties of corrosion-resistant stainless steel fasteners (series)
9223	Corrosion of metals and alloys—Corrosivity of atmospheres—Classification, determination and estimation
EN	
10088	Stainless steels
10088-1	Part 1: List of stainless steels
IFI	Industrial Fasteners Institute, USA
114	Break Mandrel Blind Rivets

1.3 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.3.1 Accessories

Ridge, gable and hip capping, flashings and fasteners.

1.3.2 Anti-capillary feature

A depression in the rolled profile that creates a gap wider than 1 mm at the side lap of installed sheets, which prevents capillary action drawing moisture into the side lap.

1.3.3 Cladding system

Roof or wall cladding, accessories and fasteners, which are defined by a single profile, sheet thickness, material grade and specification, fastener type and size, fastener spacing (p), and washer configuration, and which may have various spans (S).

1.3.4 Creep

The phenomenon of increasing deformation under constant load.

1.3.5 Cyclone regions

Wind Regions C and D as defined in AS/NZS 1170.2 or site classifications C1 to C4 in AS 4055.

1.3.6 Design documentation

Details of the mandatory requirements for cladding systems that are in accordance with this Standard (see Clause 3.5).

NOTE: Design documentation is used to ensure that the design and the test verification of the performance of the cladding matches the requirements for installation (see Clause 4).

1.3.7 De-indexing

The releasing of the interlock between preformed sheets.

1.3.8 Fastener spacing (p)

The maximum distance between fasteners, measured along the centre-line of the supporting member.

1.3.9 Non-cyclone regions

Wind Regions A and B as defined in AS/NZS 1170.2 or site classifications N1 to N6 in AS 4055.

1.3.10 Oil canning

Minor elastic distortion in the form of waviness or out-of-flatness in a preformed sheet, normally caused by local buckling of the sheet metal.

1.3.11 Pan

The flat, or curved portion between the ribs in a pan-type preformed sheet.

1.3.12 Pierce fastened profile

A metal cladding fixed only by screws or nails that pass through the cladding.

1.3.13 Preformed sheet

A metal roofing sheet preformed to increase its resistance to vertical loads, which may have longitudinal ribs of corrugated type or of pan type, in which the distance between the ribs is greater than the width of the ribs, or be formed in other ways to represent tiles or other shapes.

1.3.14 Rainwater goods

Downpipes, rainheads, sumps, spreaders, soakers, nozzles and eaves, box and valley gutters.

1.3.15 Rib

A longitudinal upstand produced by bending, folding or crimping the sheet during manufacture.

1.3.16 Secret (concealed) fastened profile

A metal cladding fixed by secret (hidden) brackets, clips, etc including standing seam profile.

NOTE: Where deformation of the sheeting under ultimate test loading could cause loss of engagement of the fastening system, typically from opening of rib from deformation of pans or unzipping of laps, the sheeting is regarded as secret fastened profile.

1.3.17 Serviceability limit state

State that corresponds to conditions beyond which specified service criteria for a structure or structural element are no longer met.

1.3.18 Shall

Indicates that a statement is mandatory.

1.3.19 Should

Indicates a recommendation.

1.3.20 Span (S)

The distance between the centre-lines of sheet fastenings to adjacent purlins or battens measured normal to such centre-lines.

1.3.21 Strength limit state

State associated with collapse or with other similar forms of structural failure.

1.3.22 Supporting member

The member to which the cladding is attached (e.g. purlins, battens, girts).

1.3.23 Unclipping

The releasing of preformed secret fixed sheets from their fastenings.

SECTION 2 MATERIALS

2.1 SHEETS, ROLLED SECTIONS AND EXTRUSIONS USED FOR THE MANUFACTURE OF CLADDING AND ACCESSORIES

2.1.1 Aluminium

Aluminium for the manufacture of sheet cladding shall conform to the requirements of AS/NZS 1734. The copper content of any aluminium alloy used in sheet roof and wall cladding shall not exceed 0.25%.

Aluminium alloys used shall be alloy 5251 or 5052 with temper not exceeding H 38.

Base metal thickness shall be not less than 0.7 mm.

