

The logo for Lysaght, featuring the word "LYSAGHT" in a bold, blue, sans-serif font. A blue swoosh underline is positioned beneath the letters, starting under the 'L' and ending under the 'T'.

**LYSAGHT**

A photograph of a modern building's facade, characterized by dark, vertical structural elements and a prominent horizontal overhang. The lighting creates strong shadows and highlights, giving the structure a three-dimensional appearance.

# REFEREE

34TH EDITION

**A HANDBOOK OF  
USEFUL INFORMATION**

# THE LYSAGHT REFEREE

34TH EDITION

**A HANDBOOK OF  
USEFUL INFORMATION**

PRODUCED BY

**LYSAGHT**

The logo for Lysaght, featuring the word "LYSAGHT" in a bold, blue, sans-serif font. A thick blue horizontal line is positioned below the letters, starting from the left edge of the 'L' and ending under the 'T', with a slight upward curve at the right end.

As a general reference handbook it is not possible to list contact addresses for all contributors and/or suppliers of products and services.

Information on many of the listed steel products is available from distributors of BlueScope products, located throughout Australia.

Product or contact information is also available by calling 1800 641 417 or by visiting our web site at [www.lysaght.com](http://www.lysaght.com).

COLORBOND®, ZINCALUME®, TRUECORE®, XLERPLATE®, DECKFORM®, GALVSPAN®, GALVALUME®, TRU-SPEC®, GALVABOND®, ZINCFORM®, ZINC HI-TEN®, ZINCANNEAL®, ZINCSEAL®, AQUAPLATE®, COOLMAX®, PERMAGARD®, Activate®, THERMATECH®, LYSAGHT®, CUSTOM ORB®, CUSTOM BLUE ORB®, CUSTOM ORB ACCENT®, TRIMDEK®, LYSAGHT TRIM-KLIP®, SPANDEK®, KLIP-LOK®, KLIP-LOK 700 HI STRENGTH®, KLIP-LOK CLASSIC®, LOK-KLIP®, FLATDEK®, MINI ORB®, PANELRIB®, MULTICLAD®, LYSAGHT WALLCLAD®, TRIMWALL®, EASYCLAD®, WEATHERLINE®, LONGLINE 305®, ENSEAM®, DOMINION®, LYSAGHT BAROQUE®, WAVELINE®, PERMALITE V-RIB®, LT7®, ALSPAN®, ALSULATE 125®, ROOFTRAK®, SHEERLINE®, TRIMLINE®, EMLINE®, FITFAST®, LYSAGHT OGEE®, LYSAGHT SHORELINE®, RANCELINE®, COLONIAL®, NOVALINE®, SUPRAFRAME®, SUPRATRUS®, TOPSPAN®, FIRMILOK®, LYSAGHT LIVING®, NEETASCREEN®, MINISCREEN®, SMARTASCREEN®, CUSTOMSCREEN®, LYSAGHT SLATSCREEN®, LYSAGHT LOUVRESCREEN®, BONDEK®, BONDEK PLUS®, INTERLOK®, PERMALITE®, RANBUILD®, ORB®, SUPAZED®, SUPACEE®, SupaPurlin®, BONFILL®, BONSTRIP®, BONWEDGE®, SURFMIST®, PAPERBARK®, EVENING HAZE®, DUNE®, WINDSPRAY®, PALE EUCALYPT®, COVE®, WHITEHAVEN®, GALACTIC®, COSMIC® and RHEA® are registered trademarks of BlueScope Steel Limited. LYSAGHT ZENITH™, LYSAGHT IMPERIAL™, CLASSIC CREAM™, SHALE GREY™ & LYSAGHT SMARTPARTS™ are trademarks of BlueScope Steel Limited. COLORSTEEL® is a registered trademark of New Zealand Steel Ltd. BUTLER® & Varco Pruden® are registered trademarks of BlueScope Buildings North America, Inc. TRUZINC® & PRIMAMAJU-R® are registered trademarks of NS BlueScope. Z-NAL®, TruZinc® & SPECTRASCAPE® are registered trademarks of Steelscape, Inc. ALLGAL® & SmartCOTE® are registered trademarks of Orrcon Manufacturing Pty. Ltd. BISSALOY® is a registered trademark of Bissalloy Steels Pty. Ltd. Roof Zips®, Auto Teks®, RippleZips® & Teks® are registered trademarks of ITW Australia Pty. Ltd. QUIKA-FLOOR® & Uni-Pier® are registered trademarks of Uni-Pier Australia Pty Ltd. 300PLUS®, 500PLUS® & TEMPCORE® are registered trademarks of OneSteel Manufacturing Pty. Ltd. SupaGal®, DuraGal® & KleenKote® are registered trademarks of Australian Tube Mills Pty. Ltd.

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# TABLE OF CONTENTS

<b>FOREWORD</b> .....	<b>7</b>
<b>INTRODUCTION TO BLUESCOPE</b> .....	<b>8</b>
OUR BOND.....	12
BLUESCOPE – A LONG & PROUD HISTORY.....	13
REFEREE HISTORY.....	17
UNDERSTANDING STEEL.....	19
CUSTOMER SUPPORT.....	22
AUSTRALIAN STEEL INSTITUTE.....	23
<b>PLATE, SHEET &amp; COIL</b> .....	<b>25</b>
XLERPLATE® STEEL.....	25
BISALLOY® STEEL.....	28
HOT ROLLED COIL.....	33
COLD ROLLED STEEL PRODUCTS.....	36
METALLIC COATED STEEL PRODUCTS.....	40
COLORBOND® PREPAINTED STEEL.....	46
<b>ROOFING &amp; WALLING PRODUCTS</b> .....	<b>58</b>
APPLICATION OF LYSAGHT CLADDING PROFILES.....	59
ROOF DRAINAGE.....	60
LYSAGHT CUSTOM ORB®.....	74
LYSAGHT CUSTOM BLUE ORB®.....	77
LYSAGHT CUSTOM ORB ACCENT® 21.....	79
LYSAGHT CUSTOM ORB ACCENT® 35.....	81
LYSAGHT TRIMDEK®.....	84
LYSAGHT TRIM-KLIP®.....	87
LYSAGHT SPANDEK®.....	89
LYSAGHT KLIP-LOK® 406.....	92
LYSAGHT KLIP-LOK® 700 HI STRENGTH.....	94
LYSAGHT KLIP-LOK CLASSIC® 700.....	96

LYSAGHT LOK-KLIP®	98
LYSAGHT FLATDEK®	100
LYSAGHT FLATDEK® II	102
LYSAGHT FLATDEK® 310	104
LYSAGHT MINI ORB®	106
LYSAGHT PANELRIB®	109
LYSAGHT MULTICLAD®	111
LYSAGHT WALLCLAD®	113
LYSAGHT TRIMWALL®	115
LYSAGHT EASYCLAD®	117
LYSAGHT WEATHERLINE®	119
LYSAGHT ZENITH™ ARCHITECTURAL CLADDING RANGE	121
LYSAGHT LONGLINE 305®	122
LYSAGHT ENSEAM®	125
LYSAGHT IMPERIAL™	127
LYSAGHT DOMINION®	129
LYSAGHT BAROQUE®	131
PERMALITE® ALUMINIUM CLADDING RANGE	133
PERMALITE WAVELINE®	134
PERMALITE V-RIB®	135
PERMALITE LT7®	136
PERMALITE ALSPAN®	137
PERMALITE ALSULATE-125®	138
LYSAGHT ROOFTRAK® 675 & 450	139
<b>RAINWATER GOODS</b>	<b>140</b>
LYSAGHT® QUAD 115 HI-FRONT GUTTER	140
LYSAGHT® QUAD 115 LO-FRONT GUTTER	143
LYSAGHT® QUAD 150 HI- & LO-FRONT GUTTER	144
LYSAGHT® QUAD 175 GUTTER	145
LYSAGHT® QUAD (D) 125 GUTTER	146
LYSAGHT® QUAD SQUARE BEAD GUTTER UTTER	147

LYSAGHT SHEERLINE® GUTTER.....	148
LYSAGHT TRIMLINE® GUTTER.....	150
LYSAGHT EMLINE® GUTTER.....	152
LYSAGHT FITFAST® GUTTER.....	153
LYSAGHT® HALF ROUND GUTTER.....	154
LYSAGHT® FLATBACK GUTTER.....	157
LYSAGHT® HALF ROUND 190 GUTTER.....	159
LYSAGHT® FLATBACK 190 GUTTER.....	160
LYSAGHT OGEE® GUTTER.....	161
LYSAGHT SHORELINE® GUTTER.....	163
LYSAGHT SHORELINE® MINI GUTTER.....	164
LYSAGHT RANCELINE® GUTTER.....	165
LYSAGHT COLONIAL® GUTTER.....	166
LYSAGHT® QUARTER ROUND GUTTER.....	167
LYSAGHT NOVALINE® FASCIA.....	168
LYSAGHT NOVALINE® REBATE FASCIA.....	170
DOWNPIPES.....	171
FLASHINGS.....	173
ROOF DRAINAGE.....	174

## **HOUSE FRAMING COMPONENTS..... 183**

LYSAGHT SUPRAFRAME®.....	183
LYSAGHT SUPRATRUSS®.....	185
STEEL BUILDING FRAME SYSTEM.....	186
LYSAGHT QUIKA-FLOOR® SYSTEM.....	187
TOPSPAN® SECTIONS.....	189

## **HOME IMPROVEMENTS..... 195**

LYSAGHT FIRMLOK®.....	195
LYSAGHT FLATDEK®.....	199
LYSAGHT FLATDEK® II.....	201
LYSAGHT FLATDEK® 310.....	203

LYSAGHT LIVING®.....	205
<b>LYSAGHT FENCING RANGE.....</b>	<b>209</b>
LYSAGHT NEETASCREEN® FENCING.....	210
LYSAGHT MINISCREEN® FENCING.....	211
LYSAGHT SMARTASCREEN® FENCING.....	212
LYSAGHT CUSTOMSCREEN® FENCING.....	213
LYSAGHT SLATSCREEN®.....	214
LYSAGHT LOUVRESCREEN®.....	215
LYSAGHT GATES.....	216
THE PLUS RANGE.....	219
CYCLONIC FENCE RANGE.....	220
<b>RAINWATER TANKS.....</b>	<b>222</b>
<b>STRUCTURAL SOLUTIONS.....</b>	<b>225</b>
LYSAGHT SUPAZED® PURLIN.....	225
LYSAGHT SUPACEE® PURLIN.....	225
ZED SECTION PURLIN.....	229
CEE SECTION PURLIN.....	229
LYSAGHT® COLD FORM SECTION.....	231
STRUCTURAL STEEL DECKING.....	233
LYSAGHT BONDEK®.....	233
LYSAGHT BONDEK PLUS®.....	235
LYSAGHT BONDEK PLUS® 2P.....	237
LYSAGHT INTERLOK® II.....	241
<b>STRUCTURAL STEEL.....</b>	<b>243</b>
REINFORCING BARS.....	252
SURFACE PROTECTION GUIDE FOR STRUCTURAL STEEL.....	258
STRUCTURAL STEEL IN HOUSING.....	262
<b>STRUCTURAL &amp; PIPELINE PRODUCTS.....</b>	<b>275</b>
4 RECTANGULAR HOLLOW SECTIONS (RHS).....	279

SQUARE HOLLOW SECTIONS (SHS).....	283
CIRCULAR HOLLOW SECTIONS (CHS).....	287
<b>BUILDING SOLUTIONS.....</b>	<b>294</b>
PERMALITE® ALUMINIUM BUILDING PRODUCTS.....	294
RANBUILD® SHEDS & GARAGES.....	295
THE ROOFING CENTRE TASMANIA.....	296
KITELEYS.....	296
METALFORM.....	296
<b>PRACTICAL ADVICE ON USING STEEL.....</b>	<b>297</b>
ON-SITE SAFETY FOR EVERYONE.....	298
SERVICE CONDITIONS AND SUITABLE PRODUCTS.....	302
ATMOSPHERIC EXPOSURE CONDITIONS – STEEL CLADDING.....	304
HANDLING AND SITE NOTES.....	311
EXTERNAL FASTENERS.....	316
ADHESIVES FOR JOINING STEEL SHEET PRODUCTS.....	320
SOLDERING ZINCALUME® STEEL.....	325
SEALANTS FOR ZINCALUME® STEEL & COLORBOND® STEEL.....	326
PAINTING OF ZINC-COATED & ZINCALUME® STEEL SHEET.....	328
<b>SUSTAINABILITY.....</b>	<b>333</b>
REDUCING OUR ECOLOGICAL FOOTPRINT.....	342
HERITAGE CONSERVATION.....	348
<b>USEFUL RURAL INFORMATION.....</b>	<b>351</b>
STOCK BREEDING TABLE.....	355
CAPACITY OF TANKS – CALCULATIONS.....	357
AVERAGE DISTRICT RAINFALL THROUGHOUT AUSTRALIA.....	359
AUSTRALIAN RAINFALL DISTRICTS.....	363
MAJOR DAMS AND RESERVOIRS IN AUSTRALIA.....	367
AERIAL AGRICULTURE.....	371

<b>GENERAL INFORMATION</b> .....	<b>375</b>
STEEL ROAD SAFETY BARRIERS.....	375
CONCRETE.....	378
CONCRETE CONSTRUCTION.....	382
MASONRY – BRICKWORK AND BLOCKWORK.....	388
BRICKWORK DIMENSIONS FOR MODULAR BRICKS.....	391
SAFETY PRECAUTIONS.....	395
ELECTRICAL INSTALLATION.....	396
LIQUEFIED PETROLEUM GAS (LPG).....	401
MASS DENSITIES OF MATERIALS.....	403
GEOMETRY AND MENSURATION.....	406
TRIGONOMETRIC RATIOS.....	414
CONVERSION FACTORS.....	417
AUSTRALIA - LAND MASS.....	420
DISTANCES BETWEEN AIRPORTS.....	421
METALLURGICAL TERMS.....	422
BUILDING & ENGINEERING TERMS.....	432
<b>USEFUL WEBSITES</b> .....	<b>444</b>
<b>INDEX</b> .....	<b>451</b>

## INFORMATION IN THE REFEREE

The Referee's aim is to supply general information to a wide range of businesses, trades and professions. For that reason it does not attempt to cover all aspects of each subject.

In addition to Lysaght's own product, technical and general information we have utilised a range of reference sources in compiling this edition of The Referee.

While every effort has been made to ensure the currency and accuracy of the information presented herein the reader should contact the individual supplier of any goods and services mentioned to assure themselves of having the most up-to-date accurate information.

# FOREWORD

One hundred and fifty years ago, a twenty-five year old Irishman named John Lysaght bought a small galvanising works in Bristol, England and in doing so marked the foundation of the LYSAGHT® brand as it is known today. At the time, Lysaght could never have imagined the success of his early business or the way it has shaped the Australian and international building industries.

Today, the company John Lysaght started is part of Australia's leading steel company, BlueScope Steel Limited, and his name is perpetuated in the company's building products business, Lysaght, publisher of the Lysaght Referee.

The Referee was first published in 1897 when large parts of the output of the English rolling mills of John Lysaght were destined for Australia to support the growth of a quickly developing nation. This tradition has continued over the years and Lysaght is proud to continue distributing this iconic publication.

The strength of The Referee has always been its range of content. It is a valuable rich source of varied information for builders, plumbers, business people, farmers, architects, engineers, students - and just about anybody who's handy with the contents of a toolbox. Much of the latter "useful" and "general" information sections have overtime been labelled quirky and irrelevant in today's society though given the extensive reader group remain a valued inclusion in The Referee.

Since the last edition of The Referee in 2012, BlueScope has implemented many exciting developments including numerous mergers, acquisitions and new product offerings in both the domestic and international markets. This thirty-fourth edition not only details these achievements but celebrates the long and proud history of the LYSAGHT® brand on its sesquicentennial anniversary having now reached 150 years of age. And while our company's history is of great interest and importance, current global activities are of equal significance so in this edition you'll also find detail on steel in the sustainable environment and numerous new useful web sites relevant to the building and construction industries.

Some information in this edition has been provided by outside sources and recognised authorities. While great care has been taken to ensure accuracy, no responsibility can be accepted for any errors which may have escaped the attention of the editors. We hope you will find this edition of The Lysaght Referee as useful as generations before you.

# INTRODUCTION TO BLUESCOPE

## **A different kind of steel building products company**

The transformation of BlueScope in recent years has resulted in a more diversified business with a greater contribution from value-added steel products, principally focused on building and construction markets. We also enjoy greater geographic diversity with our portfolio spanning 18 countries – a mix of rich developed and developing economies – providing significant growth opportunities to expand the contribution from our high value-added steel products made in-country.

In short, we have created a steel building products company that is differentiated from its peers.

Today, BlueScope employs over 14,000 people across five key business segments outlined below:

### **Australian Steel Products**

BlueScope Australian Steel Products employs around 6,000 employees across hundreds of sites in Australia.

We specialise in flat steel products, including slab, hot rolled coil, cold rolled coil, plate and value-added metallic coated and painted steel solutions. Our key focus is on higher value, branded products for the building and construction industry.

Our iconic steelworks at Port Kembla - in New South Wales' Illawarra region - is the largest steel production facility in Australia with an annual production capacity of approximately 3.2 million tonnes.

BlueScope's branded products are market leaders in Australia, and include COLORBOND® steel, ZINCALUME® metallic coated steel, TRUCORE® steel house framing, and the LYSAGHT® brand of quality steel building products.

The Lysaght business rollforms and supplies a range of products, including roof and wall cladding, steel house framing, rainwater products, fencing, structural products such as purlins and flooring systems, meshes and walkways, and home improvement products. LYSAGHT® products are sold through distributors and suppliers.

Additionally, BlueScope has several other businesses within its Australian portfolio, including Fielders, Orrcon Steel, Ranbuild and Metalcorp.

## **New Zealand Steel and Pacific Islands**

New Zealand Steel and Pacific Islands business comprises the Waikato North Head mine, the Glenbrook steelworks, the Pacific Steel rolling mill and the Pacific Islands businesses.

New Zealand Steel, the only fully integrated steel producer in New Zealand, uses locally-sourced iron sand and coal to manufacture about 650,000 tonnes of steel slab and billet a year at the Glenbrook steelworks south of Auckland. It produces a range of flat and long steel products for domestic and export use, and supplies all major markets including construction, manufacturing, infrastructure, packaging and agriculture.

The integrated steelmaking process starts with the Waikato North Head iron sands mine, which supplies approximately 1.2 mtpa of iron sands concentrate to the Glenbrook Steelworks, sufficient to meet its annual production requirements. The mine is operated under a long-term exclusive license with the New Zealand government.

The Glenbrook steelworks comprises ironmaking, steelmaking, a slab and billet caster, a hot and cold rolling mill, galvanising line, a paint line and a hollow sections mill. Slabs are rolled into hot and cold rolled products, which are then sold or further processed into products like hollow sections, galvanised steel, ZINCALUME® and COLORSTEEL steel products. Steel billets are produced at Glenbrook and sent via rail to Pacific Steel rolling mill for domestic reinforcing and wire products.

Our New Zealand and Pacific Islands business employs around 1400 people.

## **BlueScope Buildings North America**

Buildings North America is a leader in engineered building solutions. With more than 2,200 employees, it services the low-rise non-residential construction needs of customers in North America. This business also includes the BlueScope Properties Group, which develops industrial properties, predominantly warehouses and distribution centres.

Buildings North America partners with BlueScope's customers, many of them global brands and Fortune 500 companies such as Costco, to deliver the buildings they need, wherever they are doing business, by leveraging BlueScope's network of manufacturing facilities and sales offices. In this way, BlueScope has a unique proposition to design, manufacture and construct buildings for clients who want to standardise construction across their operations.

Our customers, working with our program account team, are able to realise significant savings in the total cost of their buildings, and in an industry where time is money, these customers are benefiting from significant reductions in their construction schedules. As well, the Company's innovative building designs and engineering systems can reduce the building weight per square metre, which also results in substantial cost savings for clients.

In addition to a range of custom engineered steel buildings, such as factories, bulk warehouses and stores, Buildings North America manufactures and markets framing and cladding systems and steel building components. Its Butler® and Varco Pruden® brands are highly recognised in the industry.

