Fiji Islands Standard

Design and installation of sheet roo and wall cladding

Part 1: Metal

STANDARDS FIJI ✓

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STANDARDS AUSTRALIA

This Fiji Islands Standard constitutes the endorsement of the Australian Standard AS 1562.1—1992 as amended from time to time for use in the Fiji Islands. It was approved as a Fiji Islands Standard by the Minister of Commerce, Industry, Co-operatives and Public Enterprises, acting on the advice of the Trade Standards Advisory Council, on 8th October 1998. It was published on 18th November 1998.

The following interests are represented on the Trade Standards Advisory Council:
Food Processing Industry
Manufacturing Sector
Importers
Professional Engineers
Consumer Council of Fiji Islands and the Fiji Islands Building Standards Committee
Office of Trade Standards and Quality Control

This Fiji Islands Standard adopts the provisions of AS 1562.1—1992, including Amendment Nos 1 and 2, the text of which is reproduced herewith. The Trade Standards Advisory Council, with the approval of the Minister, may amend this Standard as considered necessary from time to time, by either addition or deletion. Any amendment must be annexed to the Standard and its notification published in the Fiji Islands Gazette by the Minister.

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FIJI ISLANDS AMENDMENTS

The following Fiji Islands Standards amendments, additions or deletions apply to AS 1562.1—1992:

1.1 SCOPE

Add the following new Note:

This Standard covers the grade of steel to be used in the manufacture of metal roofing sheets and wall cladding that shall withstand the cyclone conditions in Fiji Islands. It was first adopted by the Fiji Islands Building Standards Committee in 1998 and since then remained in form.

5.5 RESISTANCE TO WIND PRESSURES FOR NON-CYCLONE REGIONS

Delete entire Clause.

SECTION 6 ADDITIONAL REQUIREMENTS FOR STEEL ROOFING SHEETS AND WALL CLADDING

6.1 TESTING LABORATORIES The testing laboratories set out in the schedule to this Standard are authorized to test metal roofing sheets and wall cladding as specified in this Standard and other laboratories as approved from time to time by the Trade Standards Advisory Council.

6.2 TEST CERTIFICATE Conformance to the Fiji Islands Standard shall be in the form of a certificate issued by laboratories as specified in the schedule to this Standard, certifying compliance with the Standard.

6.3 ROUTINE TESTING The Trade Standards Advisory Council shall arrange for analysis and examination to be carried out at least once in every 12 months.

6.4 SAMPLING OF PRODUCTS

6.4.1 Sampling The Chief Inspector shall carry out at least two samplings of the products covered by this Standard in each 12 months period. Conformance to the Fiji Islands Standard shall be in a form of a certificate issued by laboratories as specified in the schedule to this Standard, certifying compliance with the Standard.

6.5 INTERPRETATION For the purpose of this Standard, the following interpretations apply, unless the context otherwise requires:

6.5.1 Tolerance—the amount by which the measure of a value can vary from the amount intended.

6.5.2 Absolute—completely certain without any tolerance.

6.5.3 Metallic coating—a coating obtained by dipping prepared ferrous articles into molten zinc or molten aluminium/zinc alloy as per AS 1397.

6.5.4 Painted—covered with special colouring matter.

6.5.5 Pre-painted—covered in advance with special colouring matter.

6.5.6 Chief Inspector—appointed under section 14(2) of Trade Standards and Quality Control Decree 1992.

6.6 STEEL COILS FOR MANUFACTURE OF ROOFING SHEETS AND WALL CLADDING

6.6.1 Base metal thickness The minimum thickness of steel out of which any type of metal roofing and wall cladding sheets is manufactured shall be 0.42 millimetre (mm) Base Metal Thickness absolute.

6.6.2 Coating class—Steel sheets The minimum metallic coating class on steel used for manufacture of metal roofing and wall cladding sheets shall be of Class AZ150 and Z400.

6.6.3 Coating class—Pre-painted steel sheets The minimum metallic coating of pre-painted steel used for manufacture of metal roofing and wall cladding sheets shall be of Class AZ150, Z300. Where high build paint primer system has been used Z275 shall be allowed.

6.6.4 Steel grade—0.55 mm sheets Metal roofing and wall cladding sheets with base metal thickness of 0.55 mm shall be manufactured out of steel grade between G250 and G550.

6.6.5 Coating class—Purlins The minimum metallic coating on steel used for the manufacture of steel purlins shall be Z400 or AZ150.

6.7 TEST PROCEDURE OF ROOFING SHEETS The testing laboratories set out in the schedule to this Standard are authorised to test metal roofing and wall cladding sheets as specified in this Standard.

Steel sheet also known as coil steel sheeting that is used for manufacture shall comply with the schedule of this Standard.

6.8 METALLIC COATING PROCESS The steel used for manufacture of cladding shall show no defects or in the case of galvanised sheets, have any powdery formations.