2.1.2 Copper

Copper shall conform to the requirements of AS 1566, relevant to sheet and coil products.

2.1.3 Steel

The material shall be metallic-coated steel.

Except where the requirements of Clause 2.1.5 apply, the material shall conform to the requirements of AS 1397 for minimum coating Class Z450, AZ150 or AM125.

2.1.4 Stainless steel

Stainless steel shall conform to the requirements of ASTM A240, ASTM A276, ASTM A666, EN 10088-1 or JIS G4305, as applicable.

2.1.5 Prepainted

Prepainted and organic film/metal laminate products shall conform to the requirements of AS/NZS 2728.

2.1.6 Other metals

Metals that are not specifically referred to may be used, provided they fulfil all other requirements of this Standard.

NOTE: Due to toxicity, lead is not recommended for cladding.

2.2 SHEET FASTENINGS

2.2.1 General

Fasteners shall be durable and corrosion resistant. The coating shall be appropriate for the corrosion environment specified in ISO 9223 with a design life equal to or superior to the cladding. Fasteners shall be compatible with any other material with which they may be in contact or, if not compatible, shall be electrolytically insulated from such material to minimize the risk of dissimilar metal corrosion.

NOTES:

- 1 Fasteners should only be used in the applications and environments recommended by the fastener manufacturer.
- 2 The fastenings, including any retained mandrels (e.g. rivet stems), may be suitably plated or coated to achieve the necessary corrosion resistance and compatibility. Such platings or coatings should be sufficiently robust to remain substantially undamaged by the fixing process.
- 3 For information on all materials referenced in Clause 2.2, see Table C3, Appendix C.
- 4 For a comparison table from AS 4312, see Table C2, Appendix C.

Where fitted, fastener sealing washers and all other seals in direct contact with the cladding shall be made from materials that conform to ASTM D2000 Specification 3BA 606, A14 B13, such as EPDM or neoprene chlorinated rubber. Fillers shall be completely encapsulated when conductive materials such as carbon are used. Linear electrical resistance between contact points on opposing surfaces of the washer shall be greater than 1 MΩ when tested at 1000 V.

NOTE: The use of inert or non-conductive fillers is preferred, as the risk of a conductive rubber with a carbon-metal corrosion cell is eliminated.

Where fitted, load spreading washers shall be compatible with any other material that they are in contact with (e.g. fasteners or cladding material).

2.2.2 Aluminium

Aluminium fastenings shall conform to the following requirements:

- (a) Nails and hook bolts shall be made from extruded aluminium: 6000 series aluminium alloy.
- (b) Fastenings such as clips, brackets and washers shall be made from sheet aluminium: 3000 series or 5000 series aluminium alloy.
- (c) Screws and other fasteners made from non-compatible materials such as stainless steel shall be isolated from aluminium cladding.

NOTE: See Tables C2 and C3, Appendix C, for further information.

2.2.3 Copper and copper alloys

The fastenings used to retain copper and copper alloy sheeting shall be of a compatible material.

2.2.4 Steel

Steel fastenings shall conform to the following requirements:

- (a) Non-self-drilling screws, self-drilling screws, nails and bolts shall be in accordance with AS/NZS 1214, AS 2334, AS 3566.1, AS 1789 or AS 4397.
- (b) Clips, brackets, straps and washers shall be in accordance with Clause 2.1.3 or Clause 2.1.6.

2.2.5 Stainless steel

Stainless steel fastenings shall conform to the composition requirements of ISO 3506 (series) and shall be in accordance with Clause 2.2.1.

NOTE: See Table C3, Appendix C, for further information.

2.2.6 Rivets

Rivets shall conform to IFI 114.

SECTION 3 DESIGN

3.1 SCOPE

This Section sets out requirements for the design of cladding systems comprising cladding, and cladding fasteners.

NOTES:

- 1 Guidance on roof ventilation is given in Appendix A.
- 2 Guidance on water penetration is given in Appendix B.
- 3 This Section requires the specification of the supporting members in order to define the capacity of the cladding fasteners, but the scope of this Section does not cover the design of the supporting members themselves.
- 4 Cladding systems are not normally designed to carry additional loads from accessories fixed directly to the cladding, e.g. air-conditioning units, vents or antennas. If these are to be fixed directly to the cladding then the capacity of the cladding to carry these loads should be verified.