## **BlueScope Building Products Asia and North America**

Building Products Asia and North America comprises the Company's metal coating, painting and roll-forming businesses, employing 3,000 people across 29 plants in Indonesia, Thailand, Malaysia, Vietnam, Singapore, Brunei, Myanmar and the US. This business also includes 1,200 people in Building Products China, comprising metal coating, painting and Lysaght operations, and China engineered building solutions.

Building Products produces a portfolio of highly competitive, locally manufactured, premium sustainable products for the residential and non-residential building segments. BlueScope continues to develop high quality branded products tailored to meet specific regional needs, such as Clean COLORBOND® steel which is resistant to tropical discolouration. Other successful brands include PRIMAMAJU® steel and TRUZINC® galvanised steel. In North America, the Building Products range includes Z-NAL®, TruZinc® and SPECTRASCAPE® steels.

The business targets building and construction markets, leveraging operating technologies and supply chain and business development opportunities across BlueScope's network. It is a technology leader in metal coated and painted steel building products, principally focussed on the NS BlueScope Coated Products joint venture with Nippon Steel & Sumitomo Metal Corporation which came into effect in March 2013.

### **North Star BlueScope Steel**

Established in 1996, the facilities of this highly productive mini-mill are among the newest in North America, and use leading edge steelmaking technologies and processes. Around 2 million tonnes of hot rolled coil are produced annually from North Star's dual electric arc furnaces, using scrap metal, pig iron and alloys. North Star BlueScope Steel ranks fifth by volume in the production of hot rolled coil in North America, and is consistently voted the number one flat rolled steel supplier in North America in the annual Jacobson Survey of steel customers measuring customer satisfaction.

In October 2015, BlueScope acquired the remaining 50 per cent of North Star BlueScope Steel from Cargill Inc. to move to full ownership of this business.

# OUR BOND

We and our customers proudly bring inspiration, strength and colour to communities with BlueScope.

## **OUR CUSTOMERS ARE OUR PARTNERS**

Our success depends on our customers and suppliers choosing us. Our strength lies in working closely with them to create value and trust, together with superior products, service and ideas.

## **OUR PEOPLE ARE OUR STRENGTH**

Our success comes from our people. We work in a safe and satisfying environment. We choose to treat each other with trust and respect and maintain a healthy balance between work and family life. Our experience, teamwork and ability to deliver steel inspired solutions are our most valued and rewarded strengths.

## **OUR SHAREHOLDERS ARE OUR FOUNDATIONS**

Our success is made possible by the shareholders and lenders who choose to invest in us. In return we commit to continuing profitability and growth in value, which together make us stronger.

## **OUR COMMUNITIES ARE OUR HOMES**

Our success relies on communities supporting our business and products. In turn, we care for the environment, create wealth, respect local values and encourage involvement. Our strength is in choosing to do what is right.

# BLUESCOPE – A LONG & PROUD HISTORY

BlueScope is one of the newest names in the global steel industry, yet it has a long and proud history as an efficient, trusted and innovative steel maker.

The company evolved from the coming together of three companies that pioneered the Australian steel industry in the early 20th Century – The Broken Hill Proprietary Company Limited (BHP), John Lysaght (Australia) Pty Ltd (Lysaght's) and Australian Iron and Steel Limited (AI&S) – with the more recent acquisitions of international companies, New Zealand Steel, Butler Manufacturing Company, Smorgon Steel Distribution and IMSA Steel Corporation. The three original companies were led by pioneers of the Australian steel industry - John Lysaght, the Hoskins brothers, and the man who persuaded BHP to go into steel, Guillaume Delprat.

The story of these three companies begins as early as 1857, when John Lysaght bought a small galvanising works in Bristol, England, and selected "Orb" as the brand his product would carry. From the early years, much of the galvanised iron had been exported, with Australia as an important consumer. At this time, each individual merchant was buying direct from England though this arrangement had not proved very successful for the parties involved. John Lysaght decided to establish a Central Selling Agency in Australia through which all Australian sales would be made. The agency was opened in Melbourne in 1880 with other branches to follow in other Australian states. During this time the first Lysaght Referee was distributed through the Australian market.

BHP at the time had developed into a successful mining company following Charles Rasp's discovery of the world's richest known deposits of silver, lead and zinc at Broken Hill in 1883. For more than 45 years, the BHP Big Mine was to produce fabulous wealth for its owners and make a substantial contribution to the growth of Australia's economy.

In 1912, BHP's General Manager Guillaume Delprat took his vision for an Australian steel industry to the directors of BHP. At his urging work began on a new steelworks at Newcastle in New South Wales, that for many years was to be the backbone of BHP's steelmaking operations. In 1915 the steelworks was completed and officially opened by Governor-General Sir Reginald Ferguson and while World War One and the depression hampered activities in the early years, BHP successfully forged ahead, experiencing significant growth.

In 1914 to 1918 the galvanised iron production capabilities of Lysaght's in Bristol, England were crippled as a result of World War One. The meagre resources available were mainly directed at the special needs of war and emphasised the isolation of the Australian business and its dependence on British production. The dangerous significance of this situation was realised very early by the firm and arrangements were made at Newcastle to erect a galvanised iron manufacturing facility beside BHP's new steelworks. To mark the coming of an era the Australian organisation was renamed John Lysaght (Australia) Pty Ltd and the head office was transferred from Melbourne to Sydney.

Meanwhile, Charles and George Hoskins were experiencing great success in running an iron foundry business in Ultimo, Sydney. Using their highly developed skills and knowledge, the Hoskins brothers took over William Sandford's ailing Lithgow Steelworks in 1907 (originally opened in 1876) and became the first people to profitably make steel in Australia. Under Sandford's management the Steelworks had not proved financially viable, and it soon became clear to Charles Hoskins that Lithgow was not a suitable location for the plant. Despite this, and the increasing competition from BHP, the Lithgow works flourished during World War One with the manufacture of many special steels that could no longer be imported.

However, during the early 1920s, the Lithgow works continued to fall behind the increasingly technologically sophisticated BHP works in Newcastle. In 1924, Charles Hoskins and his son Cecil acquired land at Port Kembla for the development of an integrated steelworks. Port Kembla was the obvious choice for the steelworks given its deep water harbour, high quality coal deposits, family owned coke ovens at nearby Wongawilli, proximity to limestone deposits at Marulan and the reasonably close proximity to the NSW capital, Sydney.

The steelworks was carefully planned to avoid the inefficiencies of the Lithgow works and allow for future growth and development. The plans included facilities not only for making steel, but also for production of rolled steel sheets. The financial requirements of its development led to the formation of a new company, Australian Iron and Steel Limited in 1928.

Charles Hoskins died in 1926 but his sons continued his work and on 29 August 1928 Charles' widow Emily commissioned the No. 1 Blast Furnace.

BHP acquired AI&S in 1935, and at this time made an offer to sell the sheet steel facilities to Lysaght's, provided they installed and operated a sheet plant at Port Kembla with an output double that of the existing AI&S plant. The official purchase went through in March 1936, and Lysaght's designed and erected the Lysaght Springhill plant adjoining the AI&S facilities. During its construction, production continued at the AI&S plant until 1939 when the new Lysaght Springhill plant was completed.

With BHP and Lysaght's now with significant interests in Newcastle and Port Kembla, both companies continued to grow and prosper. Numerous improvements to the plants and facilities occurred, domestic and international foot prints broadened and significant steel product innovations were launched.

The 1960s was a big decade for Lysaght's as they launched COLORBOND® steel into the market, closed the Newcastle sheet steel plant, purchased a 600 hectare site at Western Port to build a vast new steel mill and BHP acquired a 50% share in their ownership. In 1971, Lysaght's acquired the steel building products division of Brownbuilt resulting in a merger of the similar product offers and renamed the building products division Lysaght Brownbuilt Industries. This placed them as the biggest steel building products supplier in Australia.

The remainder of the 1970s continued as a significant time in Lysaght's history as the Western Port facilities were commissioned, ZINCALUME® steel was launched and BHP acquired the remaining 50% of John Lysaght (Australia) Pty Ltd in 1979 from British firm GKN (Guest Keen & Nettlefords Limited) which had superseded John Lysaght as the parent company. This acquisition was the final step in bringing together three separate ventures into one proud company.

In 1985, BHP restructured the business and John Lysaght (Australia) Limited became known as the Coated Products Division of BHP Steel. It incorporated all aspects of the old company with the sheet manufacturing business operating as Sheet & Coil Products. Lysaght Brownbuilt Industries was the only divisional unit of Coated Products division to retain the original Lysaght name which is synonymous with high quality steel building products though retired the Brownbuilt name and became known as Lysaght Building Industries in 1987.

The 1980s and 90s saw major changes in the industry and the growth of BHP's steel business in South-East Asia. BHP made huge investments in modernisation, but it was also a period of consolidation and rationalization which saw the closure of the Newcastle Steelworks, the acquisition of New Zealand Steel, and the Lysaght name was retired as Lysaght Building Industries and became known as BHP Building Products and later reintroduced as BHP Steel Lysaght in 1999.

In 2000, the long products business became OneSteel Limited, an independent, publicly listed company and then in 2001, having merged with Anglo-South African mining company Billitton Plc, BHP decided to quit steel altogether. Its remaining steel business was floated on the Australian Stock Exchange in 2002 as an unrelated public company, which today is BlueScope Steel Limited. Since the public listing BlueScope has expanded further into Asia with the development of new plants in China, Indonesia, Thailand and Vietnam.

In 2004, the company acquired the United States based Butler Manufacturing Company, which had started life in the early 1900s, manufacturing grain bins in the United States and has grown to become the leader in pre-engineered metal buildings in North America and China. The most recent acquisitions mark another significant move in BlueScope The Lysaght Referee has been an Australian building and construction industry institution since its first publication in Melbourne in 1897 as "The Metal Trades Referee and Storekeepers Guide".

# REFEREE HISTORY

With over one hundred and ten years in circulation, this long and proud tradition has seen the publication of thirty-two editions. The eleventh edition saw the first publication under the title “The Lysaght Referee”, coinciding with the opening of Lysaght’s first Australian factory at Newcastle in New South Wales, and the first Australian production of ORB® brand galvanised corrugated steel sheet.

To browse through all the editions of the Referee is to take a journey through the history of a company and a country, as well as to learn something of

the various trades and citizens catered for by the handbook. One sees reference to old Lysaght brand names, prices, terms, how to detect signs of or treat ague, apoplexy, delirium tremens, rupture, snake bite, sore feet or sunstroke. Key highlights in Australian history can also be noted, such as the conversion from imperial to metric systems of weights and measures and implementation of the decimal currency system.

Compare the content in this thirty-fourth edition of The Lysaght Referee to that of the first and you will notice vast developments in the progressive steel industry over time. The first edition contained only thirty-two pages, a far cry from the 400 pages detailed in this edition. The diversification and development of the Lysaght business and products through time are detailed throughout each edition of the handbook. Exploring buildings and architectural history along with the Lysaght Referees of that time demonstrates the way BlueScope and LYSAGHT® products have helped shape the Australian built environment over the past one hundred and fifty years.

Now considered unique and sometimes quirky, the relevance of the “useful” and “general” information sections is now regarded as company heritage within the handbook and the publishers feel it important to maintain these historical qualities. Information such as stock breeding tables and hay stacks volume calculations were included to assist farmers and are known by the company to still be used today. The Lysaght Referee is a sought after publications with many avid collectors endeavouring to grow complete sets of the thirty-fourth editions. Early editions of the handbook have been known to be sold in secondhand bookstores and in more recent years have even been available for auction on eBay. A full list of the titles and publication years of The Lysaght Referee is detailed on the next page:

<b>Edition</b>	<b>Year</b>	<b>Title</b>
1st	1897	The Metal Trades' Referee and Storekeepers' Guide
2nd	1900	The Metal Trades' Referee and Storekeepers' Guide
3rd	1906	The Metal Trades' Referee and Storekeepers' Guide
4th	1908	The Metal Trades' Referee and Storekeepers' Guide
5th	1908	The Metal Trades' Referee and Storekeepers' Guide
6th	1910	The Metal Trades' Referee and Storekeepers' Guide
7th	1912	The Metal Trades' Referee
8th	1914	The Metal Trades' Referee With Other Useful Information
9th	1916	The Metal Trades' Referee With Other Useful Information
10th	1918	The Metal Trades' Referee With Other Useful Information
11th	1920	The Referee. A Handbook of Useful Information
12th	1922	The Referee. A Handbook of Useful Information
13th	1923	The Referee. A Handbook of Useful Information
14th	1924	The Referee. A Handbook of Useful Information
15th	1927	The Referee. A Handbook of Useful Information
16th	1934	Lysaght's Referee. A Handbook of Useful Information
17th	1938	Lysaght Referee. A Handbook of Useful Information
18th	1950	Lysaght Referee. A Handbook of Useful Information
19th (Centenary)	1957	Lysaght Referee. A Handbook of Useful Information
20th (Centenary)	1957	Lysaght Referee. A Handbook of Useful Information
21st	1961	Lysaght Referee. A Handbook of Useful Information
22nd	1963	Lysaght Referee. A Handbook of Useful Information
23rd	1967	Lysaght Referee
24th	1972	Lysaght Referee
25th	1974	Lysaght Referee
26th	1981	Lysaght Referee
27th	1985	The Referee
28th	1988	The Referee. A Handbook of Useful Information
29th (Centenary)	1997	The Referee
30th	1999	Lysaght Referee
31st	2005	Lysaght Referee
32nd	2008	Lysaght Referee
33rd	2012	Lysaght Referee. 33rd Commemorative Edition
34th	2019	Lysaght Referee. A Handbook of Useful Information

# UNDERSTANDING STEEL

## WHAT IS STEEL?

Have you ever tried to imagine your world without steel? It's the metal that provides you with cars, bridges, trains and buses for transport, house frames, roofs and fences for protection, sporting equipment and venues for leisure, and electrical appliances and furniture for comfort and convenience.

Steel is a general term for iron containing small amounts of carbon, manganese and other elements.

Steel is used to make such a wide range of products because it possesses many useful features which can be controlled and slightly changed to suit a particular purpose.

## IRONMAKING

In traditional blast furnace technology, iron is extracted from iron ore at high temperatures in a reduction process. Coke and fluxes are the other materials required in this process.

## BASIC OXYGEN STEELMAKING

A Basic Oxygen Steelmaking (BOS) vessel holds about 280 tonnes of steel. Molten iron and scrap are charged into the vessel. Almost pure oxygen is blown into the vessel, causing the temperature to rise and carbon content to be lowered. The resulting product is molten steel. This is the method used at BlueScope's integrated steelworks at Port Kembla.

## ELECTRIC ARC FURNACE STEELMAKING

An Electric Arc Furnace (EAF) is used to produce new steel from scrap metal or other iron feed such as HBI (Hot Briquetted Iron). Electrodes produce arcs of electricity to the charge, which melt the iron and reduce it to molten steel. This is the method used at the company's Delta, Ohio, operations in the USA.

## CASTING

Liquid steel is cast continuously into lengths so it can be rolled into a variety of shapes and sizes.

## ROLLING

Cast steel is a relatively weak mass of coarse, uneven metal crystals, or 'grains'. Rolling causes this coarse grain structure to recrystallize into a much finer grain structure, giving greater toughness, shock resistance and tensile (stress) strength.

Rolling is the main method used to shape steel into different products. There are two types of rolling – hot and cold.

The rolling process (for both hot and cold) consists of passing the steel between two rolls revolving at the same speed but in opposite directions. The gap between the rolls is smaller than the steel being rolled, so that the steel is reduced in thickness and at the same time lengthened.

## COATING AND PAINTING

Some cold-rolled products are coated with other metals or paint to protect the steel surface, or to give the steel special characteristics.

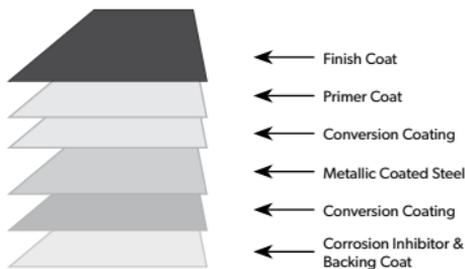
Next Generation ZINCALUME® steel is steel strip with a zinc/aluminium/magnesium alloy coating. The coating makes the steel more corrosion resistant.

The process involves cleaning, annealing and then coating the strip. Annealing is a general term which describes processes that clean and soften the steel and prepare it for further machining.

The strip enters a coating bath that contains the heated zinc/aluminium mixture. The strip then passes by jets that control the amount of metal coating by blowing off any excess.

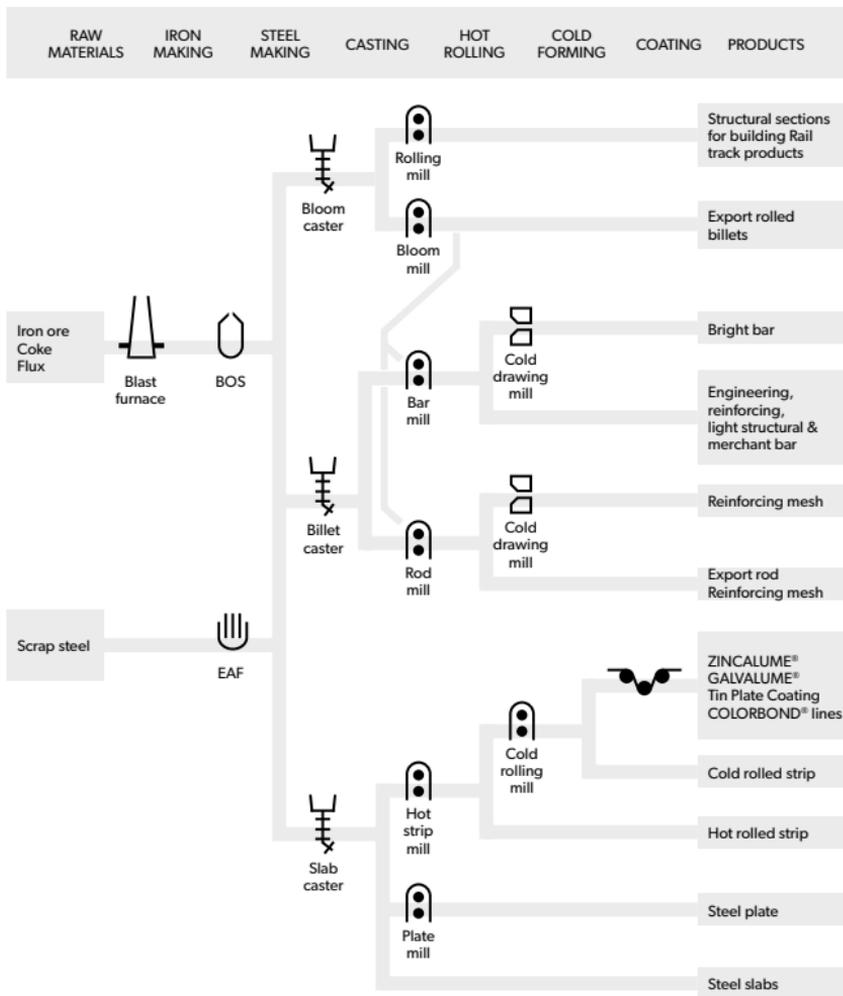
COLORBOND® prepainted steel is normally metallic coated steel which is painted.

The steel strip is cleaned and a conversion coating applied to ensure good paint adhesion.



## THE STEEL PATHWAY

The pathway from raw material to finished steel product is a complex one. This chart shows the main steps involved in the process.



# CUSTOMER SUPPORT

## STEEL – CORRECT SELECTION FOR USE & TECHNICAL SERVICES

Selection of the correct steel type or product with the appropriate finish is the first and perhaps most important step in producing a finished article or goods.

The Referee offers broad information about steel in the building and construction industry. For more in-depth information on individual product, BlueScope offers a number of avenues.

BlueScope has a comprehensive product website. The latest information on all our products and services is available 24/7 for your convenience:

[www.steel.com.au](http://www.steel.com.au).

In each State capital and in some regional centres, there is a BlueScope sales office with staff trained to assist customers in the selection of the most cost effective material for their requirements. BlueScope staff can also help solve problems which may arise through the application of this material. Printed data and other information on steel sheet products are freely available.