6.9 PAINTED AND PRE-PAINTED STEEL ROOFING AND WALL CLADDING SHEETS The steel sheet for manufacture of cladding which are painted or pre-painted shall have no defects on its painting and have no damage to paint work.

6.10 ROLLING OF STEEL ROOFING SHEETS The design of corrugated steel roofing sheets shall be approved in writing by the Chief Inspector from time to time.

Rolled/manufactured steel roofing sheets shall be of such type to meet the minimum wind force for cyclonic conditions as determined by the Trade Standards Advisory Council from time to time.

SCHEDULE

Authorised Laboratories

Compliance Certification and Testing of Metal Roofing and Wall Cladding Sheets (FJS 1562.1:1998)

The following are authorised laboratories for the purpose of the testing specified in this Standard and the issue of compliance certificates:

(a) Cyclone Testing Station
James Cook University School of Engineering
James Cook University
Queensland 4811
Australia

(b) Any other National Association of Testing Authorities (NATA) Certified Laboratory, approved by the Trade Standards Advisory Council on the recommendation of Chief Inspector.

AS 1562.1—1992

Australian Standard®

Design and installation of sheet roof and wall cladding

Part 1: Metal

STANDARDS AUSTRALIA

This Australian Standard was prepared by Committee BD/14, Metal Roofing Construction. It was approved on behalf of the Council of Standards Australia on 15 May 1992 and published on 20 July 1992.

The following interests are represented on Committee BD/14:

Aluminium Development Council

Association of Consulting Engineers, Australia

Curtin University of Technology

James Cook University of North Queensland

Metal Building Products Manufacturers Association

Metal Roofing and Cladding Association of N.S.W.

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Suggestions for improvements to Australian Standards, addressed to the head office of Standards Australia, are welcomed. Notification of any inaccuracy or ambiguity found in an Australian Standard should be made without delay in order that the matter may be investigated and appropriate action taken.

This Standard was issued in draft form for comment as DR 91138.

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 on Metal Roofing Construction to supersede (in part) AS 1562—1980, *Design and installation of metal roofing*.

This Standard differs from the 1980 edition in that the scope has been broadened to include wall cladding and metal tiles, and that provision has been made for the inclusion of a cyclic load test which simulates cyclonic conditions.

In addition, the methods of test have been issued separately as Parts of AS 4040, *Methods of testing sheet roof and wall cladding*.

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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.

NOTE: The term 'metal roof' is considered to include metal tiles.

1.2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS
1170 Minimum design loads on structures
1170.1 Part 1: Dead and live loads and load combinations
1170.2 Part 2: Wind loads
1170.3 Part 3: Snow loads
1214 Hot-dipped galvanized coatings on threaded fasteners (ISO metric coarse thread series)
1397 Steel sheet and strip—Hot dipped zinc-coated or aluminium/zinc coated
1449 Wrought alloy steels—Stainless and heat-resisting steel plate, sheet and strip
1566 Copper and copper alloys—Rolled flat products
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2424 Plastics building sheets—General installation requirements and design of roofing systems
2728 Prepainted and organic film/metal laminate products—Performance requirements for interior/exterior applications in buildings
3566 Screws—Self-drilling—For the building and construction industries
4040 Methods of testing sheet roof and wall cladding
4040.0 Part 0: Introduction, list of methods and general requirements
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4100 Steel structures
K132 Electroplated coatings on threaded components

ASTM
D 2000 Classification system for rubber products in automotive applications

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 Cladding system—roof or wall cladding, accessories and fasteners.

1.3.3 Creep—the phenomenon of increasing deformation under constant load.

1.3.4 Cyclone regions—regions C and D as defined in AS 1170.2.

1.3.5 De-indexing—the releasing of the interlock between preformed sheets.

1.3.6 Non-cyclone regions—regions A and B as defined in AS 1170.2.

1.3.7 **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.

1.3.8 **Pan**—the flat, or curved portion between the ribs in a pan-type preformed sheet.

1.3.9 **Preformed sheet**—a metal roofing sheet preformed to increase its resistance to vertical loads. It 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.

1.3.10 **Rainwater goods**—downpipes, rainheads, sumps, spreaders, soakers, nozzles and eaves, box and valley gutters.

1.3.11 **Rib**—a longitudinal upstand produced by bending, folding or crimping.

1.3.12 **Span** (S)—the distance between the centre-lines of sheet fastenings to adjacent purlins or battens measured normal to such centre-lines.

1.3.13 **Supporting member**—the member to which the cladding is attached, e.g. purlins, battens, girts.

1.3.14 **Unclipping**—the releasing of preformed 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 shall comply with AS 1734 and shall be an aluminium alloy containing manganese or magnesium, or a mixture of magnesium and silicon. Aluminium sheets may be clad with an aluminium/zinc alloy. The copper content of any aluminium alloy shall not exceed 0.25%.