3.2 LOADING

3.2.1 General

The cladding and its fastenings to the supporting member shall be designed to withstand the loads derived from the actions specified in AS/NZS 1170.1, AS/NZS 1170.2 and AS/NZS 1170.3, when combined in accordance with the load combinations in AS/NZS 1170.0, for the particular circumstances in which the cladding and fastening system will be used.

Materials and installation specifications shall achieve resistance to the loads and actions identified in this Clause (3.2) and shall be recorded in design documentation as specified in Clause 3.5.

3.2.2 Imposed actions

Imposed actions shall be appropriate for the roof categories defined in AS/NZS 1170.1. For roof category R2, the design documentation (see Clause 3.5) shall clearly identify whether the roof is designed for either one of the following:

- (a) Cladding providing direct support and that persons may walk or stand anywhere on the roof without causing damage to the sheet.
- (b) Cladding over which boards or ladders are required to be laid, and including indication of—
 - (i) the positions on the roof sheet on which a person may walk or stand without causing damage to the sheet;
 - (ii) temporary walkways that are to be provided for access; or
 - (iii) the marking of roofing with a visible sign or sticker with the warning 'FOOT TRAFFIC IS NOT ALLOWED'.

3.2.3 Wind actions

Local pressure factors defined in AS/NZS 1170.2 or edge region pressures defined in AS 4055 shall be applied to the external pressures for cladding system at edges, ridges and corners of building roofs and walls.

3.2.4 Snow and ice action

Design for loads from the accumulation of snow shall conform to AS/NZS 1170.3.

NOTE: AS/NZS 1170.3 does not address loads from hail.

3.2.5 Lateral restraint

Cladding is not considered to be efficient restraint for supporting structures against buckling, in particular cold-formed steel purlins, unless experimental (test) data are available for cladding assemblies including cladding, its fixings and supporting structures.

3.2.6 Thermally induced movement or loadings

Thermally induced effects shall be accommodated by either—

- (a) demonstrating that the system can resist the applied thermal loads; or
NOTE: This may be achieved by limiting maximum length between top and bottom rows of fasteners on a sheet.
- (b) detailing the system to absorb the applied thermal movement.
NOTE: Absorption of applied thermal movements may be achieved by the—
 - (a) provision of expansion joints; and/or
 - (b) use of elongated slots on sheets.

NOTES:

- 1 Appendix C provides guidance on typical coefficients of linear expansion.
- 2 To give an indication of the extent of thermal expansion that needs to be considered, an unrestrained 15 m steel sheet expands through approximately 12 mm and aluminium for 24 mm for a temperature variation from 0°C to 65°C. In practice, cladding movement in roofs may be less than this due to many factors including friction and flexibility of the supporting structure.
- 3 Practical demonstration of bracing capacity of the sheeting may be required for systems with provision for accommodating thermal induced movement (see Appendix E).
- 4 Transverse thermal expansion in ribbed cladding is absorbed by lateral distortion of the ribs.

3.3 ROOF DRAINAGE

3.3.1 General

The cladding system shall provide water resistance and drainage when subjected to a rainfall resulting from a storm having an average recurrence interval of 100 years as determined in accordance with AS/NZS 3500.3 or local meteorological data.

NOTE: Roof drainage is affected by—

- (a) the length and pitch (i.e. slope) of the roof;
- (b) the profile of the cladding and its water channel drainage capacity;
- (c) the risk of ponding in the case of a low pitch roof;
- (d) anti-capillary feature geometry and location design on side laps;
- (e) the potential penetration of water through end and side laps;
- (f) drainage from an upper roof to a lower roof;
- (g) change of pitch or a concave roof leading to a transition from laminar to turbulent flow;
- (h) any penetrations in the roof that affect the flow of water down the roof pitch; and
- (i) deflection of a roof structure will alter the roof pitch; the initial pitch, which therefore, should include an allowance for any permanent deflection of the roof structure, in particular long-term deflections in timber-framed structures.