Product information is also available from BlueScope's Customer Support Centre, Port Kembla, referred to as:

### **BlueScope Steel Direct:**

T: 1800 800 789

F: 1800 800 744

# AUSTRALIAN STEEL INSTITUTE

Australia's steel industry employs 100,000 people, has an annual turnover of \$29 billion and produces 5.3 million tonnes of steel a year. The Australian Steel Institute (ASI) was, formed in 2002 from the amalgamation of two long established steel bodies, the Australian Institute of Steel Construction (AISC) and the Steel Institute of Australia (SIA), as the peak industry association representing this important sector of the Australian economy.



AUSTRALIAN STEEL INSTITUTE

The Institute's mission is to deliver increased use of Australian steel and improved industry competitiveness in construction and other strategic markets. The ASI provides marketing & technical leadership to promote Australian-made steel as the preferred material to building, construction and manufacturing industries and policy advocacy to government. Membership of ASI covers the full spectrum of companies and individuals involved in the manufacture, distribution, rollforming, fabrication, design, detailing, education, surface protection and construction of steel. Membership also includes suppliers of goods and services to the industry.

The ASI has four key objectives:

1. Understand and communicate Australian steel industry capability and competitiveness.
2. Focus on segment growth opportunities.
3. Provide an information exchange and communication service for members.
4. Influence external parties to use steel.

The ASI's competitive advantage is its ability to unite and align sectors of the industry to focus on common goals, and to leverage industry efforts and funding to deliver cost effective outcomes. Through its representation of the vertical channels (supplier/customer) and horizontal channels (competitors), ASI provides independence and credibility to leverage industry influence, and economy of scale to provide member services.

ASI core business activities are coordinated and supported by a wide range of committees, councils and task forces operating under a charter determined by the Board. The full channel and national reach of ASI's activities provides a united and externally focussed industry body committed to adding value to its members in the steel value chain.

For more information visit the ASI web site at [www.steel.org.au](http://www.steel.org.au).

# PLATE, SHEET & COIL

## PLATE GRADES - XLERPLATE® STEEL

XLERPLATE® steel is available in structural, analysis, boiler and pressure vessel grades. Visit [www.steel.com.au](http://www.steel.com.au) to download the current datasheets.

Structural Grades (AS/NZS 3678) - Plate for structural applications including floor plate.

Analysis Grades (AS/NZS 3678) - Plate that meets a specific chemical composition.

Boiler & Pressure Vessel Grades (AS 1548) - Plate designed for boiler and pressure vessel applications.

## PRODUCT DIMENSIONS<sup>(1)(2)</sup>

### XLERPLATE® steel

Dimension Availability: 1200 - 3200mm width  
5 - 100mm thickness  
2.4 - 3.2m lengths

### XLERPLATE® Coil Plate steel

Dimension Availability: 910 - 1800mm width  
3.0 - 12mm thickness<sup>(3)</sup>  
1.2 - 9.6m lengths as standard  
9.601 - 12m lengths by enquiry

(1) Note - Other sizes may be available subject to enquiry.

(2) Note - Not all thickness and width combinations are available. Refer to BlueScope Steel Direct on 1800 800 789.

## XLERPLATE® STEEL PLATE MASS CALCULATIONS

Plate Mass (t) = Density (t/m<sup>3</sup>) x width (m) x length (m) x thickness (m)

Mass = 7.85 x 3 x 9 x 0.01

= 2.120t

## PLATE GRADES - TRU-SPEC® STEEL

TRU-SPEC® steel is available in a range of structural grades, widths and lengths. Typically used in light and standard structural members, brake press forming applications, light poles, trailer and automotive components, general fabrications and galvanising applications. Visit [www.steel.com.au](http://www.steel.com.au) to download the current datasheets.

Structural Grades (AS/NZS 1594) – Hot-rolled steel plate, floorplate, sheet and strip.

### PRODUCT DIMENSIONS<sup>(1)(2)</sup>

#### TRU-SPEC® steel

Dimension Availability:	910 – 1550mm width
	1.5 – 12.7mm thickness
	1200 – 9600mm lengths

(1) Note - Other sizes may be available subject to enquiry.

(2) Note - Not all thickness and width combinations are available. Refer to BlueScope Steel Direct on 1800 800 789.

### TRU-SPEC® STEEL PLATE MASS CALCULATIONS

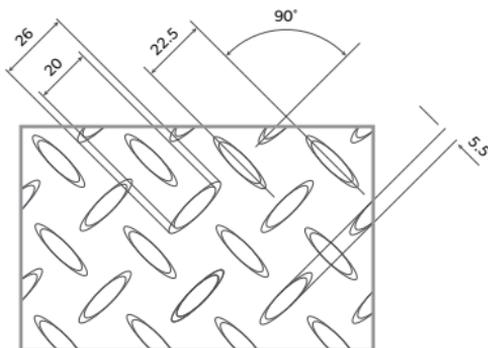
$$\begin{aligned}
 \text{Plate Mass (t):} &= \text{Density (t/m}^3\text{) x width (m) x length (m) x thickness (m)} \\
 &= 7.85 \times 1.0 \times 9.6 \times .12 \\
 &= 9.043\text{t}
 \end{aligned}$$

## FLOOR PLATE

Floor Plate is characterised by a raised angular pattern (see diagram) rolled on to one surface. The nominal thickness of floor plates is exclusive of the raised pattern.

XLERPLATE® Floor Plate steel is produced on the plate mill to AS/NZS 3678-250.

Coil Floor Plate is produced on the hot strip mill to AS/NZS 1594-HA250.



## FLOOR PLATE PRODUCT DIMENSIONS

### XLERPLATE® Floor Plate steel

Dimension Availability:	1800mm width
	6 - 12mm thickness
	6m lengths

### Coil Floor Plate

Dimension Availability:	1200 and 1500mm width as standard <sup>(1)</sup>
	2.1, 3, 5, 6, 8mm thicknesses <sup>(2)</sup>
	1.2 – 9.6m lengths as standard
	9.601 – 12m lengths by enquiry

(1) Note - Other sizes may be available subject to enquiry.

(2) Note - Not all thickness and width combinations are available. Refer to BlueScope Steel Direct on 1800 800 789.

## FLOOR PLATE MASS CALCULATIONS

When calculating the theoretical mass of floor plate, the 'Plate Mass Calculation' should be used as well as an additional 0.002 tonne per metre squared.

# BISALLOY® STEEL

Bisalloy Steels, producer of BISALLOY® steel, is Australasia's only manufacturer of high strength, abrasion resistant/high hardness and armour plate grades of quenched and tempered steel plate.

The BISALLOY® steel product range includes\*:

Grade	Thickness Availability*	Typical Applications
BISALLOY® Structural steel (60, 70, 80, 100)	5 – 100mm	Transport Equipment, Trailers, Dump Trucks, Cranes & Lifting Equipment, & High Rise Buildings
BISALLOY® Structural 80 Pressure Vessel steel	6 – 100mm	Road Tankers & Storage Tanks
BISALLOY® Wear steel (320, 400, 450, 500, 600)	5 – 100mm	Dump Truck & Bucket Liners, Chutes, Bins, Cutting Edges, Ground-Engaging Tools, WearParts in Industrial Equipment
BISALLOY® Armour steel (RHA300, RHA360, HTA400, UHT440, HHA500, UHH600)	5 – 50mm	Military and civilian applications requiring light weight and resistance to shock loading and penetration by ballistic projectiles
BISALLOY® Protection steel (250, 300, 360, 400, 440, 500, 550, 600)	5 – 50mm	Security Vehicles, Training Facilities, Security Booths, Splinter Boxes, Embassy Safe Rooms'

\* Not all thicknesses available in all grades. Refer to [www.bisalloy.com.au](http://www.bisalloy.com.au) for complete details.

## SUMMARY TABLES OF MECHANICAL PROPERTIES

### STRUCTURAL STEEL GRADES

Steel Grade	Plate Thickness (mm)	Carbon Equivalent (IIV), typical	Mechanical Properties Tensile			
			Plate Thickness (mm)	0.2% Proof Stress (MPa)	Tensile Strength (MPa)	Elongation in 50mm G.L
BISALLOY® 60 Structural steel	5 - <8	0.40	5 - 100mm	580	640	30%
	≥8 - ≤30	0.44				
	≥30 - 80	0.54				
	>80 - 100	0.58				
BISALLOY® 70 Structural steel	5 - <8	0.40	5 - 100mm	670	760	28%
	≥8 - ≤30	0.44				
	≥30 - 80	0.54				
	>80 - 100	0.58				
BISALLOY® 80 Structural steel	5 - <8	0.40	5 - 100mm	750	830	26%
	≥8 - ≤30	0.44				
	≥30 - 80	0.54				
	>80 - 100	0.58				
BISALLOY® 100 Structural steel	5 - <8	0.40	5 - 30mm	890	940 - 1100	13% (min)
	≥8 - <30	0.44				
BISALLOY® 80 Structural Pressure Vessel steel	5 - <8	0.40	5 - 100mm	750	830	26%
	≥8 - ≤30	0.44				
	≥30 - 80	0.54				
	>80 - 100	0.58				

#### LEGEND

L - Longitudinal

T - Transverse

IIV - Carbon Equivalent Formula:  $C.E = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$

Please refer to [www.bisalloy.com.au](http://www.bisalloy.com.au) for full details.

## WEAR STEEL GRADES

Steel Grade	Plate Thickness (mm)	Carbon Equivalent (IIV), typical	Mechanical Properties Tensile			
			Plate Thickness (mm)	0.2% Proof Stress (MPa)	Tensile Strength (MPa)	Elongation in 50mm G.L
BISALLOY® Wear 320 steel	5 - <8	0.40	5-100mm	970	1070	18%
	≥8 - ≤30	0.44				
	≥30 - 80	0.54				
	>80 - 100	0.58				
BISALLOY® Wear 400 steel	5 - <8	0.40	5-100mm	1070	1320	14%
	≥8 - ≤30	0.44				
	≥30 - 80	0.54				
	>80 - 100	0.58				
BISALLOY® Wear 450 steel	6 - 20	0.46	6-100mm	1150	1400	12%
	>20 - 50	0.58				
	>50 - 100	0.62				
BISALLOY® Wear 500 steel	8 - 100	0.62	8-100mm	1400	1640	10%
		0.44				
BISALLOY® Wear 600 steel	12 - 50	0.62	12-50mm	-	-	-

### LEGEND

L - Longitudinal

T - Transverse

IIV - Carbon Equivalent Formula:  $C.E = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$

Please refer to [www.bisalloy.com.au](http://www.bisalloy.com.au) for full details.

## ARMOUR STEEL GRADES

Steel Grade	Plate Thickness <sup>#</sup> (mm)	Carbon Equivalent (I <sub>W</sub> ), typical	Brinell Hardness (HB 3000/10)	Mechanical Properties Charpy V - Notch Impact		
				Test Temp. (°C)	Min. Energy (T)	Min. Energy (L)
BISALLOY® Armour RHA300 steel	5	0.61	260-310HB	-40°C	-	-
	6 - <9.5			-40°C	20J	20J
	9.5 - <12			-40°C	30J	30J
	≥ 12			-40°C	40J	40J
BISALLOY® Armour RHA360 steel	5	0.61	310-410HB	-40°C	-	-
	6 - <9.5			-40°C	12J	12J
	9.5 - <12			-40°C	17J	17J
	≥ 12			-40°C	22J	22J
BISALLOY® Armour HTA400 steel	5	0.61	370-430HB	-40°C	-	-
	6 - <9.5			-40°C	9J	9J
	9.5 - <12			-40°C	13J	13J
	≥ 12			-40°C	17J	17J
BISALLOY® Armour UHT440 steel	6 - <8	0.46	370-430HB	-40°C	11J	11J
	8 - <12			-40°C	17J	17J
	≥ 12			-40°C	22J	22J
BISALLOY® Armour HHA500 steel	5	0.61	477-534HB	-40°C	-	-
	6 - <9.5			-40°C	8J	10J
	9.5 - <12			-40°C	12J	15J
	≥ 12			-40°C	16J	20J
BISALLOY® Armour UHH600 steel	≥ 12	0.75	570-640HB	-40°C	8J	8J

### LEGEND

L - Longitudinal

T - Transverse

I<sub>W</sub> - Carbon Equivalent Formula:  $C.E = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$

# Please refer to [www.bisalloy.com.au](http://www.bisalloy.com.au) for other available thicknesses.

**PROTECTION STEEL GRADES**

Steel Grade	Plate Thickness* (mm)	Carbon Equivalent (I <sub>IIW</sub> ), typical	Brinell Hardness (HB 3000/10), typical	Mechanical Properties Charpy V - Notch Impact		
				Test Temp. (°C)	Min. Energy (T)	Min. Energy (L)
BISALLOY® Protection 250 steel	5 - 50	0.61	260-310HB	-40°C	-	-
BISALLOY® Protection 300 steel	5	-	260-310HB	-40°C	-	-
	6 - <9.5			-40°C	20J	20J
	9.5 - <12			-40°C	30J	30J
	≥ 12			-40°C	40J	40J
BISALLOY® Protection 360 steel	5	-	310-410HB	-40°C	-	-
	6 - <9.5			-40°C	12J	12J
	9.5 - <12			-40°C	17J	17J
	≥ 12			-40°C	22J	22J
BISALLOY® Protection 400 steel	5	-	370-430HB	-40°C	-	-
	6 - <9.5			-40°C	9J	9J
	9.5 - <12			-40°C	13J	13J
	≥ 12			-40°C	17J	17J
BISALLOY® Protection 440 steel	2.5 - < 8	-	420-470HB	-40°C	11J	11J
	8 - <12			-40°C	17J	17J
	≥ 12			-40°C	22J	22J
BISALLOY® Protection 500 steel	2.5 - 5	-	370-430HB	-40°C	-	-
	6 - <9.5			-40°C	8J	10J
	9.5 - <12			-40°C	12J	15J
	≥ 12			-40°C	16J	20J
BISALLOY® Protection 550 steel	≥ 12	-	530-570HB	-40°C	10J	12J
BISALLOY® Protection 600 steel	≥ 12	-	570-640HB	-40°C	8J	8J

**LEGEND**

L - Longitudinal

T - Transverse

 I<sub>IIW</sub> - Carbon Equivalent Formula:  $C.E = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$ 

 Please refer to [www.bisalloy.com.au](http://www.bisalloy.com.au) for full details.

 # Please refer to [www.bisalloy.com.au](http://www.bisalloy.com.au) for other available thicknesses.

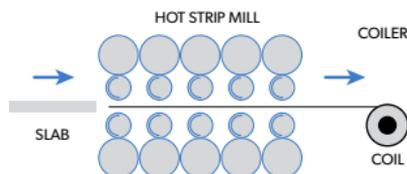
# HOT ROLLED COIL

For information relating to the availability of grades, thicknesses and specific customer requirements, please contact BlueScope Steel Direct on 1800 800 789.

## HOT ROLLED COIL PRODUCTION FLOW

Hot rolled products are available in five product groups; Formable, Extra Formable, Structural, Carbon and Hardness.

The product designations are based on those of the Australian Standards AS/NZS 1594:2002.



### Surface Characteristics

The temperature at which hot-rolling is completed results in an oxidized strip surface. The oxide film is termed hot-mill scale.

Pickling removes the hot-mill scale. Pickled strip is generally supplied oiled to preserve this surface finish.

Skin-passing is a light cold rolling operation which suppresses the appearance of stretcher strain and minimizes coil break during uncoiling and subsequent processing. The surface texture and flatness are improved by skin passing.

### Ageing

Non ageing, or stabilized, steels, do not experience yield point reappearance during storage. Stretcher strain markings do not develop in these steels during pressing or drawing.

## Storage

The surface of pickled material is susceptible to atmospheric corrosion during storage. For this reason the normal supply condition is 'pickled and oiled', the thin layer of protective oil providing improved resistance to atmospheric corrosion.

When an oiled surface is not compatible with the customer's further processing requirements 'pickled and not oiled' may be supplied. In this case adherence to the following guidelines will minimise, but not prevent, the occurrence of surface corrosion:

- Packs must be kept dry;
- Packs must be stored under cover;
- The materials should be used promptly after receipt;
- The materials should not be stored as part coils after unpacking.

Where possible the guidelines for storage and use of 'pickled – not oiled' product should be used for 'pickled-oiled' to minimise the opportunity for surface corrosion.

## Edge Condition

Mill edge strip (ME) is supplied with the hot-rolled edge intact. The width tolerances for mill edge strip are quite broad.

Side trimmed or slit material should be specified if tighter width tolerances are required. Mill edge strip is not normally available in widths less than 650mm.

## Formable Grades

Formable grades are typically used for applications such as general fabrication, structural members, shelving and tanks.

### **Extra Formable Grades**

Extra Formable grades are typically used for applications requiring minimum yield strengths in the range 300-480 MPa, combined with a greater degree of formability than is achievable with structural steels.

### **Structural grades**

These are steels supplied for applications where minimum yield strengths are required, and/or where surface standard is not of prime importance. Minimum yield strengths in the range 200 to 350 MPa and available, all with excellent weldability.

### **Analysis grades**

A range of steels supplied to guaranteed chemical compositions.

# COLD ROLLED STEEL PRODUCTS

BlueScope produces a variety of cold-rolled steel sheet and strip to AS/NZ 1595 specification. These steels are available in strip or sheet form in a range of surface finishes and surface qualities, with formability and/or hardness requirements for most end applications.

Dimensional tolerances are in accordance with AS 1365.

## Designations

In AS/NZ 1595, cold rolled steel is signified by the first character in the designation. Basic types of cold rolled steel are:

### Formable (ductile), Hardness, Structural (strength) and Composition

In addition, the quality designation indicates:

Surface finish, and Surface quality. Formable (Ductile) Grades.

The second character (**A, U, V, K, or W**) indicates steel type:

A = Aluminium killed

U = Unspecified steel type

V = Vitreous enamelling steel

K = Silicon/aluminium killed

W = Weathering Resistant

The third character (**1, 2, 3 or 4**) indicates degree of formability:

1 = Commercial forming

2 = Commercial drawing

3 = Deep drawing

4 = Extra deep drawing

5 = Extra Deep Drawing Fully Stabilised

A fourth character (**S or A**) is added to designate performance characteristics, and a fifth character (**N**) if non-ageing grade steel is necessary.

S = Skin-passed

A = Annealed last

N = Non-ageing (stabilised)

**Hardness Grades** the second and third characters are a two-digit number representing the minimum Rockwell hardness (scale B).

The fourth character is the letter T to indicate that the hardness has been achieved by temper rolling.

**Surface Quality** designated by a letter (**G, E**) joined to the quality designation by a dash.

G = General purpose

E = Exposed

## TYPICAL COLD ROLLED STEEL QUALITIES

### Formable (Ductile) Grades

For applications requiring formability, a range of steels is available with ductilities varying from commercial forming through to extra deep drawing. Non-ageing steel types are also available.

Details of the full range of BlueScope Cold Rolled Steel qualities can be obtained from BlueScope sales offices. Assistance with the selection and specification of steels is also freely available.

Typical BlueScope products include:

**CA2S-E** - a skin-passed commercial drawing steel capable of moderate forming and pressing and with a surface suitable for exposed panels. This is a very versatile product.

**CA3SN-G** - a skin-passed deep drawing steel guaranteed non-ageing and free from stretcher strain for general purpose components.

**CA5SN-E** - a skin-passed critical drawing steel suitable for severely drawn components in exposed applications with a minimum of rework. This product is guaranteed free of ageing and stretcher straining.

### Hardness Grades

These are produced for applications where minimum hardness is required and where ductility and surface finish are not of prime importance.

### Structural Grades

A range of structural grade steels is produced mainly for applications where design requirements specify minimum strength. Steels are available with minimum yield strengths varying from 350 to 600 MPa. These steels are outside the scope of AS/NZ 1595 but designation and supply follow the principles embodied in Australian standards.

## Composition/Carbon grades

These are plain carbon steels often used in applications where heat treatment is a necessary part of the manufacturing process. The chemical composition is guaranteed and indicated by a four digit carbon content. The first two numbers in steel composition grades are "10" for plain, unalloyed, carbon steels.