2.1.2 Copper Copper shall comply with the appropriate requirements of AS 1566.

2.1.3 Steel The material shall be coated steel as follows:

(a) Except where the requirements of Item (b) apply, the material shall comply with the requirements of AS 1397 for coating Class Z 450 or AZ 150.

(b) Prepainted and organic film/metal laminate products shall comply with the appropriate requirements of AS 2728.

2.1.4 Stainless steel Stainless steel shall comply with the appropriate requirements of AS 1449.

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

2.2 SHEET FASTENINGS

2.2.1 General Fastenings shall be durable, corrosion-resistant in accordance with AS 3566, and compatible with any other material with which they may be in contact in the roof or, if not compatible, shall be electrolytically insulated from such material. 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 shall be sufficiently robust to remain substantially undamaged by the fixing process.

2.2.2 Aluminium Aluminium fastenings shall comply with the following requirements, as appropriate:

(a) Nails and hook bolts made from extruded aluminium: 6000 Series aluminium alloy.

(b) Fastenings such as clips, brackets and washers made from sheet aluminium: 3000 Series or 5000 Series aluminium alloy.

2.2.3 Copper and copper alloys The fastenings used to retain copper and copper alloy sheeting shall comply with AS 1566, AS 1567, or AS 1573, as appropriate.

2.2.4 Steel Steel fastenings shall comply with the following requirements, as appropriate:

(a) Non-self-drilling screws, nails and bolts: AS 1214, AS 1789 or AS K132.

(b) Clips, brackets, straps and washers: where applicable, the provisions of Clause 2.1.3 shall apply.

2.2.5 Stainless steel Stainless steel shall comply with the composition requirements of AS 1449.

2.2.6 Self-drilling screws Self-drilling screws shall comply with AS 3566.

2.2.7 Steel nails Steel nails shall comply with AS 2334.

2.2.8 Fastener sealing washers Fastener sealing washers shall be prepared from weather-resistant rubbers which comply with ASTM D 2000 Specification 3BA 606 A14 B13, such as EPDM or neoprene chlorinated rubber. Fillers in the rubber shall be completely encapsulated, especially when conductive materials such as carbon are used. Linear electrical resistance between contact points 20 mm apart shall be greater than 1 MΩ.

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

SECTION 3 DESIGN

3.1 SCOPE This Section sets out the requirements for the design of the cladding, supporting members and fasteners.

NOTE: Guidance on roof ventilation is given in Appendix A.

3.2 GENERAL

3.2.1 Service loading The cladding and its fastenings to the supporting member shall be designed in accordance with the appropriate Australian Standards to withstand the loads and load combinations set out in AS 1170.1, AS 1170.2 and AS 1170.3, for the particular circumstances in which the cladding and fastening system will be used.

The cladding and its fastening system comply with these requirements if, on being tested in accordance with Section 5 of this Standard, they fulfil the requirements of that Section.

NOTES:

1 Attention is drawn to the occurrence of high negative wind pressures on the upper surfaces of a roof, together with high positive pressures on the underside, particularly at eaves, ridges and verges (see AS 1170.2).

2 Care should be taken to ensure that all roof loadings are taken into account, for example, air-conditioning units, walkways and vents or chimneys attached to the cladding.

3.2.2 Loadings during construction Other forces that may reasonably be expected to apply during construction, for example, the temporary stacking of materials, shall be taken into account. Particular attention shall be given to the effect of the possible temporary absence of ceilings, walls, glazing and the like on the intensity of internal wind pressures.

3.2.3 Bracing Cladding is not considered to be effective in restraining the lateral deflection of that flange of the supporting member to which the sheeting is connected, except in cases where experimental (test) data are available to show that the cladding and its fixings, tightened to a degree which may reasonably be expected in practice, are able to provide such restraint.

NOTE: Practical demonstration of bracing ability is particularly important for structures incorporating provision for thermal movement.

3.2.4 Thermal movement If thermal movement of the sheeting would have a deleterious effect, adequate provision shall be made to accommodate such movement.

Where thermal expansion of cladding is restrained, consideration shall be given to the forces imposed.

NOTES:

1 Typical coefficients of linear expansion are given in Table 3.1.

2 To give an indication of the extent of thermal expansion which needs to be considered, a 15 m steel sheet expands through approximately 12 mm for a temperature variation from 0°C to 65°C.

TABLE 3.1

TYPICAL COEFFICIENTS OF LINEAR EXPANSION

Base material	Coefficient of linear expansion K^{-1}
Aluminium	24×10^{-6}
Copper	17×10^{-6}
Steel	12×10^{-6}
Stainless steel	17×10^{-6}
Zinc	26×10^{-6}

3.3 WATER PENETRATION The cladding system shall provide adequate water resistance when subjected to a 100-year storm (see AS 2180).