## GENERAL GUIDE TO COMPARATIVE FEATURES - COLD ROLLED STEEL

Quality	CA2S-E	CA3SN-G	CA5SN-E
Form	Strip, sheet	Strip, sheet	Strip, sheet
Surface quality	Exposed Panel Oiled	General Purpose Oiled	Exposed Panel Oiled
Bending	Excellent	Excellent	Excellent
Roll-forming	Excellent	Excellent	Excellent
Pressing	Good	Excellent	Excellent
Drawing	Good	Very good	Excellent
Welding	Excellent	Excellent	Excellent
Painting (pre-treatment)	Excellent	Excellent	Excellent

## Dimensions of Cold Rolled Flat Steel Products

Details of the wide range of thickness/width/length combinations possible are available on request. The following table gives the normal thickness ranges of the formable products listed.

Product	Thickness range, mm
CA2SE	0.50-3.2
CA2SNG	0.60-3.2
CA5SNE	0.60-3.0

# METALLIC COATED STEEL PRODUCTS

## COATINGS ON STEEL SHEET

Coatings are applied to steel sheet to protect the steel against its natural tendency to form iron oxide (rust). Sometimes coatings serve to provide decoration, but frequently both oxide protection and for decoration.

Steel coating technology has progressed to keep pace with, or ahead of, changing atmospheric environments in cities and industrial areas, particularly where claddings for buildings are concerned.

Selection of the appropriate coated steel to suit conditions is important. For example, coating needs for rural or non-aggressive inland locations differ from those required for marine and industrial environments. Some useful information is included under the heading "Atmospheric Exposure Conditions."

In general terms, the metallic-coated steel products produced on the continuous coil coating lines by BlueScope are:

- Zinc-coated (AS 1397)
- Zinc/aluminium alloy-coated (AS 1397)
- Zinc-iron alloy coated (AS 1397)

**Zinc-coated products** include GALVABOND® steel (ductile-coated products), ZINCFORM® steel (structural) and ZINC HI-TEN® steel (high strength) in various coating classes and finishes. ZINCANNEAL® steel, a ductile product, has a surface modified in production by a post galvanizing heat treatment. DECKFORM® steel and GALVASPAN® steel are zinc coated structural steels.

**Zinc/aluminium alloy-coated sheet** include ZINCALUME® steel in structural and high strength grades in two coating classes and TRUECORE® steel which is a zinc/aluminium alloy coated steel with a distinctive blue surface finish, developed for use in residential low-rise framing applications.

**Zinc/aluminium/magnesium alloy-coated steel** including next generation ZINCALUME® steel with patented Activate® technology introduces magnesium into the aluminium-zinc alloy coating, improving galvanic protection by activating the aluminium. The result is a tougher protective coating that's more resistant to scratches and scuffs potentially encountered during transport, handling and construction.

## GENERAL DESCRIPTION

The metallic-coated products of BlueScope are generally described by a registered trade mark followed by a designation of the steel base and coating class, as outlined in Australian Standard AS 1397.

### Metallic-coated steels

As the surface of steel products gradually reverts to its most stable form (that is, iron oxide,) it is necessary to isolate the surface from atmospheric conditions to prevent the unsightly oxide forming. This can be achieved by covering the surface with metals, such as zinc and aluminium, or organic materials, such as paint or laminate. The latter materials and some metals like aluminium provide a blanket covering to protect the steel from the atmosphere. This is successful provided the complete coverage remains intact. Some metals, such as zinc, give an added feature of sacrificial protection at areas where the steel base is exposed, such as cut edges, holes and scratches. A zinc/aluminium alloy-coating combines the best features of both aluminium and zinc coatings. Metallic coating with zinc or zinc/aluminium alloy is a universally proven and accepted system. The continuous metallic coating lines operated by BlueScope produce a range of zinc-coated and zinc/aluminium-coated steel sheet and strip products to meet the requirements of manufacturers in Australia and overseas.

The degree of corrosion protection afforded by each coating type and class depends on the many macro and micro environments in which it performs and therefore cannot be simply quantified. However, it can be generally assumed that for a particular coating class the life of the sheet would be in direct proportion to the coating mass on the sheet. For normal exterior protection, the life of zinc/aluminium coatings is far superior to the life of an equivalent thickness zinc coating, particularly in areas that include any marine influence.

For optimum product lifespan and performance, the metallic coating should be specified to suit the environment. ZINCALUME® steel generally offers superior performance in most building applications. Galvanised coatings do offer some advantages in specific applications such as intensive animal farming (Refer to "Atmospheric Exposure Conditions" pg 268).

For recommendation on the most suitable product for a given environment or need, visit the BlueScope web site [www.steel.com.au](http://www.steel.com.au) or contact BlueScope Steel Direct on 1800 800 789.

## GENERAL INFORMATION

### Metallic-coated steels

The steel base grades of BlueScope's metallic-coated steels qualities are designated with the letter "G" followed by characters which indicate formability or strength and condition. Refer to the table below.

### DESIGNATION SYSTEM FOR BASE STEEL METALLIC COATED

Groups	Character Position			
	1	2	3	4
Formable (Ductile)	Product Type	Degree of Formability	Condition	Surface Quality
	G - Continuously heat-treated and metallic coated	1 - Profiling 2 - Commercial 3 - Drawing	S - Skin-passed N - Non-ageing X - Special properties	F - Fully inspected
<b>Example</b>	<b>G</b>	<b>2</b>	<b>S</b>	
Structural (Strength)	Product Type	Strength (Minimum Yield Strength – Mpa)		
	G - Continuously heat-treated and metallic coated	Numeral	Numeral	Numeral
<b>Example</b>	<b>G</b>	<b>2</b>	<b>5</b>	<b>0</b>

### Designation System – Coatings

Metallic coatings on steel sheet and strip are divided into three different types. Refer to the table below.

### METALLIC COATING TYPES AND DESIGNATIONS

Coating Type	Coating Designation
Zinc (Zn)	Z
Zinc/aluminium (Zn/Al)	AZ
Zinc/iron (Zn/Fe)	ZF, ZS
Zinc/aluminium/magnesium (Zn/Al/Mg)	AM

### **Coating Mass**

The ability of a metallic-coated sheet and strip product to withstand corrosion in a particular environment is a function of the amount (and type) of coating on the surface of the steel base substrate. This is quantified as the “coating mass” and is the combined mass of coating on both sides of the steel base expressed in grams per square metre ( $\text{g}/\text{m}^2$ ).

### **Coating Class**

Coating Class is designated by the specified coating type and the minimum mass of coating on both sides of the sheet measured by the triple spot test, as detailed in Australian Standard AS 1397, eg AZ125, zinc/aluminium/magnesium coating with a minimum coating of  $125 \text{ g}/\text{m}^2$ .

### **Coating Adhesion**

The ability of metallic coating to withstand deformation without peeling from the sheet substrate varies with coating type and coating mass. The table below lists the guaranteed performance of the various metallic coatings and base combinations.

## COATING ADHESION (180° BEND TEST)

Steel Grade Designation	Diameter of Mandrel in terms of thickness of product (t)							
	Coating Class							
	Z100	Z200	Z275	Z350	Z450	Z600	AZ150	AZ200
G250	0	0	0	0	t	2t	0	t
G300	0	0	t	t	t	2t	t	t
G350	0	0	t	t	t	2t	t	t
G450	0	t	2t	2t	2t	3t	2t	2t
G500	t	2t	2t	2t	2t	3t	2t	2t
G550	t	2t	2t	2t	2t	3t	2t	2t
G1	0	0	0	0	t	2t	-	-
G2	0	0	0	0	t	2t	-	-
G3	0	0	0	0	t	2t	-	-

Note: These tables are an explanation of the DESIGNATED SYSTEM ONLY. It does not imply that all combinations are available. 0 indicates that the coated steel is bent on itself.

# COLORBOND® PREPAINTED STEEL

COLORBOND® preprinted steel can be fabricated into an end product without further treatment. Produced on high speed continuous strip coating lines, COLORBOND® steel is available with a base of zinc-coated or zinc/aluminium alloy-coated steel.

COLORBOND® preprinted steel for interior/exterior building applications conforms to the requirements of AS 2728.

A range of colours, coating types and gloss levels has been developed for a wide variety of applications, both exterior and interior. These products are available either single sided or double sided.

By selecting the correct COLORBOND® steel product, standard fabrication techniques such as deep drawing, roll-forming, lock-seaming, stamping, spinning and brake press forming are possible without damage or deterioration to the coating. In some fabrication techniques the paint coating acts as a lubricant and can measurably increase tool life.

COLORBOND® steel is available in widths from 25mm to 1500mm and in preferred thicknesses from 0.30mm to 1.6mm, depending on steel substrate.

The paint finish coating on COLORBOND® steel for both interior and exterior use is applied over a corrosion-inhibitive primer.

If it is intended to use COLORBOND® steel in exterior applications within 1km of a salt marine location, or in severe industrial or unusually corrosive environments, please contact the nearest BlueScope sales office for specialised advice.

## WORKING WITH COLORBOND® PREPAINTED STEEL

Manufacturers planning to use COLORBOND® prepainted steel are advised to contact BlueScope Sales Offices for specialised advice. Benefits can accrue when new or modified production lines are planned to fully exploit the advantages of using COLORBOND® steel. For example, it may simplify operations if the prime surface faces downwards, or if a bending operation is performed in an unconventional manner.

BlueScope specialists have a lot of local and overseas experience in production innovation and welcome any opportunity to assist in early design stages. Prototypes of customers' new applications can be developed to demonstrate the most cost-effective material and manufacturing technique.

### Typical Applications

COLORBOND® steel is manufactured to suit a range of end uses from severe exterior applications to interior fittings and fixtures. COLORBOND® steel can be used but is not limited to the following applications:

- Roofing and Walling
- Gutters, Downpipes and Fascia
- Fencing applications
- Garage doors
- Hot water service jackets, air conditioner cabinets and other applications requiring good exterior performance.
- Sign writing panels

**COLORBOND® Metallic steel** - designed for a range of decorative roofing and walling applications.

**COLORBOND® steel Matt** - designed for a range of roofing, walling, gutters, fascia and downpipe applications.

**COLORBOND® Stainless steel** - designed for a range of roofing and walling applications for maximum corrosion resistance.

**COLORBOND® Ultra steel** - designed for extreme environments, with excellent corrosion resistance against marine or industrial environments.

**COLORBOND® PERMAGARD®** - designed for the manufacture of sandwich panels for the coolroom industry.

Ensure when you purchase or specify **COLORBOND®** prepainted steel, the product is genuine. Look for the **COLORBOND®** branding on the back.

### **AQUAPLATE® steel**

**AQUAPLATE®** steel is a special polymer coated steel used for the fabrication of water tanks to store potable (drinking), spa, rain, bore or river water.

The interior coating on **AQUAPLATE®** steel is a food grade polymer film lamination that makes the tanks tolerant to a wide range of water qualities and catchment materials. It is a tough, abrasion resistant film that is produced to meet Australian Standard 2070, Part 2 – Plastic Materials for Food Contact Use. (The film is not UV resistant and must not be exposed to direct sunlight for extended periods).

**AQUAPLATE®** steel is AS 1397 G300 Z450 galvanised (**COLORBOND®** steel Z275) sheet laminated with AS 2070 food grade polymer film. This steel/film laminate has been developed to make durable tanks for the storage of potable waters.

**AQUAPLATE® steel - W** (film on one side) is for tank walls and is available as flat strip sheet, or as 8 or 10.5 x 76mm corrugated sheet in custom cut lengths. A **COLORBOND®** steel paint finish is also available for the tank wall outer surface (refer to Technical Bulletin No. 3).

**AQUAPLATE® steel - B** (film on two sides) is for tank bottoms and is available 1200mm wide as flat strip or sheet. The additional film surface is to protect the tank base from tank support materials.

## **FORMABLE STEEL GRADES GALVABOND® G2, G3N STEEL (AS 1397)**

GALVABOND® steel is a general purpose zinc-coated flat sheet and is the most widely used of zinc-coated products. It is suitable for a broad range of applications demanding a high standard of formability, coating adhesion and resistance to corrosion. Several optional coating classes and finishes and two steel base grades are available to suit specific applications.

GALVABOND® steel base grade G2 with regular coating class Z275 will permit severe forming (including lock-forming) and many drawing operations. For the more critical drawing or spinning operations, base grade G3N is manufactured.

The coating, with its characteristic spangled pattern, has excellent adherence and will permit a wide range of forming operations without peeling or flaking. Soldering and welding, if carried out according to recommended practices, present no difficulties.

To achieve satisfactory paint adhesion, pretreatment or priming is required. Recommendations are given in Technical Bulletin 2, available from the BlueScope product website.

### **Typical Applications**

GALVABOND® steel is recommended for:

- Meter boxes
- Motor housings
- Ducting
- Cable trays
- Expanded metal
- Containers
- Garage doors
- Garbage cans
- Poultry feeding equipment

## ZINCANNEAL® G2, G3 STEEL (AS 1397)

Modification by a post galvanizing heat treatment, which converts the coating into a zinc/iron alloy, gives ZINCANNEAL® steel its distinctive smooth grey surface with a complete absence of spangle appearance. The coating, which possesses good adherence to the steel base, provides a corrosion-resistant surface for painting directly with high quality finishes without any additional surface treatment such as priming, (except for severe external conditions where etch priming is recommended for optimum performance). ZINCANNEAL® steel must be painted for external applications.

The mechanical properties of the base are such that ZINCANNEAL® steel permits many bending and forming operations, but as the zinc/iron alloy coating has only limited ductility, powdering may occur if the deformation becomes excessive.

ZINCANNEAL® steel presents no difficulties in welding. It can be readily soldered, but attention must be paid to the use of recommended fluxing techniques.

### Typical Applications

ZINCANNEAL® steel is recommended for:

- Signs
- Commercial refrigerators and freezers
- Number plates
- Van and bus doors
- Door frames
- Louvres

## ZINCSEAL® G2 STEEL

ZINCSEAL® steel is produced in a similar manner to ZINCANNEAL® steel. It is a low coating mass zinc/iron alloy-coated commercial forming steel suitable for bending and moderate forming, with a skin-passed extra smooth high quality surface finish suitable for high quality paint finishes. Most suitable for office furniture, light fittings and general fabrication.

## ZINCFORM® G250, G300 STEEL (AS 1397)

ZINCFORM® steel is produced to meet the minimum strength requirements of AS 1397 base grades G250 and G300. It has been specially developed for structural applications, particularly roll-formed sections, and is available in a variety of coating classes to suit particular end uses. ZINCFORM® steel is not suitable for applications where fluting is critical (e.g. Rima machines) or for severe drawing, pressing or lock-forming.

ZINCFORM® steel has a bright, relatively smooth appearance with a full spangle surface pattern. It has very good corrosion resistance and may be readily soldered, welded or painted. Pretreatment or priming is necessary to promote paint adhesion.

### Typical Applications

ZINCFORM® steel is recommended for:

- Z200 – (internal applications only) – building sections, studs, plates, purlins, ceiling hangers, fittings, general roll-formed sections
- Z275 – general roll-forming, purlins
- Z450 – rainwater goods and accessories
- Z600 – corrugated tank walls, general items exposed to severe corrosion

## ZINC HI-TEN® G450, G500, G550 STEEL (AS 1397)

ZINC HI-TEN® steel is a flat zinc-coated product produced to meet the minimum strength requirements of AS 1397 base grades G450, G500 and G550, and a specific market demand for high strength zinc-coated steel sheet with very good corrosion resistance. Careful design will often make it possible to achieve savings in costs by allowing the substitution of thinner ZINC HI-TEN® steel sheet for thicker sheet otherwise required in other qualities. In some cases, modifications to the profile may be necessary to compensate for any loss of rigidity under load resulting from this reduction in sheet thickness.

Although not intended for the same wide range of applications as GALVABOND® steel, ZINC-HI-TEN® steel has been used successfully in many roll-forming and bending operations.

ZINC HI-TEN® steel is readily formable on a brake press or other equipment in common use for cold forming operations. Only slightly higher forming pressures are required to produce a permanent set, since the lighter

ZINC HI-TEN® steel is usually used without any loss of structural strength. The technique of forming ZINC HI-TEN® steel consists mainly in making provision for more liberal radii of bends, for slightly increased die clearances and for more springback.

ZINC HI-TEN® steel may be soldered, welded and painted, provided recommended procedures are followed. In welding, allowances should be made for the loss of strength in the area of the weld where the mechanical properties will revert to those of ZINCFORM® steel. Priming or pretreatment is necessary before painting to achieve satisfactory adhesion.

### Typical Applications

ZINC HI-TEN® steel is recommended for:

Coating class

- Z275 – fence droppers, tubing
- Z600 – general items exposed to severe corrosion conditions

## **GALVSPAN® G450, G500, G550 STEEL (AS 1397)**

GALVSPAN® steel is a zinc coated structural steel with a spangled surface. Suitable for roll-formed sections for internal structural applications in benign environments.

### **Typical Applications**

GALVSPAN® steel is recommended for:

- Z350 – purlins and girts

## **DECKFORM® G550 STEEL**

DECKFORM® steel is a zinc coated structural steel with a spangled surface. It was developed for use in composite concrete slabs and formwork.

### **Typical Applications**

DECKFORM® steel is recommended for:

- Z350 – composite concrete slabs and formwork

## ZINCALUME® G300 STEEL (AS 1397)

ZINCALUME® steel provides significantly improved corrosion resistance when compared to galvanised steel, particularly in a marine environment. It is produced to meet the minimum strength requirements of AS 1397 base grade G300 and is suitable for roll-forming and bending.

All materials (except lead) that can be used in contact with traditional zinc-coated steel can be used in contact with ZINCALUME® G300 steel in the field. Economical joining and sealing systems using silicone rubber sealants are described under Sealants. Do not place ZINCALUME® steel in contact with lead based building materials.

### Typical Applications

ZINCALUME® G300 steel is recommended for:

Coating class

- AM125 – general roll-forming, garage doors, roof decking, gutters and downpipes, ridge capping and valleys, rainwater goods and accessories, vertical walling, fencing systems, refrigerator and stove rear panels, air conditioning panels (NOT DUCTWORK)

Note: Grade 250 is also available; good ductility makes it suitable for tubing, mufflers, signs and roll-formed structural sections. A restricted thickness range is offered.

## ZINCALUME® G550 STEEL (AS 1397)

ZINCALUME® steel provides significantly improved corrosion resistance when compared to galvanised steel, particularly in a marine environment. It is produced to meet the minimum strength requirements of AS 1397 base grade G550.

The same general comments apply to ZINCALUME® steels as for ZINC HI-TEN® steel equivalent products. Two notable differences are:

- priming or pretreatment are usually not necessary before painting
- ZINCALUME® steel does not readily solder – use sealants instead

All materials (except lead) that can be used in contact with traditional zinc-coated steel can be used in contact with ZINCALUME® G550 steel. Do not place ZINCALUME® steel in contact with lead based building materials.

### Typical Applications

ZINCALUME® G550 steel is recommended for:

Coating class

- AM125 – roll-formed roofing and walling

## TRUECORE® STEEL (AS 1397)

TRUECORE® steel is a zinc/aluminium/magnesium alloy coated steel with a distinctive blue surface finish. It was developed for use in residential low-rise framing applications.

Material compatibility is the same for ZINCALUME® steel, and it is available in a range of sizes and strengths.

### Typical Applications

Wall frames, roof trusses, bearers, joists, roof battens, wall battens and ceiling battens used in low-rise, residential dwellings.

## GALVALUME® G2N, G250, G300, G550 STEEL (AS 1397)

GALVALUME® zinc/aluminium/magnesium alloy-coated steel with a spangled surface is suitable for a wide range of products, depending on the mechanical properties and coating class used (which will affect fabricating performance).

Unlike ZINCALUME® steel, GALVALUME® steel is not supplied with a resin coating.

### Typical Applications

GALVALUME® steels are recommended for:

- G2N – roofing tiles, auto components, solar heaters
- G250 – tubing, mufflers, signs, structural sections
- G300 – mufflers and general manufacturers articles
- G550 – general manufactured articles

## DIMENSIONS OF ZINC-COATED AND ZINC/ALUMINIUM ALLOY-COATED FLAT STEEL SHEET

All BlueScope products are available as strip and some products are available as sheet subject to enquiry. Typical dimensions are shown for regularly produced product but other thickness/width combinations are available subject to enquiry.

Grade	Zinc-Coated		Zinc/Aluminium-Coated	
	Typical thickness (mm)	Maximum width (mm)	Typical thickness (mm)	Maximum width (mm)
<b>Formable</b>				
Commercial	0.30 – 3.2	1525*	-	-
Deep Drawing	0.50 – 1.6	1525*	-	-
<b>Structural</b>				
G250	0.8 – 3.20	1485*	-	-
G300	0.30 – 2.9	1525*	0.30 – 1.2	1235
G450	1.5 – 3.2	1350*	-	-
G500	1.1 – 1.5	1350	-	-
G550	0.35 – 1.0	1220	0.30 – 1.00	1235

\* Restricted width when >2.00mm thickness

## AREA PER TONNE OF SHEET PRODUCT

Calculated area per tonne of product (square metres per tonne)  
Uncoated and Coated Sheet and Strip.

Specified thickness of base steel (mm)	Uncoated Steel	METALLIC COATED							
		Z100 ZF100	Z200	Z275	Z450	Z600	AZ50	AZ150	AM125
0.30	424.6	402.4	388.3	378.1	354.0	332.8	412.4	396.0	402
0.35	363.9	347.5	336.9	329.2	310.8	294.3	354.9	342.7	347
0.40	318.5	305.8	297.6	291.5	277.0	263.9	311.5	302.1	306
0.42	303.3	291.8	284.3	278.8	265.5	253.4	297.0	288.4	292
0.48	265.4	256.5	250.8	246.4	236.0	226.3	260.6	253.9	256
0.50	254.8	246.6	241.3	237.2	227.5	218.6	250.3	244.2	246
0.55	231.6	224.8	220.4	217.0	208.9	201.3	227.9	222.8	225
0.60	212.3	206.6	202.8	200.0	193.1	186.6	209.2	204.9	207
0.65	196.0	191.1	187.9	185.5	170.5	173.9	193.3	189.7	191
0.70	182.0	177.8	175.0	172.9	167.6	162.7	179.7	176.5	178
0.75	169.8	166.2	163.7	161.9	157.3	153.0	167.8	165.1	166
0.80	159.2	156.0	153.8	152.2	148.1	144.3	157.5	155.0	156
0.85	149.9	147.0	145.1	143.6	140.0	136.6	148.3	146.2	147
0.90	141.5	139.0	137.3	136.0	132.7	129.6	140.2	138.2	139
0.95	134.1	131.8	130.2	129.1	126.1	123.3	132.8	131.1	132
1.00	127.4	125.3	123.9	122.9	120.2	117.6	126.3	124.7	125
1.15	110.8	109.2	108.1	107.3	105.3	103.3	109.9	108.7	109
1.20	106.2	104.7	103.7	103.0	101.0	99.3	105.4	104.3	105
1.40	91.0	89.9	89.2	88.7	87.3	85.9	90.4	89.6	90
1.50	84.9	84.0	83.4	82.9	81.7	80.5	84.4	83.7	84
1.60	79.6	78.8	78.2	77.8	76.7	75.7	79.2	78.6	79
1.80	70.8	70.1	69.7	69.3	68.5	67.7	70.4	69.9	70
1.90	67.0	66.5	66.1	65.8	65.0	64.2	66.7	66.3	66
2.00	63.7	63.2	62.8	62.5	61.8	61.2	63.4	63.0	63
2.20	57.9	57.5	57.2	56.9	56.4	55.7	57.7	57.3	57
2.50	51.0	50.6	50.4	50.2	49.8	49.2	50.8	50.5	51
3.00	42.5	42.2	42.1	41.9	41.6	41.3	42.3	42.2	42
3.20	39.8	39.6	39.5	39.4	39.1	38.8	39.7	39.5	40

# ROOFING & WALLING PRODUCTS

## PRODUCT DEVELOPMENT

The flagship profile LYSAGHT CUSTOM ORB® has led the development of an extensive range of roofing and walling profiles suitable for a variety of design solutions. The Lysaght Technology Department is NATA\* registered and tests our products to ensure accuracy and reliability of our data.

\*National Association of Testing Authorities

## FINISHES

Most profiles are available in the full range of COLORBOND® steel colours including the Ultra, Matt and Metallic range. Unpainted ZINCALUME® steel is also available.

## PROFILE LENGTHS AVAILABLE

Our profiles are available in custom cut lengths. The maximum length available for factory rolled product is dependant on transport legislation in your area. Please contact your local office for confirmation.

Crest fastened profiles; lengths greater than 24m will require an expansion joint. Valley fastened profiles; lengths greater than 15m will require an expansion joint. Further information is available in the Using LYSAGHT® Roofing & Walling manual.

New capabilities in transport and mobile roll forming means particular profiles are suitable for long length design, allowing further design freedom. These will be noted on individual profile information.

## MORE INFORMATION

The following profile details outline basic design information which will assist selection for your design or installation. We recommend you access the full product brochures and manuals for complete design information. These brochures and the availability of profiles and finishes can be found on our website [www.lysaght.com](http://www.lysaght.com).

# APPLICATION OF LYSAGHT CLADDING PROFILES

Profile	Roofing	Walling
CUSTOM ORB®	•	•
CUSTOM BLUE ORB®	•	•
CUSTOM ORB ACCENT® 21	•	•
CUSTOM ORB ACCENT® 35	•	•
TRIMDEK®	•	•
SPANDEK®	•	•
KLIP-LOK® 406	•	•
KLIP-LOK 700 HI-STRENGTH®	•	•
KLIP-LOK CLASSIC® 700	•	•
FLATDEK®	•	
FLATDEK® 310	•	
FLATDEK® II	•	
PANELRIB®		•
MINI ORB®		•
MULTICLAD®		•
WALLCLAD®		•
TRIMWALL®		•
EASYCLAD®		•
WEATHERLINE®		•
ZENITH - LONGLINE 305®	•	•
ZENITH - ENSEAM®	•	•
ZENITH - IMPERIAL™	•	•
ZENITH - DOMINION®		•
ZENITH - BAROQUE®	•	•
PERMALITE WAVELINE®		•
PERMALITE V-RIB®	•	•
PERMALITE LT7®	•	•
PERMALITE ALSPAN®	•	•
PERMALITE ALSULATE®		•

# ROOF DRAINAGE

## RAINWATER RUN-OFF

The drainage or run-off capacity of roof sheeting can limit on the total length of a sheet run and must be considered in roof design and construction.

As a guide, the table below lists the maximum recommended length of roof run for various LYSAGHT® sheet profiles at the roof slopes and rainfall intensities shown. These are based on CSIRO research and Lysaght Research & Technology calculation of the behaviour of roofing profiles under peak rainfall conditions.

The roof run is the total length of roof sheeting draining rainwater in one direction, including any end laps, expansion joints or steps that may be present in the roof. Careful consideration should be given to rainwater diverted around roof penetrations.

See the table below for rainfall intensities for selected localities.

## MAXIMUM ROOF RUN FOR DRAINAGE MEASURED FROM RIDGE TO GUTTER (M)

	Peak Rainfall Intensity	Roof Slope					
		1 in 50 (1°)	1 in 30 (2°)	1 in 20 (3°)	1 in 12 (5°)	1 in 7.5 (7.5°)	1 in 6 (10°)
<b>CUSTOM ORB®</b>	100				29	34	38
	150				20	23	25
<b>CUSTOM BLUE ORB®</b>	200				15	17	19
	250				12	14	15
	300				10	11	13
	400				7	8	10
	500				6	7	8

	Peak Rainfall Intensity	Roof Slope					
		1 in 50 (1°)	1 in 30 (2°)	1 in 20 (3°)	1 in 12 (5°)	1 in 7.5 (7.5°)	1 in 6 (10°)
<b>CUSTOM ORB ACCENT® 21</b>	100			38	46	53	60
	150			25	31	35	40
	200			19	23	27	30
	250			15	18	21	24
	300			13	15	18	20
	400			10	11	13	15
	500			8	9	11	12
<b>CUSTOM ORB ACCENT® 35</b>	100		90	103	124	143	161
	150		60	69	82	95	107
	200		45	51	62	72	80
	250		36	41	49	57	64
	300		30	34	41	48	54
	400		23	26	31	36	40
	500		18	21	25	29	32
<b>KLIP-LOK® 406</b>	100	375	467	548	682	813	934
	150	250	311	365	454	542	623
	200	188	234	274	341	406	467
	250	150	187	219	273	325	374
	300	125	156	183	227	271	311
	400	94	117	137	170	203	234
	500	75	93	110	136	163	187
<b>KLIP-LOK 700 HI-STRENGTH®</b>	100	344	428	502	624	745	856
	150	229	285	334	416	496	571
	200	172	214	251	312	372	428
	250	137	171	201	250	298	342
	300	115	143	167	208	248	285
	400	86	107	125	156	186	214
	500	69	86	100	125	149	171

	Peak Rainfall Intensity	Roof Slope					
		1 in 50 (1°)	1 in 30 (2°)	1 in 20 (3°)	1 in 12 (5°)	1 in 7.5 (7.5°)	1 in 6 (10°)
<b>KLIP-LOK CLASSIC® 700</b>	100	247	308	361	449	536	616
	150	165	205	241	300	357	411
	200	124	154	181	225	268	308
	250	99	123	144	180	214	246
	300	82	103	120	150	179	205
	400	74	93	108	135	161	185
	500	49	62	72	90	107	123
<b>LONGLINE 305® (NOT TAPERED)</b>	100	219	273	320	397	475	546
	150	146	182	213	265	317	364
	200	110	136	160	199	237	273
	250	88	109	128	159	190	218
	300	73	91	107	133	158	182
	400	55	68	80	100	119	136
	500	44	55	64	80	95	109
<b>SPANDEK®</b>	100		97	111	133	154	173
	150		65	74	89	103	115
	200		49	55	67	77	86
	250		39	44	53	62	69
	300		32	37	44	51	58
	400		24	28	33	39	43
	500		19	22	27	31	35
<b>TRIMDEK®</b>	100		220	257	320	382	439
	150		146	172	214	255	293
	200		110	129	160	191	220
	250		88	103	128	153	176
	300		73	86	107	127	146
	400		55	64	80	96	110
	500		44	51	64	76	88

	Peak Rainfall Intensity (mm/h)	Roof Slope					
		1 in 55 (1')	1 in 30 (2')	1 in 20 (3')	1 in 12 (5')	1 in 7.5 (7.5')	1 in 6 (10')
<b>LYSAGHT ENSEAM® 265MM COVER</b>	100			160	199	238	273
	150			107	133	158	182
	200			80	100	119	137
	250			64	80	95	109
	300			53	66	79	91
	400			40	50	59	68
	500			32	40	48	55
<b>LYSAGHT IMPERIAL™ 325MM &amp; 525MM COVER</b>	100	221	276	323	402	479	551
	150	148	184	215	268	320	367
	200	111	138	161	201	240	276
	250	89	110	129	161	192	220
	300	74	92	108	134	160	184
	400	55	69	81	101	120	138
	500	44	55	65	80	96	110
<b>LYSAGHT BAROQUE® 275MM &amp; 475MM COVER</b> <b>DOUBLE RIB</b>	100				27	32	37
	150				18	22	25
	200				14	16	19
	250				11	13	15
	300				9	11	12
	400				7	8	9
	500				5	6	7
<b>LYSAGHT BAROQUE® 275MM &amp; 475MM COVER</b> <b>SINGLE RIB</b>	100				29	35	40
	150				20	23	27
	200				15	17	20
	250				12	14	16
	300				10	12	13
	400				7	9	10
	500				6	7	8

Some lengths in this table may exceed the maximum allowable transport length.  
Data are based on work of CSIRO and Lysaght.

## Notes:

1. Some lengths in this table may exceed the maximum allowable transport length.
2. Data are based on work of CSIRO and Lysaght.
3. For peak rainfall intensities in your locality, see Chapter 6 unless noted otherwise.
4. FLATDEK® and FLATDEK® II are recommended for home improvement use only (carports/verandahs) where weathertightness is not of primary importance. Drainage figures are therefore not supplied.
5. SPANDEK® with slope of 2° (1 in 30) is below the minimum recommended however is available subject to enquiry. Please refer to Section 2.5.
6. CUSTOM ORB ACCENT® data are based on proprietary design.

## OTHER CONSIDERATIONS AND/OR REQUIREMENTS WHEN CONTEMPLATING A STEEL ROOF

### Type of Fastenings

Fixing to Steel or Timber (select appropriate fasteners)  
Painted heads for use with COLORBOND® steel



Insulation (for heat and/or noise reduction)

Roof Ventilators



Skylighting



Translucent Sheeting

Pipe Flashings



Infill Strips (protect against dust, insects, birds etc)



CUSTOM ORB profile shown

Sealants

# SPECIFICATIONS OF PROFILES FOR ROOFING & WALLING

	BMT mm	Mass <sup>1</sup> kg/m <sup>2</sup>	Rib depth mm	Roof pitch, min. <sup>2</sup>	Maximum recommended spacing of supports								
					ROOFS			WALLS					
					Single mm	End mm	Int. mm	Overhang <sup>3</sup>		Single mm	End mm	Int. mm	Over- hang mm
			Unstiff- ened mm	Stiff- ened mm									
<b>CUSTOM ORB<sup>3,4</sup></b>	0.42	4.3	16	5° (1 in 12)	700	900	1200	200	300	1800	2500	2700	200
	0.48	4.9	16	5° (1 in 12)	800	1300	1700	250	350	1800	2700	2700	250
<b>CUSTOM BLUE ORB<sup>3,4</sup></b>	0.60	6.1	17	5° (1 in 12)	1600	1600	1800	200	300	2400	3000	3300	200
	0.80	8.0	17	5° (1 in 12)	1800	1800	2600	400	600	2400	3200	3600	400
<b>CUSTOM ORB® ACCENT 21</b>	0.40	4.4	21	3° (1 in 20)	750	950	1350	150	400	1800	2400	2400	150
	0.48	5.2	21	3° (1 in 20)	950	1500	1900	200	450	1800	2700	2700	200
<b>CUSTOM ORB® ACCENT 35</b>	0.48	5.5	35	2° (1 in 30)	1300	1600	2400	200	600	2100	2700	2700	2000

<sup>1</sup> Masses are for unpainted ZINCALUME® steel.

<sup>2</sup> Use caution with roof pitch at 1°

<sup>3</sup> See Section 10.6 for explanation of 'stiffened'.

<sup>4</sup> With 5 fasteners per sheet, per support.

<sup>5</sup> Clips must be 75mm from ends of sheets for proper functioning of clips.

<sup>6</sup> With 4 fasteners per sheet, per support.

<sup>7</sup> With 6 fasteners per sheet, per support.

## SPECIFICATIONS OF PROFILES FOR ROOFING &amp; WALLING

Maximum recommended spacing of supports												
ROOFS					WALLS							
BMT mm	Mass <sup>1</sup> kg/m <sup>2</sup>	Rib depth mm	Roof pitch min. <sup>2</sup>	Single mm	Int. mm	Overhang <sup>3</sup>						
				End mm	Int. mm		Unstiffened mm	Stiffened mm	Single mm	End mm	Int. mm	Overhang mm
KUP-LOK® 406 <sup>5</sup>	5.0	41	2° (1 in 30)	1500	1700	2100	200	600	1800	1800	1800	300
	5.6	41	1° (1 in 50)	1800	2400	3000	200	600	2400	2400	2400	400
	7.0	41	1° (1 in 50)	2300	2700	3600	300	900	2700	3000	3000	600
KUP-LOK® 700 HI-STRENGTH <sup>6</sup>	4.7	43	2° (1 in 30)	1650	1750	2200	150	450	2400	3000	3600	150
	5.3	43	1° (1 in 50)	2050	2350	2800	200	500	2700	3300	3900	200

<sup>5</sup> Clips must be 75mm from ends of sheets for proper functioning of clips.

<sup>1</sup> Masses are for unpainted ZINCALUME® steel.

<sup>2</sup> Use caution with roof pitch at 1°

<sup>3</sup> See Section 10.6 for explanation of 'stiffened'.

<sup>4</sup> With 5 fasteners per sheet, per support.

<sup>5</sup> With 6 fasteners per sheet, per support.

<sup>6</sup> With 4 fasteners per sheet, per support.

	BMT mm	Mass <sup>1</sup> kg/m <sup>2</sup>	Rib depth mm	Roof pitch min. <sup>2</sup>	Maximum recommended spacing of supports									
					ROOFS			WALLS						
					Single mm	End mm	Int. mm	Overhang <sup>3</sup>		Single mm	End mm	Int. mm	Over- hang mm	
			Unstiff- ened mm	Stiff- ened mm										
<b>KLIP-LOK CLASSIC® 700</b>	0.42	4.61	41	2° (1 in 30)	1600	1800	2600	150	500	200	2300	300	300	
	0.48	5.24	41	1° (1 in 50)	2000	2100	3000	200	600	2450	2550	3000	400	
<b>FLATDEK®</b>	0.42	5.4	250	45	2° (1 in 30)	4500	4500	4500						
<b>FLATDEK® II</b>	0.42	5.4	250	45	2° (1 in 30)	4500	4500	4500						
<b>FLATDEK® 310</b>	0.42	5.23	250	47	2° (1 in 30)	4500	4500	4500						
<b>SPANDEK®</b>	0.42	4.7	700	24	3° (1 in 20)	1300	1800	2400	300	600	2500	3000	3300	300
	0.48	5.3	700	24	3° (1 in 20)	2000	2200	3000	400	700	3000	3000	3300	400

<sup>1</sup> Masses are for unpainted ZINCALUME® steel.

<sup>2</sup> Use caution with roof pitch at 1°

<sup>3</sup> See Section 10.6 for explanation of 'stiffened'.

<sup>4</sup> With 5 fasteners per sheet, per support.

<sup>5</sup> Clips must be 75mm from ends of sheets for proper functioning of clips.

<sup>6</sup> With 4 fasteners per sheet, per support.

<sup>7</sup> With 6 fasteners per sheet, per support.

## SPECIFICATIONS OF PROFILES FOR WALLING

	BMT mm	Mass <sup>1</sup> kg/m <sup>2</sup>	Cover width mm	Rib depth mm	Maximum recommended spacing of wall supports			
					Single mm	End mm	Int. mm	Overhang mm
<b>EASYCLAD® 2PF 300</b>	0.42	4.5	300	19	1500	1500	1500	
<b>MINI ORB<sup>5,7</sup></b>	0.42	4.0	820	6	1200	1500	1500	100
	0.48	4.5	820	6	1500	1500	1500	125
<b>MULTICLAD®</b>	0.35	3.3	840	12	1400	1800	1800	150
	0.42	3.9	840	12	1700	1800	1800	150
<b>PANELRIB<sup>6</sup></b>	0.35	3.2	850	4	1100	1200	1200	150
	0.42	3.8	850	4	1200	1200	1200	150
<b>TRIMWALL®</b>	0.35	3.6	762	29	2100	2900	3000	150
<b>LYSAGHT WALLCLAD®</b>	0.35	3.6	762	16	2100	2400	2400	150

<sup>1</sup> Masses are for unpainted ZINC/ALUME® steel.<sup>2</sup> Use caution with roof pitch at 1°.<sup>3</sup> See Section 10.6 for explanation of 'stiffened'.<sup>4</sup> With 5 fasteners per sheet, per support.<sup>5</sup> Clips must be 75mm from ends of sheets for proper functioning of clips.<sup>6</sup> With 4 fasteners per sheet, per support.<sup>7</sup> With 6 fasteners per sheet, per support.

# SPECIFICATIONS OF PROFILES FOR ROOFING & WALLING ONLY – ZENITH RANGE

		Maximum recommended spacing of supports													
		ROOFS					WALLS								
		BMT mm	Mass <sup>1</sup> kg/m <sup>2</sup>	Cover width mm	Rib depth mm	Roof pitch min. <sup>2</sup>	Single mm	End mm	Int. mm	Overhang <sup>3</sup> Unstiff-ened mm	Stiff-ened mm	Single mm	End mm	Int. mm	Overhang mm
<b>LONGLINE 305<sup>®</sup></b>		0.70	9.70	305	48	1° (1 in 50)	1800	2000	2500	150	450	2000	2700	2700	450
		0.55	6.91	265	38	3° (1 in 20)	600	600	600	50		900	900	1200	100
<b>ENSEAM<sup>®</sup></b>		0.75	9.09	265	38	3° (1 in 20)	700	700	700	50		1000	1000	1300	100
		0.55	5.92	465	38	3° (1 in 20)	Must be fixed on ply with screw fixing at 450mm c/c					450	450	450	100
		0.75	6.02	465	38	3° (1 in 20)						550	550	550	100
		0.55	5.88	285	25	n/a						1200	1200	1500	100
<b>DOMINION<sup>®</sup></b>		0.75	7.43	285	25	n/a						1300	1200	1500	100
		0.55	5.31	485	25	n/a						900	900	1200	100
		0.75	6.71	485	25	n/a						1000	1000	1300	100

<sup>1</sup> Masses are for unpainted ZINCALUME<sup>®</sup> steel.