NOTES:

1 For adequate roof drainage, consideration should be given to—

(a) the length and 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; and

(d) the potential penetration of water through end and side laps.

For a steeply-pitched roof, side laps generally need to be sealed or double lapped to prevent high velocity rainwater penetrating into the sidelaps.

2 Attention is drawn to the fact that deflection of a roof structure will alter the roof slope. The initial slope, therefore, should include an allowance for any permanent deflection of the roof structure, especially in timber structures.

3.4 FIXING OF CLADDING SYSTEM AND SUPPORTING MEMBERS Particular attention shall be given to combinations of internal and external wind pressures and frictional drag.

Where sheet fixing would otherwise allow non-returnable movement to take place, provision shall be made for suitable anchoring of the sheets.

In addition to consideration of the vertical component of the mass of the wall cladding and fasteners, consideration shall be given to the anchoring of roofing against movement down the slope due to vibration, thermal expansion and contraction or snow loads.

NOTE: As the testing requirements set out in Section 5 require that the system used to fasten the cladding to the supporting members remains substantially in place, consideration should be given to the possibility of splitting and subsequent failure of timber members if the minimum sizes specified in AS 1684 are used.

3.5 RAINWATER GOODS Rainwater goods shall comply with AS 2179 and AS 2180.

3.6 PROTECTION AGAINST CORROSION Cladding systems shall be designed so that direct contact between incompatible metals or alloys does not occur.

Where the use of incompatible materials is unavoidable, they shall be separated by use of an impervious non-conducting material. However, it is preferred that systems be designed so that direct contact between two or more incompatible materials or alloys does not occur.

NOTES:

1 Table 3.2 is given as a general guide to acceptable combinations of metals in the light of current knowledge, based on the premise that the area of cladding and accessories is relatively large in comparison to that of the fastener material.

2 If the atmosphere inside a building with metal cladding contains corrosive gases or vapours, some roof materials may require extra protection against the corrosive agents, especially if the cladding is not lined. Such extra protection should also apply to the fastenings and accessories.

The resistance of external cladding of certain metals to corrosive agents is partly dependent on the beneficial washing action of rain and on freedom from ponding. Increased corrosion may result in areas protected from these effects.

The life of most metals in severe marine atmospheres and industrial areas with atmospheres contaminated by acid-bearing agents can be extended by the use of special painting procedures (see AS 2312).

3.7 DRAINAGE The roof shall be designed to prevent drainage from one surface damaging a lower metal or alloy surface.

NOTE: Table 3.3 is given as a general guide to acceptable combinations of upper and lower metals and alloys with regard to drainage from one to the other.

TABLE 3.2
ACCEPTABILITY OF DIRECT CONTACT BETWEEN METALS OR ALLOYS

Cladding Material	Accessory or fastener material											
	Aluminium and aluminium alloys		Copper and copper alloys		Stainless steel (300 Series)		Zinc-coated steel and zinc		Aluminium/zinc alloy-coated steel		Lead	
	Atmospheric classification											
	SI and VS	Mild	SI and VS	Mild	SI and VS	Mild	SI and VS	Mild	SI and VS	Mild	SI and VS	Mild
Aluminium and aluminium alloys	Yes	Yes	No	No	No*	Yes	Yes†	Yes†	Yes	Yes	No	No
Copper and copper alloys	No	No	Yes	Yes	No	Yes	No	No	No	No	No	Yes
Stainless steel (300 Series)	No	No	No	No	Yes	Yes	No	No	No	No	No	Yes
Zinc-coated steel and zinc	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Aluminium/zinc alloy-coated steel	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	No	No
Lead ‡	No	No	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes

* Grade 316 in accordance with AS 1449 is suitable.

† Zinc-coated steel and zinc are suitable for direct contact, but are not suitable if drainage from an aluminium or aluminium alloy roof passes over the fastener or accessory.

‡ Due to its toxicity, lead is not recommended for cladding.

LEGEND:

SI, VS, Mild = severe industrial, very severe and mild classifications (see AS 2312)
Yes = acceptable
No = not acceptable

NOTES:

1 'Acceptable' and 'not acceptable' imply the following:

(a) *Acceptable*—as a result of bimetallic contact, either no additional corrosion of the cladding system will take place or, at the worst, only very slight additional corrosion. It also implies that the degree of corrosion would not significantly shorten the service life.

(b) *Not acceptable*—moderate to severe corrosion of the cladding or accessories will occur, a condition which may result in a significant reduction in the service life.

2 Unless adequate separation can be ensured, prepainted cladding materials should be considered in terms of the base material.

TABLE 3.3

ACCEPTABILITY OF DRAINAGE FROM ONE SURFACE TO A LOWER METAL OR ALLOY SURFACE

Upper cladding/ accessory material	Lower cladding/accessory material					
	Aluminium and aluminium alloys	Copper and copper alloys	Stainless steel (300 Series)	Zinc-coated steel and zinc	Aluminium/zinc alloy-coated steel	Lead
Aluminium and aluminium alloys	Yes	No*	No*	No	Yes	No*
Copper and copper alloys	No	Yes	No*	No	No	No*
Stainless steel (300 Series)	No*	No*	Yes	No	No*	No*
Zinc-coated steel and zinc	Yes	No*	No*	Yes	Yes	No*
Aluminium/zinc alloy-coated steel	Yes	No*	No*	No	Yes	No*
Lead	No*	Yes	Yes	No*	No	Yes
Prepainted metal	Yes	Yes*	No*	No	Yes	No*
Glazed roof tiles	Yes	Yes	Yes	No	Yes	Yes
Unglazed roof tiles	Yes	Yes	Yes	Yes	Yes	Yes
Acrylic/plastics	Yes	Yes	Yes	No	Yes	Yes
Glass	Yes	Yes	Yes	No	Yes	Yes

* Whilst drainage between the materials shown would be acceptable, direct material contact should be avoided (see Table 3.2).

LEGEND:
Yes = acceptable
No = not acceptable

NOTE: 'Acceptable' and 'not acceptable' imply similar service performances to those noted in Table 3.2.

3.8 WALKING AND STANDING ON ROOFS For non-trafficable roofs, as defined in AS 1170.1, in addition to complying with AS 1170.1, one of the following shall be indicated:

(a) That persons may walk or stand anywhere on the roof without causing damage to the sheet.

(b) The positions on the roof sheet on which persons may walk or stand without causing damage to the sheet.

(c) That temporary walkways need to be provided for access.

NOTE: It is recommended that this information be provided by the sheet manufacturer both in the trade literature and in any fixing instructions.

3.9 ROOF LIGHTS Where translucent sheeting is required, it shall comply with AS 2424.

SECTION 4 INSTALLATION

4.1 GENERAL The cladding system shall be installed in accordance with the design specifications or the manufacturer's installation specification, as appropriate.

All sheets shall be supported over the full width of the sheet.

4.2 SUPPORTING MEMBERS Supporting members shall be installed in accordance with the following:

(a) The spacing of supporting members shall be to the tolerances specified in the design specifications or the manufacturer's installation specifications, as appropriate. Where tolerances are not otherwise specified they shall be taken as ±5 mm on the specified support member spacing.

(b) Any vertical or horizontal misalignment at the abutting ends shall not exceed 2 mm.

(c) The tops of the supporting members shall be substantially in a plane parallel to the specified roof slope. Deviations from this plane shall be smooth and shall not exceed 7 mm per metre length of supporting member.

4.3 SUPPORTS AT HIPS AND VALLEYS Adequate support shall be given to the raking cut edges of roof sheets at hips and valleys. Hip and valley trimmers shall be provided, fixed flush with the top face of purlins and spanning between them. Hip and valley trimmers shall be fixed parallel to the edge of the sheeting and be placed so as to permit the fixing of the sheeting or of hip ridging.

4.4 LAYING THE SHEETING All sheets shall be supported as near to their ends as practicable, notwithstanding that the sheet end shall always positively overhang the full width of the supporting surface to prevent water intrusion by capillary action. The maximum and minimum unsupported end overhang for any type of sheet shall be as specified by the sheeting manufacturer.

NOTES:

1 Where possible, the sheet overhang on valley gutters should be not less than 150 mm, unless, in the case of metal tiles, it is turned down into the valley.

2 Consideration should be given to laying the initial sheet at the leeward end of the building, so the side laps are protected from the worst anticipated weather.

3 To prevent the entry of birds or vermin to the roofspace, consideration should be given to the use, particularly at the eaves, of suitably contoured accessories, caps, filler strips, or mesh.

4.5 FASTENINGS AT EAVES, RIDGES, VERGES, AND CORNERS Special care shall be exercised to ensure that the fixing of the roof at eaves, ridges, verges, and corners is in accordance with the manufacturer's special instructions in this regard.

NOTE: Metal tiles should generally be cut, and bent up or down at these locations.

4.6 DRILLING, PIERCING AND CUTTING FOR SHEET FASTENINGS Sheets may be cut and drilled as necessary, but holes shall not be punched unless this can be done without causing local distortions to the sheet. Where roofing nails are used, any local distortion shall not extend beyond the area covered by the washer and sealant.

Fasteners shall be located on the centre-line of timber or metal supports, or where hook bolts are used, as close as possible to the top edge of the supports.

NOTES:

1 Most metal cladding is suitable for use with self-drilling fasteners which are readily available and do not require predrilling or punching (see AS 3566).