<sup>2</sup> Use caution with roof pitch at 1°

<sup>3</sup> See Section 10.6 for explanation of 'stiffened'.

<sup>4</sup> With 5 fasteners per sheet, per support.

<sup>5</sup> Clips must be 75mm from ends of sheets for proper functioning of clips.

<sup>6</sup> With 4 fasteners per sheet, per support.

<sup>7</sup> With 6 fasteners per sheet, per support.

For use as walling only

## SPECIFICATIONS OF PROFILES FOR ROOFING &amp; WALLING ONLY - ZENITH RANGE

Maximum recommended spacing of supports										
ROOFS										
WALLS										
	BMT mm	Mass <sup>1</sup> kg/m <sup>2</sup>	Cover width mm	Rib depth mm	Roof pitch min. <sup>2</sup>	Single mm	End mm	Int. mm	Overhang <sup>3</sup>	Overhang mm
						Unstiffened mm	Stiffened mm	Single mm	End mm	
<b>IMPERIAL™</b>	0.55	5.48	325	27	1 <sup>1</sup> (1 in 50) OR	For all span type: Fixed clip at 350mm at roof edge Sliding clip at 700mm at general area.	For all span type: Fixed clip at 350mm at roof edge Sliding clip at 700mm at general area.	50	100	
	0.75	7.42	325	27	3 <sup>1</sup> (1 in 20) for end lap	For all span type: Fixed clip at 450mm at roof edge Sliding clip at 800mm at general area.	For all span type: Fixed clip at 450mm at roof edge Sliding clip at 800mm at general area.	50	100	
	0.55	5.09	525	27		Not suitable for roofing applications.			100	
	0.75	6.89	525	27					100	

<sup>1</sup> Masses are for unpainted ZINCALUME® steel.

<sup>2</sup> Use caution with roof pitch at 1°.

<sup>3</sup> See Section 10.6 for explanation of 'stiffened'.

<sup>4</sup> With 3 fasteners per sheet, per support.

<sup>5</sup> Clips must be 75mm from ends of sheets for proper functioning of clips.

<sup>6</sup> With 4 fasteners per sheet, per support.

<sup>7</sup> With 6 fasteners per sheet, per support.

Maximum recommended spacing of supports										
ROOFS										
BMT mm	Mass <sup>1</sup> kg/m <sup>2</sup>	Cover width mm	Rib depth mm	Roof pitch min. <sup>2</sup>	Single	Int.	Overhang <sup>3</sup>		Over- hang mm	
					mm	mm	Unstiff- ened mm	Stiff- ened mm		
LYSAGHT BAROQUE®	0.55	6.65	275	25	5° (1 in 12)	LYSAGHT BAROQUE® cladding must be fixed to ply at max 600mm c/c only for Wind Region A and Terrain Category 3. For higher Wind Regions check with your lysaght representative.	LYSAGHT BAROQUE® cladding must be fixed to ply at max 600mm c/c only for Wind Region A and Terrain Category 3. For higher Wind Regions check with your lysaght representative.			
	0.75	8.76	275	25	5° (1 in 12)					
	0.55	5.79	475	25	5° (1 in 12)					
	0.75	7.61	475	25	5° (1 in 12)					

<sup>1</sup> Masses are for unpainted ZINCALUME® steel.

<sup>2</sup> Use caution with roof pitch at 1°.

<sup>3</sup> See Section 10.6 for explanation of 'stiffened'.

<sup>4</sup> With 5 fasteners per sheet, per support.

<sup>5</sup> Clips must be 75mm from ends of sheets for proper functioning of clips.

<sup>6</sup> With 4 fasteners per sheet, per support.

<sup>7</sup> With 6 fasteners per sheet, per support.

## SPECIFICATIONS OF PROFILES FOR ROOFING & WALLING ONLY – PERMALITE® RANGE

	BMT mm	Mass <sup>1</sup> kg/m <sup>2</sup>	Cover width mm	Rib depth mm	Maximum recommended spacing of wall supports		
					Single mm	End mm	Int. mm
<b>WAVELINE®</b>	0.70	2.340	762	17	Contact your lysaght representative for specific advice.		
	0.70	2.338	990	17			
	0.90	3.009	762	17			
	0.90	3.006	990	17			
<b>PERMALITE V-RIB®</b>	0.70	2.529	915	32	Contact your lysaght representative for specific advice.		
	0.90	3.252	915	32			
	1.20	4.336	915	32			
<b>LT7®</b>	0.70	2.645	875	38	Contact your lysaght representative for specific advice.		
	0.90	3.401	875	38			
	1.20	4.534	875	38			

<sup>1</sup> Masses are for unpainted Mill Finish aluminium.

<sup>2</sup> Use caution with roof pitch at 1°

<sup>3</sup> See Section 10.6 for explanation of 'stiffened'.

<sup>4</sup> With 5 fasteners per sheet, per support.

<sup>5</sup> Clips must be 75mm from ends of sheets for proper functioning of clips.

<sup>6</sup> With 4 fasteners per sheet, per support.

<sup>7</sup> With 6 fasteners per sheet, per support.

	BMT mm	Mass' kg/m <sup>2</sup>	Cover width mm	Rib depth mm	Maximum recommended spacing of wall supports		
					Single mm	End mm	Int. mm
<b>ALSPAN®</b>	0.70	2.679	864	52			
	0.90	3.444	864	52			Contact your Lysaght representative for specific advice.
	1.20	4.592	864	52			Contact your Lysaght representative for specific advice.
<b>ALSULATE-125®</b>	Top Skin – 0.70	6.423	1000	Rib – 35			
	EPS – 125	6.423	1000	EPS – 125			Contact your Lysaght representative for specific advice.
	Bottom Skin –0.70	6.423	1000	Total - 162			Contact your Lysaght representative for specific advice.

<sup>1</sup> Masses are for unpainted Mill Finish aluminium.

<sup>2</sup> Use caution with roof pitch at 1°

<sup>3</sup> See Section 10.6 for explanation of 'stiffened'.

<sup>4</sup> With 5 fasteners per sheet, per support.

<sup>5</sup> Clips must be 75mm from ends of sheets for proper functioning of clips.

<sup>6</sup> With 4 fasteners per sheet, per support.

<sup>7</sup> With 6 fasteners per sheet, per support.

# LYSAGHT CUSTOM ORB®



LYSAGHT CUSTOM ORB®, the traditional corrugated profile offers high strength, lightweight and excellent deformation resistance. It is equally at home in either traditional or contemporary styles. It can be aligned and installed quickly offering excellent value.

\*Cyclonic design data is available for this product. Visit [www.lysaght.com](http://www.lysaght.com)

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Standard COLORBOND® steel colours, COLORBOND® Ultra steel, COLORBOND® Stainless steel, COLORBOND® Metallic steel, COLORBOND® steel Matt and ZINCALUME® steel
<b>BMT</b>	0.42mm, 0.48mm
<b>Minimum roof slope</b>	5 degrees (1:12)
<b>Curving data</b>	Spring Curving; Minimum radii for convex curving is 12m

## MATERIAL SPECIFICATION

CUSTOM ORB® is made from:

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G550, AM125 (550 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).
- COLORBOND® Stainless steel is pre-painted steel and is used for severe and coastal environments. The painting complies with AS/NZS 2728:2013 and the steel base is a stainless-steel complying with AISI/ASTM Type 430; UNS No. S43000.

- COLORBOND® Ultra is pre-painted steel for severe coastal or industrial environments (generally within about 100-200 metres of the source). The painting complies with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011, G550, AM150 (550 MPa minimum yield stress, 150g/m<sup>2</sup> minimum coating mass).
- COLORBOND® steel Matt and COLORBOND® Metallic steel options may also be available subject to enquiry.

## FIXING DATA

CUSTOM ORB® is pierce-fixed to steel or timber supports. This means that fasteners pass through the sheeting. To maximise watertightness always place fasteners through the crests. For walling, you may use either crest or valley fixing.

	Fix to Steel Single & lapped steel thickness ≥0.55 up to 1.0mm BMT	Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT	Fix to Steel Total lapped thickness ≥1.00 BMT up to 3.8mm BMT	Fix to Timber Hardwood J1-J3	Fix to Timber Softwood J4
<b>Crest Fixed</b>	Roof Zips M6-11x50	12-14x35, Metal Tekes HG, HH or AutoTekes M5.5- 14x39	12-14x35, Metal Tekes HG, HH or AutoTekes M5.5- 14x39	12-11x50, Type 17 HG, HH	12-11x50, Type 17 HG, HH or Roof Zips M6-11x50 HG, HH
<b>Pan Fixed</b>	10-16x16, Metal Tekes, HH or M5-16x25 Designer Head or Roof Zips M6-11x25	10-16x16, Metal Tekes, HH or M5-16x25 Designer Head	10-16x16, Metal Tekes, HH	10-12x25, Type 17, HH M5-16x25 Designer Head or 12-11x25, Type 17, HH	10-12x30, Type 17, HH M5-16x25 Designer Head 12-11x25, Type 17, HH or Roof Zips M6-11x25
<b>Side-laps</b>	(If required) 10-16x16, Metal Tekes, HH or Roof Zips M6-11x25 or M5-16x25 Designer Head or Sealed blind rivet ø4.8mm aluminium				

### Notes:

1. For other steel thicknesses not specified please seek advice from screw manufacturer.
2. Values given are: gauge/threads per inch/ lengths (mm). HH = Hex. Head, WH = Wafer Head, HG = Hi-Grip
3. Care is required during installation to prevent stripping of thin material. (Single ply)
4. Screw specification as above or equivalent fastener.
5. All screws with EPDM sealing washer.

Crest: 3 fasteners †



Pan/Valley: 3 fasteners †



Crest: 5 fasteners †



Pan/Valley: 5 fasteners †



† Fasteners per sheet per support. Most common practice is:  
3 fasteners for internal spans and 5 fasteners for single and end spans.

# LYSAGHT CUSTOM BLUE ORB®



LYSAGHT CUSTOM BLUE ORB® is the corrugated profile perfect for curving, it is the perfect match to harmonise with LYSAGHT CUSTOM ORB®. Roll formed using thicker ductile steel it is used in roofing and walling applications where bull-nosing or curving is required.

\*Cyclonic design data is available for this product.

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Standard COLORBOND® steel colours and ZINCALUME® steel
<b>BMT</b>	0.60mm
<b>Minimum roof slope</b>	5 degrees (1:12)
<b>Curving data</b>	The minimum curving radius is 300mm (400mm in Victoria). At the end of a curve, there must be a straight vertical section of at least 100mm (80mm in Victoria).

## MATERIAL SPECIFICATION

CUSTOM BLUE ORB® is made from:

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G300, AM125 (300 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).
- ZINCFORM® zinc-coated (galvanised) steel complying with AS 1397:2011 G300, Z600 (300 MPa minimum yield stress, 600g/m<sup>2</sup> minimum coating mass).
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G300, AM100 (300 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).

## FIXING DATA

CUSTOM BLUE ORB® is pierce-fixed to steel or timber supports.

This means that fasteners pass through the sheeting. To maximise watertightness always place roof screws through the crests. For walling, you may use either crest or valley fixing.

	<b>Fix to Steel Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT</b>	<b>Fix to Steel Total lapped thickness ≥1.00 BMT up to 3.8mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>	<b>Fix to Timber Softwood J4</b>
<b>Crest Fixed</b>	Roof Zips M6-11x50	12-14x35, Metal Tekes HG, HH or AutoTekes M5.5- 14x39	12-14x35, Metal Tekes HG, HH or AutoTekes M5.5- 14x39	12-11x50, Type 17 HG, HH	12-11x50, Type 17 HG, HH or Roof Zips M6-11x50 HG, HH
<b>Pan Fixed</b>	10-16x16, Metal Tekes, HH or M5-16x25 Designer Head or Roof Zips M6-11x25	10-16x16, Metal Tekes, HH or M5-16x25 Designer Head	10-16x16, Metal Tekes, HH	10-12x25, Type 17, HH M5-16x25 Designer Head or 12-11x25, Type 17, HH	10-12x30, Type 17, HH M5-16x25 Designer Head 12-11x25, Type 17, HH or Roof Zips M6-11x25
<b>Side-laps</b>	(If required) 10-16x16, Metal Tekes, HH or Roof Zips M6-11x25 or M5-16x25 Designer Head or Sealed blind rivet ø4.8mm aluminium				

### Notes:

- For other steel thicknesses not specified please seek advice from screw manufacturer.
- Values given are: gauge/threads per inch/ lengths (mm). HH = Hex. Head, WH = Wafer Head, HG = Hi-Grip
- Care is required during installation to prevent stripping of thin material. (Single ply.)
- Screw specification as above or equivalent fastener.
- All screws with EPDM sealing washer.

Crest: 3 fasteners †



Pan/Valley: 3 fasteners †



Crest: 5 fasteners †

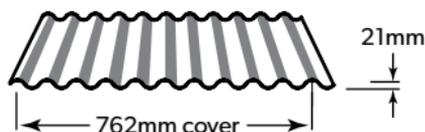


Pan/Valley: 5 fasteners †



† Fasteners per sheet per support. Most common practice is:  
3 fasteners for internal spans and 5 fasteners for single and end spans.

# LYSAGHT CUSTOM ORB ACCENT® 21



LYSAGHT CUSTOM ORB ACCENT® 21 is the perfect alternative to traditional corrugated steel roofing. The deeper profile of CUSTOM ORB ACCENT® 21 steel roofing not only gives a striking visual effect but also delivers real benefits to the architect, builder and owner alike.

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Limited COLORBOND® steel colours and ZINCALUME® steel
<b>BMT</b>	0.40, 0.48mm
<b>Minimum roof slope</b>	3 degrees (1:20)

## MATERIAL SPECIFICATION

CUSTOM ORB ACCENT® 21 is made from:

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G550, AM125 (550 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).

## FIXING DATA

CUSTOM ORB ACCENT® 21 is pierce-fixed to steel or timber supports.

This means that fasteners pass through the sheeting. To maximise watertightness always place fasteners through the crests. For walling, you may use either crest or valley fixing.

	Fix to Steel Single & lapped steel thickness ≥0.55 up to 1.0mm BMT	Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT	Fix to Steel Total lapped thickness ≥1.00 BMT up to 3.8mm BMT	Fix to Timber Hardwood J1-J3	Fix to Timber Softwood J4
<b>CREST FIXED</b>	Roof Zips M6-11x50	12-14x35, Metal Tekes HG, HH or AutoTekes 12.5- 14x39	12-14x35, Metal Tekes HG, HH or AutoTekes 12.5- 14x39	12-11x50, Type 17 HG, HH	12-11x50, Type 17 HG, HH or Roof Zips M6-11x50 HG, HH
<b>PAN FIXED</b>	10-16x16, Metal Tekes, HH or 10-16x25 Designer Head or Roof Zips M6-11x25	10-16x16, Metal Tekes, HH or 10-16x25 Designer Head	12-14x35, Metal Tekes HG, HH or AutoTekes 12.5- 14x39	10-12x25, Type 17, HH 10-16x25 Designer Head or 12-11x25, Type 17, HH	10-12x30, Type 17, HH 12-11x25, Type 17, HH 10-16x25 Designer Head or Roof Zips M6-11x25
<b>SLIDE LAPS</b>	(If required) 10-16x16, Metal Tekes, HH or Roof Zips M6-11x25 or 10-16x25 Designer Head or Sealed blind rivet ø4.8mm aluminium				

### Notes:

For other steel thicknesses not specified please seek advice from screw manufacturer.

Values given are: gauge/threads per inch/ lengths (mm). HH = Hex. Head, WH = Wafer Head, HG = Hi-Grip

Care is required during installation to prevent stripping of thin material. (Single ply.)

4. Screw specification as above or equivalent fastener.

5. All screws with EPDM sealing washer.

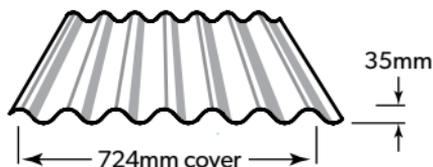
Crest: 3 fasteners †



Valley: 3 fasteners †



# LYSAGHT CUSTOM ORB ACCENT® 35



With corrugations 120% deeper and 50% wider than traditional corrugated profiles LYSAGHT CUSTOM ORB ACCENT® 35 is ideally suited to the large cladding areas in modern industrial, commercial, residential and recreational buildings.

\*Cyclonic design data is available for this product. Visit [www.lysaght.com](http://www.lysaght.com)

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Limited COLORBOND® steel colours and ZINCALUME® steel.
<b>BMT</b>	0.48mm
<b>Minimum roof slope</b>	2 degrees (1:30)

## MATERIAL SPECIFICATION

CUSTOM ORB ACCENT® 35 is made from:

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G550, AM125 (550 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).

## FIXING DATA

CUSTOM ORB ACCENT® 35 is pierce-fixed to timber or steel supports. This means that fastener screws pass through the sheeting. You can place screws through the crests or in the valleys. To maximise watertightness, always place roof screws through the crests. For walling, you may use either crest or valley-fixing. Always drive the screws perpendicular to the sheeting, and in the centre of the corrugation or rib. Don't place fasteners less than 25mm from the ends of sheets.

	<b>Fix to Steel Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT</b>	<b>Fix to Steel Total lapped thickness ≥1.00 BMT up to 3.8mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>	<b>Fix to Timber Softwood J4</b>
<b>CREST FIXED</b>	Roof Zips M6-11x65	12-14x68, Metal Tekes HG, HH	12-14x68, Metal Tekes HG, HH	12-11x65, Type 17 HG, HH	12-11x65, Type 17 HG, HH or Roof Zips M6-11x65 HG, HH
<b>PAN FIXED</b>	10-16x16, Metal Tekes, HH or 10-16x25 Designer Head or Roof Zips M6-11x25	10-16x16, Metal Tekes, HH or 10-16x25 Designer Head	10-16x16, Metal Tekes, HH	10-12x25, Type 17, HH 10-16x25 Designer Head or 12-11x25, Type 17, HH	10-12x30, Type 17, HH 12-11x25, Type 17, HH 10-16x25 Designer Head or Roof Zips M6-11x25
<b>SIDE LAPS</b>	(If required) 10-16x16, Metal Tekes, HH or Roof Zips M6-11x25 or 10-16x25 Designer Head or Sealed blind rivet ø4.8mm aluminium.				

Crest: 3 fasteners per sheet for internal supports



Crest: 6 fasteners per sheet for end supports  
(including single spans)



Valley: 3 fasteners per sheet for internal and end supports



Valley: 6 fasteners per sheet for end supports  
(including single spans)



# LYSAGHT TRIMDEK®



LYSAGHT TRIMDEK® is a subtle square fluted steel cladding profile incorporating fluted pans for strength and long spanning capabilities.

\*Cyclonic design data is available for this product. Visit [www.lysaght.com](http://www.lysaght.com)

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Standard COLORBOND® steel colours, COLORBOND® Ultra steel, COLORBOND® Stainless steel, COLORBOND® Metallic steel, COLORBOND® steel Matt and ZINCALUME® steel
<b>BMT</b>	0.42mm, 0.48mm
<b>Minimum roof slope</b>	2 degrees (1:30)
<b>Curving data</b>	Not suitable for curving.

## MATERIAL SPECIFICATION

TRIMDEK® is made from:

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G550, AM125 (550 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).
- COLORBOND® Stainless steel is pre-painted steel and is used for severe and coastal environments. The painting complies with AS/NZS 2728:2013 and the steel base is a stainless-steel complying with AISI/ASTM Type 430; UNS No. S43000.

- COLORBOND® Ultra is pre-painted steel for severe coastal or industrial environments (generally within about 100-200 metres of the source). The painting complies with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011, G550, AM150 (550 MPa minimum yield stress, 150g/m<sup>2</sup> minimum coating mass).
- COLORBOND® steel Matt and COLORBOND® Metallic steel options may also be available subject to enquiry.