2 Special tools for punching holes are often available from the roofing manufacturer.

4.7 FIXING THE SHEETING The cladding system shall be fixed to the supporting members using one or more of the methods given below, as appropriate. Unless otherwise specified, all fasteners shall be installed normal to the plane of the roof or wall and all fasteners which pierce the cladding shall be provided with adequate sealing to prevent leakage.

The methods are as follows:

(a) *Crest fasteners* Crest fasteners shall be tightened no more than is necessary to form a weatherproof seal without deformation of the sheet profile or damage to the sealing washer.

(b) *Valley fasteners* Care shall be taken to ensure an adequate seal to prevent leakage, particularly where valley fasteners are used in roofing applications.

NOTES:

1 Because of the solid contact with the supporting structure, valley fasteners are often used where the cladding is designed to act as bracing to the supporting structure.

2 Some roofing profiles with a narrow pan width are unsuitable for valley fastening, as the fastener will significantly impede water flow.

(c) *Concealed fasteners/clips* Cladding to be fixed using a concealed fastener system shall be fixed using the fastener, or clips and fasteners, specified by the manufacturer for use with that cladding.

NOTE: It is essential that the correct cladding/fastener system is used, otherwise the resistance to wind forces of the system may be seriously reduced.

4.8 PROJECTIONS THROUGH ROOFS Where any projections such as pipes, ducts, chimneys and the like, pass through roof surfaces, they shall be adequately flashed.

NOTE: Such projections should preferably pass through the pan of pan-type sheets or through the crest of the corrugation of corrugated-type sheets. Where this is not possible, because of the position or size of the projection, ribs or corrugations may be cut away as required, provided that such cut ribs or corrugations are adequately flashed.

Where necessary, all cut sections of the sheet shall be supported by additional roof framing.

In all cases, all cutting and flashing shall be arranged so that adequate provision is made for drainage of all pans or corrugations.

4.9 PROTECTION OF CLADDING DURING INSTALLATION All debris, such as cement mortar and in particular, metal clippings and filings shall be removed from the roof and adjacent eaves and box gutters daily.

Surface coatings shall be protected from damage during installation.

SECTION 5 TESTING

5.1 GENERAL If testing is required to demonstrate the compliance of the cladding or the cladding fastenings with the requirements of this Standard, the provisions of this Section and of the appropriate Parts of AS 4040 apply.

NOTE: Testing of accessories is not included, as adequate data and equipment are not available.

5.2 TEST SPECIMEN Provision shall be made to strengthen the test supporting structure where the ultimate-load test requirements with respect to wind forces are in excess of the ultimate wind-load-carrying capacity of—

(a) the supporting structure; or

(b) that part of the model that is a reproduction of the supporting structure.

However, care shall be taken to ensure that the strengthening does not affect the performance of the cladding or change its mode of failure.

5.3 STATIC LOADS—ALLOWANCE FOR VARIABILITY OF MATERIALS Provision is made in Table 5.1 for the testing of more than one sample of a test specimen to allow for variability of materials. If a number of tests is carried out, each sample is required to satisfy the performance criteria of this Standard.

TABLE 5.1
FACTORS TO ALLOW FOR VARIABILITY OF STRUCTURAL UNITS

Number of identical units to be tested	Strength limit state	Serviceability limit state
1	1.5	1.2
2	1.4	1.2
3	1.3	1.2
4	1.3	1.1
5	1.3	1.1
10	1.2	1.1

NOTES:

1 The concentrated loads and appropriate factors included in this Section for both serviceability limit state and strength limit state are in accordance with AS 1170.1. The factors to allow for variability have been adopted from AS 4100.

2 The tests given in AS 4040 are designed to test the cladding and its fastenings, and therefore the model structure (see AS 4040.0) is so specified that fully-sheeted full-length purlins or girts need not be used.

5.4 RESISTANCE TO CONCENTRATED LOADS

5.4.1 General These test requirements apply only to roof claddings which are required to support loads incidental to maintenance.

5.4.2 Serviceability test When any part of the path specified by the sheeting manufacturer (see Clause 3.9) is subjected to a concentrated test load for serviceability limit state by the method described in AS 4040.1, the elastic deflection directly under the point of application of that load shall not exceed S/100. Further, no de-indexing, unclipping, permanent local deformation, fracture or failure of any part of the cladding or failure of the fastening shall occur, and the residual deflection directly under the point of application of the load within a maximum of 5 min after removal of the load shall not exceed S/1 000.

Where no path is specified by the manufacturer, the concentrated load shall be applied to those parts of the cladding which will produce maximum deflection and maximum permanent deformation.

NOTES:

1 Limits on residual deflection have been included to preserve the appearance of the sheeting and to reduce ponding. Residual deflection may be difficult, however, to determine reliably because of frictional effects and the like. Techniques performed to improve the reliability of the measurement, such as light tapping of the sheeting, are permissible provided it can be demonstrated that such techniques serve only to settle the sheeting to its rest position.