## FIXING DATA

TRIMDEK® is pierce-fixed to steel or timber supports.

This means that fasteners pass through the sheeting. To maximise watertightness always place screws through the crests for roofing applications. For walling, you may use either crest or valley fixing. We recommend valley fixing for premium results.

	<b>Fix to Steel Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT</b>	<b>Fix to Steel Total lapped thickness ≥1.00 BMT up to 3.8mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>	<b>Fix to Timber Softwood J4</b>
<b>Crest Fixed</b>	Roof Zips M6-11x50	12-14x45, Metal Tekes HG, HH or AutoTekes 12-14x50	12-14x45, Metal Tekes HG, HH or AutoTekes 12-14x50	12-11x65, Type 17 HG, HH	12-11x65, Type 17 HG, HH or Roof Zips M6-11x65
<b>Pan Fixed</b>	10-16x16, Metal Tekes, HH or 10-16x25 Designer Head or Roof Zips M6-11x25	10-16x16, Metal Tekes, HH or 10-16x25 Designer Head	10-16x16, Metal Tekes, HH	10-12x25, Type 17, HH 10-16x25 Designer Head or 12-11x25, Type 17, HH	10-12x30, Type 17, HH 10-16x25 Designer Head 12-11x25, Type 17, HH or Roof Zips M6-11x25
<b>Side-laps</b>	(If required) 10-16x16, Metal Tekes, HH or Roof Zips M6-11x25 or 10-16x25 Designer Head or Sealed blind rivet ø4.8mm aluminium				

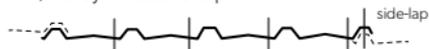
### Notes:

1. For other steel thicknesses not specified please seek advice from screw manufacturer.
2. Values given are: gauge/threads per inch/lengths (mm). HH = Hex. Head, WH = Wafer Head, HG = Hi-Grip
3. Care is required during installation to prevent stripping of thin material. (Single ply.)
4. Screw specification as above or equivalent fastener.
5. All screws with EPDM sealing washer.

Crest: 4 fasteners †



Pan/Valley: 4 fasteners †



# LYSAGHT TRIM-KLIP®

The LYSAGHT TRIM-KLIP® system provides installers with a quick and easy end joint/expansion joint solution between overlapping sheets of TRIMDEK®.

Comprising a fully engineered steel bracket and a custom profiled weather strip, the LYSAGHT TRIM-KLIP® bracket is sandwiched between the overlapping sheets at the ribs and is fixed using standard pierce-fixed screw fasteners.

## TRIM-KLIP® JOINT LAYOUT AND FIXING

The following layout will allow normal pierce-fixed screw fastening at the support and still allow thermal movement to occur at the LYSAGHT TRIM-KLIP®.

The LYSAGHT TRIM-KLIP® system should consist of a LYSAGHT TRIM-KLIP® bracket at each rib with weather strips, as per figure on following page. The weather strips are secured in place by being sandwiched between the lower portion of the bracket and the lower roofing sheet. The lower portion of the bracket is secured in-place by the standard roofing screws through the pre-formed hole and through the roofing rib to the support underneath.

The upper roofing sheet is placed so that the ribs sit upon the upper portion of the LYSAGHT TRIM-KLIP® bracket. The upper sheet is then fixed to the upper portion of the LYSAGHT TRIM-KLIP® bracket using two standard walling screws. Refer to Table for fastener requirements.

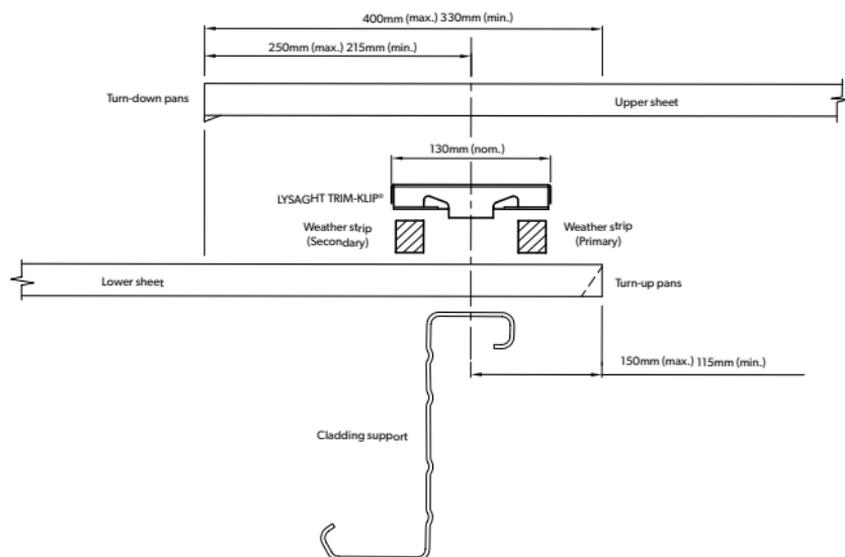
## FASTENERS FOR LYSAGHT TRIM-KLIP® INSTALLATION.

Bracket portion	No. per bracket	Fastener specification
Lower	1	#12-14x45 Metal Tek's HG, HH or AutoTek's M5.5-14x50
Upper	2	#10-16x16 Metal Tek's, HH

## TESTING

The LYSAGHT TRIM-KLIP® system has been tested for performance in wind uplift and weather-resistance at Lysaght's NATA-accredited materials science testing laboratory. This means you can be confident that LYSAGHT TRIM-KLIP® will perform to specification when installed according to our design limitations and installation guidelines.

## LAYOUT DETAILS OF LYSAGHT TRIM-KLIP® SYSTEM AT SUPPORT.



# LYSAGHT SPANDEK®



LYSAGHT SPANDEK® is a contemporary looking trapezoidal profile, which is ideal where a stronger, bolder modern corrugated appearance is required. Originally designed for the commercial sector, SPANDEK® is finding increasing popularity in contemporary home design.

\*Cyclonic design data is available for this product.

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Standard COLORBOND® steel colours, COLORBOND® Ultra steel, COLORBOND® Stainless steel, COLORBOND® Metallic steel, COLORBOND® steel Matt and ZINCALUME® steel
<b>BMT</b>	0.42mm, 0.48mm
<b>Minimum roof slope</b>	3 degrees (1:20)
<b>Curving data</b>	Spring curving – the minimum radii for convex spring curve is 20m

## MATERIAL SPECIFICATION

SPANDEK® is made from:

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G550, AM125 (550 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).
- COLORBOND® Stainless steel is pre-painted steel and is used for severe and coastal environments. The painting complies with AS/NZS 2728:2013 and the steel base is a stainless-steel complying with AISI/ASTM Type 430; UNS No. S43000.

- COLORBOND® Ultra is pre-painted steel for severe coastal or industrial environments (generally within about 100-200 metres of the source). The painting complies with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011, G550, AM150 (550 MPa minimum yield stress, 150g/m<sup>2</sup> minimum coating mass).
- COLORBOND® steel Matt and COLORBOND® Metallic steel options may also be available subject to enquiry.

## FIXING DATA

SPANDEK® is pierce-fixed to timber or steel supports.

This means that fastener screws pass through the sheeting. You can place screws for SPANDEK® through the crests or in the valleys. To maximise watertightness, always place roof screws through the crests. For walling, you may use either crest or valley fixing.

	<b>Fix to Steel Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT</b>	<b>Fix to Steel Total lapped thickness ≥1.00 BMT up to 3.8mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>	<b>Fix to Timber Softwood J4</b>
<b>Crest Fixed</b>	Roof Zips M6-11x50	12-14x45, Metal Tek's HG, HH or AutoTek's 12-14x50	12-14x45, Metal Tek's HG, HH or AutoTek's 12-14x50	12-11x65, Type 17 HG, HH	12-11x65, Type 17 HG, HH or Roof Zips M6-11x65
<b>Pan Fixed</b>	10-16x16, Metal Tek's, HH or 10-16x25 Designer Head or Roof Zips M6-11x25	10-16x16, Metal Tek's, HH or 10-16x25 Designer Head	10-16x16, Metal Tek's, HH	10-12x25, Type 17, HH 10-16x25 Designer Head or 12-11x25, Type 17, HH	10-12x30, Type 17, HH M5-16x25 Designer Head 10-11x25, Type 17, HH or Roof Zips M6-11x25
<b>Side-laps</b>	(If required) 10-16x16, Metal Tek's, HH or Roof Zips M6-11x25 or 10-16x25 Designer Head or Sealed blind rivet ø4.8mm aluminium				

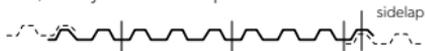
### Notes:

1. For other steel thicknesses not specified please seek advice from screw manufacturer.
2. Values given are: gauge/threads per inch/lengths (mm). HH = Hex. Head, WH = Wafer Head, HG = Hi-Grip
3. Care is required during installation to prevent stripping of thin material. (Single ply)
4. Screw specification as above or equivalent fastener.
5. All screws with EPDM sealing washer.

Crest: 3 fasteners †



Pan/Valley: 3 fasteners †



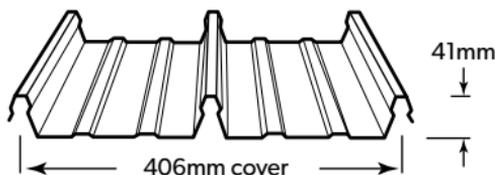
Crest: 4 fasteners †



Pan/Valley: 4 fasteners †



# LYSAGHT KLIP-LOK® 406



LYSAGHT KLIP-LOK® 406 is a strong durable long length profile that combines the strength of steel, a lock action rib design and concealed fixing to allow application on low pitched roofs. It is also suitable for walling both horizontal and vertical installation.

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Limited COLORBOND® steel colours and ZINCALUME® steel
<b>BMT</b>	0.48mm
<b>Minimum roof slope</b>	1 degree (1:50)
<b>Curving data</b>	Not available for curving.

## MATERIAL SPECIFICATION

KLIP-LOK® 406 is made from:

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G550, AM125 (550 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).
- COLORBOND® Stainless steel is pre-painted steel and is used for severe and coastal environments. The painting complies with AS/NZS 2728:2013 and the steel base is a stainless-steel complying with AISI/ASTM Type 430; UNS No. S43000.

- COLORBOND® Ultra is pre-painted steel for severe coastal or industrial environments (generally within about 100-200 metres of the source). The painting complies with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011, G550, AM150 (550 MPa minimum yield stress, 150g/m<sup>2</sup> minimum coating mass).
- COLORBOND® steel Matt and COLORBOND® Metallic steel options may also be available subject to enquiry.

## FIXING DATA

Concealed fixing is the method of fixing sheets using fasteners, which do not pass through the sheet. Instead, the cladding is held in place with clips.

	<b>Fix to Steel Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single thickness steel ≥1.0mm BMT up to 3.0mm BMT</b>	<b>Fix to Steel Total lapped thickness of ≥1.0mm BMT up to 3.8mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>	<b>Fix to Timber Softwood J4</b>
<b>CLIP FIXED</b>	10-16x16, Metal Tekes, WH or 10-16x22, Metal Tekes, WH	10-16x16, Metal Tekes, WH or 10-16x22, Metal Tekes, WH	10-16x16, Metal Tekes, WH or 10-16x22, Metal Tekes, WH	10-12x25, Type 17, WH	10-12x35, Type 17, WH
<b>SIDE LAPS</b>	(If required) 10-16x16, Metal Tekes, HH or Roof Zips M6-11x25 or M5-16x25 Designer Head or Sealed blind rivet ø4.8mm aluminium				

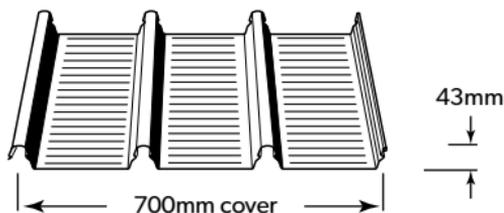
### Notes:

1. For other steel thicknesses not specified please seek advice from screw manufacturer.
2. Values given are: gauge/threads per inch/lengths (mm). HH = Hex. Head, WH = Wafer Head, HG = Hi-Grip
3. Care is required during installation to prevent stripping of thin material. (Single ply.)
4. Screw specification as above or equivalent fastener.
5. All screws with EPDM sealing washer.

1 clip, 2 fasteners †



# LYSAGHT KLIP-LOK 700 HI STRENGTH®



LYSAGHT KLIP-LOK 700 HI STRENGTH® is a wide-cover concealed fixed cladding offering long spans and excellent uplift performance. Also available on our mobile machine, onsite roll-forming allows for long lengths previously unachievable due to transport limitations.

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Standard COLORBOND® steel colours, COLORBOND® Ultra steel, COLORBOND® Stainless steel, COLORBOND® Metallic steel, COLORBOND® steel Matt and ZINCALUME® steel
<b>BMT</b>	0.42mm, 0.48mm
<b>Minimum roof slope</b>	1 degree (1:50) for 0.42mm BMT material subject to design provisions being met.
<b>Lengths</b>	Available custom cut. Maximum lengths reliant on transport and handling capabilities however long lengths available with mobile rollformer.
<b>Curving data</b>	Not available for curving.

## MATERIAL SPECIFICATION

KLIP-LOK 700 HI STRENGTH® is made from:

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G550, AM125 (550 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).

- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).
- COLORBOND® Stainless steel is pre-painted steel and is used for severe and coastal environments. The painting complies with AS/NZS 2728:2013 and the steel base is a stainless-steel complying with AISI/ASTM Type 430; UNS No. S43000.
- COLORBOND® Ultra is pre-painted steel for severe coastal or industrial environments (generally within about 100-200 metres of the source). The painting complies with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011, G550, AM150 (550 MPa minimum yield stress, 150g/m<sup>2</sup> minimum coating mass).
- COLORBOND® steel Matt and COLORBOND® Metallic steel options may also be available subject to enquiry.

## FIXING DATA

Concealed fixing is the method of fixing sheets using fasteners, which do not pass through the sheet. Instead, the cladding is held in place with clips.

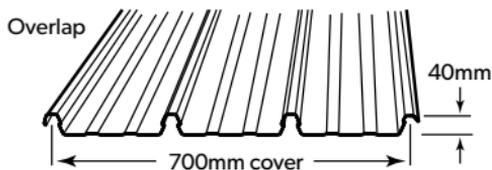
	<b>Fix to Steel Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT</b>	<b>Fix to Steel Total lapped thickness ≥1.00 BMT up to 3.8mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>	<b>Fix to Timber Softwood J4</b>
<b>CLIP FIXED</b>	RoofZips M6-11x25	12-14x20*, Metal Tekes, HH	12-14x20*, Metal Tekes, HH	12-11x25, Type 17, HH	12-11x45, Type 17, HH or RoofZips M6-11x25

Notes:

1. For other steel thicknesses not specified please seek advice from screw manufacturer.
2. HH = Hex. Head.
3. Use 3 screws per clip.
4. As above or equivalent fastener.

\* Longer screws may be easier to install (e.g. 12-14x30).

# LYSAGHT KLIP-LOK CLASSIC® 700



A roofing and walling profile with a strong rib making a bold statement rising from flat pans with longitudinal fluting offering long, straight lines for a crisp and clean finish. Primarily usage on commercial and industrial buildings.

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Standard COLORBOND® steel colours, COLORBOND® Ultra steel, COLORBOND® Stainless steel, COLORBOND® Metallic steel, COLORBOND® steel Matt and ZINCALUME® steel
<b>BMT</b>	0.42mm, 0.48mm
<b>Minimum roof slope</b>	2 degrees for 0.42 BMT (1:30) 1 degree for 0.48 BMT (1:50)
<b>Curving data</b>	Not suitable for curving.

## MATERIAL SPECIFICATION

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G550, AM125 (550 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).

- COLORBOND® Stainless steel is pre-painted steel and is used for severe and coastal environments. The painting complies with AS/NZS 2728:2013 and the steel base is a stainless-steel complying with AISI/ASTM Type 430; UNS No. S43000.
- COLORBOND® Ultra is pre-painted steel for severe coastal or industrial environments (generally within about 100-200 metres of the source). The painting complies with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011, G550, AM150 (550 MPa minimum yield stress, 150g/m<sup>2</sup> minimum coating mass).
- COLORBOND® steel Matt and COLORBOND® Metallic steel options may also be available.

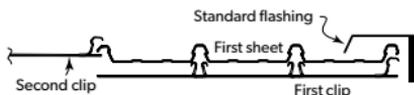
## FIXING DATA

Concealed fixing is the method of fixing sheets using fasteners, which do not pass through the sheet. Instead, the cladding is held in place with clips.

	Fix to Steel Single steel thickness ≥1.0 BMT up to 3.0mm BMT	Fix to Steel Total lapped thickness ≥1.0 BMT up to 3.8mm BMT	Fix to Timber Hardwood J1-J3	Fix to Timber Softwood J4
<b>Clip Fixed</b>	5.4-14x25, Vortex, HH 12-14x30 Concealed Hex Tek's	5.4-14x25, Vortex, HH 12-14x30 Concealed Hex Tek's	5.4-14x25, Vortex, HH	5.4-14x25, Vortex, HH

### Notes:

1. For other steel thicknesses not specified please seek advice from screw manufacturer.
2. HH = Hex. Head.
3. Use 3 screws per clip.



# LYSAGHT LOK-KLIP®

The LYSAGHT LOK-KLIP® system provides installers with a quick and easy end joint/expansion joint solution between overlapping sheets of LYSAGHT KLIP-LOK 700 HI-STRENGTH® and LYSAGHT KLIP-LOK CLASSIC 700®.

The LOK-KLIP® system comprises a fully engineered ZINCALUME® steel bracket and a custom shaped weather resistant polyethylene foam weather strip. The LOK-KLIP® bracket replicates the role of a standard concealed fix bracket and is secured to the ribs of the bottom sheet using standard roofing fasteners.

## LOK-KLIP® JOINT LAYOUT AND FIXING

When a LOK-KLIP® is used, the length of each individual sheet is necessarily shorter, thus reducing the impact of thermal movement.

This will allow normal concealed fastening at the support and therefore allow thermal movement to occur at the LOK-KLIP®. To install the LOK-KLIP® bracket, locate each LOK-KLIP® bracket, then hand press to snap fit each LOK-KLIP® bracket to the KLIP-LOK® rib (Figure a, b).

For non-cyclonic areas, using a low torque setting on the drill to ensure the cladding is not stripped, secure through the top hole of the LOK-KLIP® and also through the crest of the lower sheet (Figure a). For cyclonic areas, use two fasteners by fixing through the sides of the LOK-KLIP® bracket into the sides of the rib (Figure b).

## FASTENERS FOR LOK-KLIP® INSTALLATION

### KLIP-LOK 700 HI-STRENGTH®

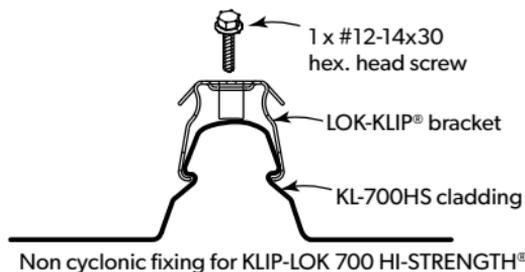
NON-CYCLONIC	1 x #12-14x30 Hex head screw on top of bracket
CYCLONIC	2 x #10-16x16 Wafer head screw at each leg of bracket, 2 in total

### KLIP-LOK CLASSIC® 700

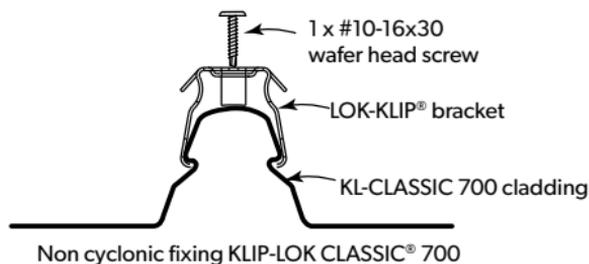
NON-CYCLONIC	1 x #10-16x30 Wafer head screw on top of bracket
CYCLONIC	2 x #10-16x16 Wafer head screw at each leg of bracket, 2 in total

**Figure a**

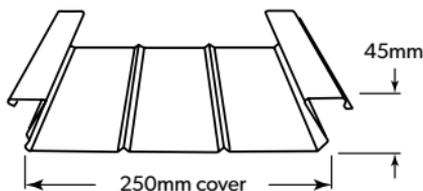
Fixing of LOK-KLIP® brackets to cladding.