2 The location of maximum deflection may not necessarily coincide with the position of maximum deformation. When testing for maximum permanent deformation, consideration should be given to the application of the concentrated load directly over a supporting member or between sidelap fasteners.

5.4.3 Strength test When any part of the cladding or the path specified by the manufacturer is subjected, for not less than 1 min, to a concentrated test load for strength limit state in accordance with AS 4040.1, the load shall be sustained, irrespective of any permanent deformation that may occur.

5.5 RESISTANCE TO WIND PRESSURES FOR NON-CYCLONE REGIONS

5.5.1 Serviceability test When the cladding system is subjected to the test pressure for serviceability limit state, in accordance with AS 4040.2, the maximum deflection of the cladding relative to the supporting members shall not exceed S/150. Further, no de-indexing, unclipping, permanent local deformation, or fracture or failure of any part of the sheeting or of the fastenings shall occur, and the residual deflection 1 min after the removal of the pressure shall not exceed S/1 000 (see also Note 1 to Clause 5.4.2).

5.5.2 Strength test The cladding system shall be subjected to the test pressure for strength limit state for non-cyclone regions, as specified in accordance with AS 4040.2. The pressure shall be sustained and all parts of the cladding system shall remain substantially in position, notwithstanding any permanent distortion that might occur in the sheeting and fastenings.

5.6 RESISTANCE TO WIND PRESSURES FOR CYCLONE REGIONS

5.6.1 General Cladding systems to be used in cyclone regions shall be tested for their capacity to resist low-cycle fatigue loading. These test requirements apply to cladding for both roofs and walls.

5.6.2 Serviceability test When the cladding system is subjected to a test pressure for serviceability limit state in accordance with AS 4040.3, the maximum deflection between adjacent support members of the sheeting and fastening system shall not exceed S/150. Further, no de-indexing, unclipping, permanent local deformation, or fracture or failure of any part of the sheeting or of the fastenings shall occur and the residual deflection 1 min after the removal of the pressure shall not exceed S/1 000 (see also Note 1 to Clause 5.4.2).

5.6.3 Strength test When subjected to the sequence of fatigue loading for cyclone regions specified in AS 4040.3, the cladding system shall remain substantially in position, notwithstanding any permanent distortion, fracture or damage that might occur in the sheeting and fastenings.

APPENDIX A

ROOF VENTILATION, WATER VAPOUR AND CONDENSATION

(Informative)

Condensation is one of the biggest single items contributing to the deterioration of buildings. It can occur in all types of buildings, largely due to poor design or inappropriate use of materials and, once present, it is difficult to eliminate. The moisture is deposited within the structure, usually in inaccessible places and any damage caused is expensive to rectify. The problems which can be encountered include rotting of timber or corrosion of structural steel, reduction in the efficiency of bulk insulation, physical deterioration of ceilings made from absorbent materials and staining of walls and ceilings. Clearly, prevention is simpler and less expensive than cure.

Water vapour occurs naturally in the air and substantial quantities are added by such day to day activities as cooking, washing dishes and clothes, drying clothes indoors, combustion heating, showering and bathing, perspiration and the breathing of occupants and plants. The amount of vapour which can be supported by the air varies with the temperature and pressure—as air warms it is able to support more water vapour. Conversely, as air cools its relative humidity rises until it becomes saturated (the dew point). Cooling below dew point causes the vapour to condense as droplets of water.

All roofing absorbs radiation and becomes warmer. In turn, this heat is radiated at a rate dependent upon the emittance of the roofing. This emittance of radiant heat can continue after the source of heat is no longer present and the roof temperature can drop below that of the surrounding air. On cold clear nights, metal roofing temperatures of around five degrees (C) below the outside ambient temperature are quite common. When a build-up of water vapour occurs under these conditions, the water vapour will condense on the underside of the low temperature roof sheet. The condensation occurs as dew and excess quantitites fall from the roof as droplets. With very low pitch roofs, there is very little natural ventilation. Warm air naturally rises but has little tendency to move laterally, except when a strong wind blows into roof vents or causes substantial differences in air pressure on opposite side of the building. Consequently, ventilation of the roof space will not prevent condensation on the underside of the cold roofing.

A vapour barrier, generally metallic foil or plastic film, will inhibit the passage of water vapour. Correctly placed, it will prevent water vapour from reaching the cold surface. It should always be placed on the warm side of the structure, generally on the lower side of the roof where it is kept above dew point during cold weather. Where a ceiling is installed, the vapour barrier is usually, for aesthetic reasons, placed immediately above the ceiling lining. In air-conditioned buildings in hot, humid climates, the reverse applies—the vapour barrier is placed on the outside of the structure. In temperate climates, the foil sheet can also provide thermal insulation and support for bulk insulation in contact with the roof sheeting. In cold climates, or where greater insulation is desired, an additional vapour barrier or insulation sheet should be installed just above the ceiling.

Bulk insulation keeps ceilings warmer and roofing cooler than if no insulation is installed in the cavity and, being porous, allows water vapour to reach the cold roof surface where it condenses. In addition to the physical dangers to the structure and finishes, the increase in moisture content can reduce the effectiveness of the bulk insulation by up to 30%. Consequently, a vapour barrier should always be installed on the warm side of any bulk insulation.

STANDARDS AUSTRALIA

Amendment No. 1
to
AS 1562.1—1992
Design and installation of sheet roof and wall cladding

Part 1: Metal

REVISED TEXT

The 1992 edition of AS 1562.1 is amended as follows; the amendment should be inserted in the appropriate place.

SUMMARY: This Amendment applies to Clause 5.5.1.

Published on 12 July 1993.

AMDT No. 1 JULY 1993

Page 12 Clause 5.5.1

Delete existing Clause and *substitute*:

5.5.1 **Serviceability test** When the cladding system is subjected to the test pressure for serviceability limit state, in accordance with AS 4040.2, the maximum deflection of the cladding relative to the supporting members shall not exceed S/100 for AS 1170.2, Region A, or S/150 for AS 1170.2, Region B. Further, no de-indexing, unclipping, permanent local deformation, or fracture or failure of any part of the sheeting or of the fastenings shall occur, and the residual deflection 1 min after the removal of the pressure shall not exceed S/1000 (see also Note 1 to Clause 5.4.2).

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STANDARDS AUSTRALIA

Amendment No. 2
to
AS 1562.1—1992
Design and installation of sheet roof and wall cladding
Part 1: Metal

REVISED TEXT

The 1992 edition of AS 1562.1 is amended as follows; the amendment(s) should be inserted in the appropriate place.

SUMMARY: This Amendment applies to Clauses 1.1, 1.3.15, 2.2.2(c), 2.2.8, 3.2.1, 4.7(a), 5.3, 5.4.2, 5.5.1 and 5.6.2.

Published on 5 September 1995.

AMDT No. 2 SEP. 1995

Page 3 Clause 1.1

Delete all the existing text and *substitute* the following:

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 loading.

AMDT No. 2 SEP. 1995

Page 4 New Clause 1.3.15

After Clause 1.3.14 *add* the following new Clause:

1.3.15 Fastener spacing (p)—the maximum distance between fasteners, measured along the centreline of the supporting member.

AMDT No. 2 SEP. 1995

Page 5 New Clause 2.2.2(c)

After Clause 2.2.2(b) *add* the following:

2.2.2(c) Fastener sealing washers shall be prepared from weather-resistant rubbers which comply with ASTM D 2000 Specification 3BA 606 A14 B13, such as EPDM or neoprene chlorinated rubber. Fillers in the rubber shall be completely encapsulated, especially when conductive materials such as carbon are used. Linear electrical resistance between contact points 20 mm apart shall be greater than 1 MΩ.

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

AMDT No. 2 SEP. 1995

Page 5 Clause 2.2.8

Delete existing Clause 2.2.8.

AMDT No. 2 SEP. 1995

Page 6 New Note 3 to Clause 3.2.1

After Clause 3.2.1, Note 2 *add* the following new Note:

3 At the time of publication of this Standard, adequate methods of verification by calculation are not generally available. Consequently, it is anticipated that compliance with this Standard will normally be demonstrated by testing in accordance with Section 5.

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AMDT No. 2 SEP. 1995

Page 9 Clause 4.7(a)

In the last line *delete* the words 'sealing washer' and *substitute* with 'sealing systems'.

AMDT No. 2 SEP. 1995

Page 11 Clause 5.3

Add the following new sentence to the end of the Clause:

Identical units shall have the same mode of failure; however, they may be tested at different span configurations or length.

AMDT No. 2 SEP. 1995

Page 11 Clause 5.4.2

In line 3 *delete* the words 'The elastic deflection directly under the point of application, of that load shall not exceed S/100. Further,'.

AMDT No. 2 SEP. 1995

Page 12 Clause 5.5.1

Delete the existing Clause in AS 1562.1 and Amendment 1 of 1993 and *substitute* the following:

5.5.1 Serviceability test When the cladding system is subjected to the test pressure for serviceability limit state, in accordance with AS 4040.2, the maximum deflection of the cladding relative to the supporting members shall not exceed (S/120 + p/30). Further, no de-indexing, unclipping, permanent local deformation, or fracture or failure of any part of the sheeting or of the fastenings shall occur, and the residual deflection 1 min after the removal of the pressure shall not exceed S/1000 (see also Note 1 to Clause 5.4.2).

AMDT No. 2 SEP. 1995

Page 12 Clause 5.6.2

Line 3, *delete* the equation 'S/150' and *substitute* the following:

'(S/120 + p/30)'.

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