**Figure b**

Fixing of LOK-KLIP® brackets to cladding.



# LYSAGHT FLATDEK®



LYSAGHT FLATDEK® is a long-span cladding particularly suited to home improvement projects like patios, carports & pergolas. The underside of FLATDEK® features clean uninterrupted lines, with an attractive gloss finish ensuring visual appeal.

<b>Application</b>	Roofing (light or no foot traffic installation)
<b>Finishes available</b>	A range of COLORBOND® pre-painted steel colours with a range of top side/bottom side colour combinations, with a gloss finish on the underside.
<b>BMT</b>	0.42mm
<b>Minimum roof slope</b>	2 degrees (1:30)
<b>Lengths</b>	Available custom cut.

## MATERIAL SPECIFICATIONS

FLATDEK® is made from:

- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).

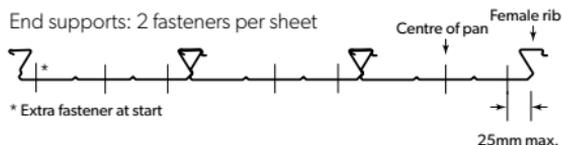
## FIXING DATA

The unique overlapping dovetail ribs of the FLATDEK® profile can be easily fitted together by hand. FLATDEK® is simply and economically fixed on top of its supporting members using self-drilling screws in the pans. This method, using the recommended fasteners, is appropriate for open sided awnings where a high degree of weather tightness is not required.

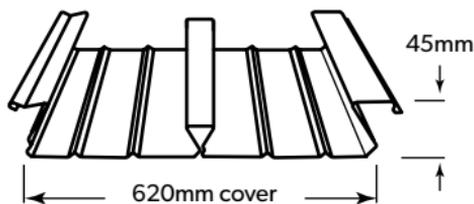
	<b>Fix to Steel (Total 2.0mm) Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>	<b>Fix to Timber Softwood J4</b>
<b>PAN FIXED</b>	12-14x20, Metal Tekes, HH with EPDM seal or Roof Zips M6-11x25 with EPDM seal	12-14x20, Metal Tekes, HH with EPDM seal	M5.5-11x35 Batten Zip 16mm bonded Aluminium EPDM washer	M5.5-11x35 Batten Zip 16mm bonded Aluminium EPDM washer

### Notes:

1. Values given are: gauge-threads per inch x lengths (mm). HH = Hex. Head. Finish is Coating Class 4.
2. When fixing to FIRMLOK®, tighten until washer is just gripped enough to give a weathertight seal. Don't tighten any more.
3. Screw specification as above or equivalent fastener. Refer to Timber Code AS1720.2 for timber grades.
4. For awnings with double spans of 4000mm or more for wind class 3, 3 sides blocked, use 3 fasteners per pan for middle supports. For single spans for wind categories up to N4, 3 sides blocked use 2 fasteners per span.



# LYSAGHT FLATDEK® II



LYSAGHT FLATDEK® II is a long-span cladding particularly suited to home improvement projects such as patios, carports & pergolas. The underside of FLATDEK® II features clean uninterrupted lines, with an attractive gloss finish ensuring visual appeal.

**Application** Roofing

**Finishes available** A range of COLORBOND® pre-painted steel colours with a range of top side/bottom side colour combinations, with a gloss finish on the underside.

**BMT** 0.42mm

**Minimum roof slope** 2 degrees (1:30)

## MATERIAL SPECIFICATION

FLATDEK® II is made from:

- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).

## FIXING DATA

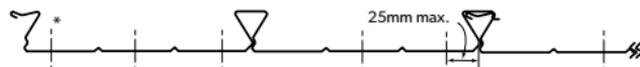
The unique overlapping dovetail ribs of the FLATDEK® II profile can be easily fitted together by hand. FLATDEK® II is simply and economically fixed on top of its supporting members using self-drilling screws in the pans. This method, using the recommended fasteners, is appropriate for open sided awnings where a high degree of weather tightness is not required.

	<b>Fix to Steel (Up To Total 2.0mm) Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>	<b>Fix to Timber Softwood J4</b>
<b>PAN FIXED</b>	12-14x20, Metal Tek's, HH with EPDM seal or Roof Zips M6-11x25 with EPDM seal	12-14x20, Metal Tek's, HH with EPDM seal	M5.5-11x35 Batten Zip 16mm bonded Aluminium EPDM washer	M5.5-11x35 Batten Zip 16mm bonded Aluminium EPDM washer

Notes:

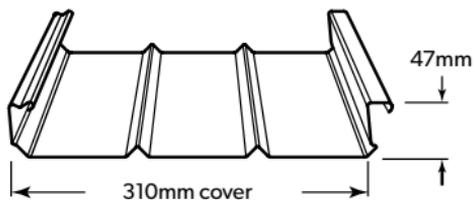
1. Values given are: gauge-threads per inch x lengths (mm). HH = Hex. Head. Finish is Coating Class 4.
2. When fixing to FIRMLOK®, tighten until washer is just gripped enough to give a weathertight seal. Don't tighten any more.
3. Screw specification as above or equivalent fastener. Refer to Timber Code AS1720.2 for timber grades.
4. For awnings with double spans >3700mm for N4 wind category, 2 & 3 sides blocked, use 3 fasteners per span for middle supports. (E.g. FIRMLOK® F100 beams). For single spans for wind categories up to N4, 3 sides blocked use 2 fasteners per pan.

### Fastener locations



\* Extra fastener at the start. Supports: 2 fasteners per pan.

# LYSAGHT FLATDEK® 310



LYSAGHT FLATDEK® 310 is a long-span cladding particularly suited to home improvement projects like patios, carports & pergolas. The underside of FLATDEK® 310 features clean uninterrupted lines, with an attractive gloss finish ensuring visual appeal.

**Application** Roofing

**Finishes available** A range of COLORBOND® pre-painted steel colours with a range of top side/bottom side colour combinations, with a gloss finish on the underside.

**BMT** 0.42mm

**Minimum roof slope** 2 degrees (1:30)

## MATERIAL SPECIFICATION

FLATDEK® 310 is made from:

- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).

## FIXING DATA

FLATDEK® 310 is simply and economically fixed on top of its supporting members using self-drilling screws (teks) in the pans. This method, using the recommended fasteners, is appropriate for open sided awnings where a high degree of weather tightness is not required.

	<b>Fix to Steel Single &amp; lapped steel thickness</b>	<b>Fix to Steel Single steel thickness</b>	<b>Fix to Timber Hardwood</b>	<b>Fix to Timber Softwood</b>
	<b>≥0.55 up to 1.0mm BMT</b>	<b>≥1.0mm BMT up to 3.0mm BMT</b>	<b>J1-J3</b>	<b>J4</b>
<b>PAN FIXED</b>	12-14x20, Metal Teks, HH with EPDM seal	12-14x20, Metal Teks, HH with EPDM seal	M5.5-11x40 Batten Zip with 16mm bonded Aluminium EPDM washer	M5.5-11x40 Batten Zip with 16mm Bonded Aluminium EPDM washer



# LYSAGHT MINI ORB®



LYSAGHT MINI ORB® is a corrugated sheet with reduced height of corrugation compared to the more traditional LYSAGHT CUSTOM ORB® profile. It is suitable for interior and exterior applications; on straight or curved surfaces; with the corrugations running vertically or horizontally.

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Standard COLORBOND® steel colours, COLORBOND® Ultra steel, COLORBOND® Stainless steel, COLORBOND® Metallic steel, COLORBOND® steel Matt and ZINCALUME® steel
<b>BMT</b>	0.42mm

## MATERIAL SPECIFICATION

MINI ORB® is made from:

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G550, AM125 (550 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).
- COLORBOND® Stainless steel is pre-painted steel and is used for severe and coastal environments. The painting complies with AS/NZS 2728:2013 and the steel base is a stainless-steel complying with AISI/ASTM Type 430; UNS No. S43000.

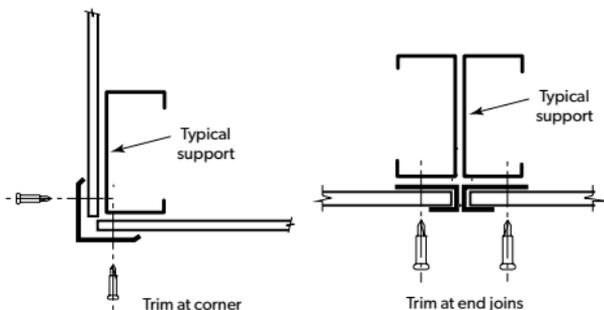
- COLORBOND® Ultra is pre-painted steel for severe coastal or industrial environments (generally within about 100-200 metres of the source). The painting complies with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011, G550, AM150 (550 MPa minimum yield stress, 150g/m<sup>2</sup> minimum coating mass).
- COLORBOND® steel Matt and COLORBOND® Metallic steel options may also be available subject to enquiry.

## FIXING DATA

You will always get a better appearance by taking a little extra care to ensure an evenly finished job, with uniform light reflection. Make sure that the supporting structure is as rigid and as flat as possible.

MINI ORB® should be fixed to all intermediate battens or studs to prevent noise if the sheet flexes with pressure fluctuations in the building. Fix fasteners no less than 15mm from ends of sheets.

## TRIMS



## MINI ORB® FASTENERS

	<b>Fix to Steel</b> Total thickness up to 3.0mm BMT	<b>Fix to Timber</b> J1-J4
<b>Valley Fixed</b>	RippleZips® screws M4.8-16x25	RippleZips® screws M4.8-16x25

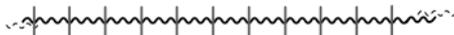
Notes:

1. For other steel thicknesses not specified please seek advice from screw manufacturer.
2. Values given are: gauge/threads per inch/ lengths (mm).
3. Care is required during installation to prevent stripping of thin material.
4. Screw specification as above or equivalent fastener.
5. RippleZips® screws are not available in Class 4 coating.

Valley: 6 fasteners †

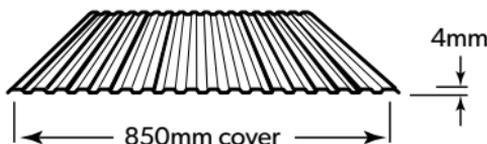


Valley: 11 fasteners †



† Number of fasteners per sheet per support depends on wind pressure.

# LYSAGHT PANELRIB®



LYSAGHT PANELRIB® has a fluted profile making it suitable for many applications where flat sheet would not normally be considered. The longitudinal flutes provide rigidity along the length of the sheet while retaining full flexibility across the width.

PANELRIB® can be used on exterior and interior walls and on straight or curved surfaces with flutes horizontal or vertical.

<b>Application</b>	Walling – external and internal
<b>Finishes available</b>	Standard COLORBOND® steel colours and ZINCALUME® steel
<b>BMT</b>	0.35mm, 0.42mm
<b>Lengths</b>	Available custom cut. Maximum lengths reliant on transport capabilities
<b>Curving Data</b>	Not available for curving

## MATERIAL SPECIFICATION

PANELRIB® is made from:

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G550, AM125 (550 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).

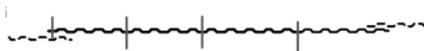
## FIXING DATA

	Fix to Steel Single & lapped steel thickness ≥0.55 up to 1.0mm BMT	Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT	Fix to Steel Total lapped thickness ≥1.0mm BMT up to 3.8mm BMT	Fix to Timber Hardwood J1-J3	Fix to Timber Softwood J4
<b>PAN FIXED</b>	10-16x16, Metal Teks, HH or 10-16x25 Designer Head or Roof Zips M6-11x25	10-16x16, Metal Teks, HH or 10-16x25 Designer Head	10-16x16, Metal Teks, HH	10-12x25, Type 17, HH or 10-16x25 Designer Hea	10-12x30, Type 17, HH or 10-16x25 Designer Head or Roof Zips M6-11x25
<b>SIDE LAPS</b>	Sealed blind rivet ø3.2mm aluminium (if required)				

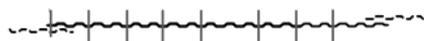
## Notes:

1. For other steel thicknesses not specified please seek advice from screw manufacturer.
2. Values given are: gauge/threads per inch/ lengths (mm). HH = Hex. Head, WH = Wafer Head, HG = Hi-Grip
3. Care is required during installation to prevent stripping of thin material. (Single ply.)
4. Screw specification as above or equivalent fastener.
5. All screws with EPDM sealing washer.

Pan: 4 fasteners †



Pan: 8 fasteners †



# LYSAGHT MULTICLAD®



LYSAGHT MULTICLAD® is an attractive trapezoidal multi ribbed profile that is quick and easy to install. It is commonly used in walling for industrial commercial and residential markets.

<b>Application</b>	Walling – external and internal
<b>Finishes available</b>	Standard COLORBOND® steel colours and ZINCALUME® steel
<b>BMT</b>	0.35mm, 0.42mm

## MATERIAL SPECIFICATION

MULTICLAD® is made from:

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G550, AM125 (550 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).

## FIXING DATA

	<b>Fix to Steel (Total 2.0mm BMT) Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT</b>	<b>Fix to Steel (Total 3.8mm BMT) Lapped thickness ≥1.00 BMT up to 1.9mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>	<b>Fix to Timber Softwood J4</b>
<b>PAN FIXED</b>	10-16x16, Metal Teks, HH or M5-16x25 Designer Head or Roof Zips M6-11x25	10-16x16, Metal Teks, HH or M5-16x25 Designer Head	10-16x16, Metal Teks, HH	10-12x25, Type 17, HH or M5-16x25 Designer Head	10-12x30, Type 17, HH or M5-16x25 Designer Head or Roof Zips M6-11x25

## Notes:

1. For other steel thicknesses not specified please seek advice from screw manufacturer.
2. Values given are: gauge/threads per inch/ lengths (mm). HH = Hex. Head, WH = Wafer Head, HG = Hi-Grip
3. Care is required during installation to prevent stripping of thin material. (Single ply)
4. Screw specification as above or equivalent fastener.
5. All screws with EPDM sealing washer.

4 fasteners per sheet/support



# LYSAGHT WALLCLAD®



LYSAGHT WALLCLAD® is a lightweight and attractive corrugated walling sheet with the same traditional profile as LYSAGHT CUSTOM ORB®. LYSAGHT WALLCLAD® can be installed either vertically or horizontally for dynamic effects.

<b>Application</b>	Walling
<b>Finishes available</b>	Standard COLORBOND® steel colours and ZINCALUME® steel
<b>BMT</b>	0.35mm
<b>Curving data</b>	Not suitable for curving.

## MATERIAL SPECIFICATION

LYSAGHT WALLCLAD® is made from:

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G550, AM125 (550 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).

## FIXING DATA

LYSAGHT WALLCLAD® is pierce-fixed to steel or timber supports. This means that fasteners pass through the sheeting. We recommend valley fixing for premium results.

	<b>Fix to Steel Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT</b>	<b>Fix to Steel Total lapped thickness ≥1.0mm BMT up to 3.8mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>	<b>Fix to Timber Softwood J4</b>
<b>VALLEY FIXED</b>	10-16x16, Metal Tek's, HH or M5-16x25 Designer Head or Roof Zips M6-11x25	10-16x16, Metal Tek's, HH or M5-16x25 Designer Head	10-16x16, Metal Tek's, HH	10-12x25, Type 17, HH or M5-16x25 Designer Head	10-12x30, Type 17, HH or M5-16x25 Designer Head or Roof Zips M6-11x25
<b>SIDE LAPS</b>	10-16x16, Metal Tek's, HH or Roof Zips M6-11x25 or M5-16x25 Designer Head or Sealed blind rivet ø4.8mm				

### Notes:

1. For other steel thicknesses not specified please seek advice from screw manufacturer.
2. Values given are: gauge/threads per inch/lengths (mm). HH = Hex. Head, WH = Wafer Head, HG = Hi-Grip
3. Care is required during installation to prevent stripping of thin material. (Single ply.)
4. Screw specification as above or equivalent fastener.
5. All screws with EPDM sealing washer.

Valley: 3 fasteners †



Valley: 5 fasteners †



† Number of fasteners per sheet per support. Most common practise is 3 fasteners for internal spans and 5 fasteners for single and end supports.

# LYSAGHT TRIMWALL®



LYSAGHT TRIMWALL® is an attractive, lightweight and versatile steel walling profile designed to complement LYSAGHT TRIMDEK®. TRIMWALL® allows long spans for quick installation.

<b>Application</b>	Walling
<b>Finishes available</b>	Standard COLORBOND® steel colours and ZINCALUME® steel
<b>BMT</b>	0.35mm
<b>Curving data</b>	Not suitable for curving.

## MATERIAL SPECIFICATION

TRIMWALL® is made from:

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G550, AM125 (550 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).

## FIXING DATA

TRIMWALL® is pierce-fixed to steel or timber supports. This means that fastener screws pass through the sheeting. For walling, you may only use valley fixing.

	<b>Fix to Steel Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT</b>	<b>Fix to Steel Total lapped thickness ≥1.0mm BMT up to 3.8mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>	<b>Fix to Timber Softwood J4</b>
<b>PAN FIXED</b>	10-16x16, Metal Teks, HH or M5-16x25 Designer Head or Roof Zips M6-11x25	10-16x16, Metal Teks, HH or M5-16x25 Designer Head	10-16x16, Metal Teks, HH	10-12x25, Type 17, HH or M5-16x25 Designer Head	10-12x30, Type 17, HH or M5-16x25 Designer Head or Roof Zips M6-11x25
<b>SIDE LAPS</b>	10-16x16, Metal Tekes, HH or Roof Zips M6-11x25 or M5-16x25 Designer Head or Sealed blind rivet ø4.8mm aluminium				

### Notes:

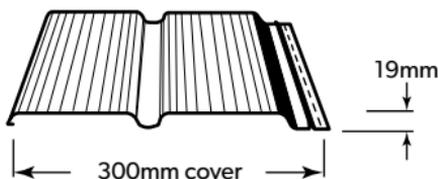
1. For other steel thicknesses not specified please seek advice from screw manufacturer.
2. Values given are: gauge/threads per inch/lengths (mm). HH = Hex. Head, WH = Wafer Head, HG = Hi-Grip
3. Care is required during installation to prevent stripping of thin material. (Single ply.)
4. Screw specification as above or equivalent fastener.
5. All screws with EPDM sealing washer.

Pan: 4 fasteners †



† Fasteners per sheet per support.

# LYSAGHT EASYCLAD®



The LYSAGHT EASYCLAD® system features stylish, clean-line panels with a wide range of trim sections and accessories catering for various design situations. A variation is available in the Northern Territory.

EASYCLAD® can be fixed either vertically or horizontally.

<b>Application</b>	Walling
<b>Finishes available</b>	Limited COLORBOND® steel colours, and ZINCALUME® steel
<b>BMT</b>	0.42mm
<b>Curving data</b>	Not suitable for curving.

## MATERIAL SPECIFICATION

EASYCLAD® is made from:

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G550, AM125 (550 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).

## FIXING DATA

	<b>Fix to Steel (Total 2.0mm BMT) Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT</b>	<b>Fix to Steel (Total 3.8mm BMT) Lapped thickness ≥1.00 BMT up to 1.9mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>	<b>Fix to Timber Softwood J4</b>
<b>CLIP AND PAN FIXED</b>	10-16x16, Metal Teks, HH or M5-16x25 Designer Head or Roof Zips M6-11x25	10-16x16, Metal Teks, HH or M5-16x25 Designer Head	10-16x16, Metal Teks, HH	H 10-12x25, Type 17, HH or M5-16x25 Designer Head	10-12x30, Type 17, HH or M5-16x25 Designer Head or Roof Zips M6-11x25

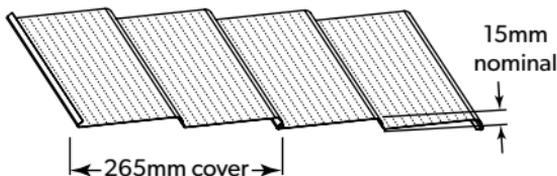
## Notes:

1. For other steel thicknesses not specified please seek advice from screw manufacturer.
2. Values given are: gauge/threads per inch/ lengths (mm). HH = Hex. Head, WH = Wafer Head, HG = Hi-Grip
3. Care is required during installation to prevent stripping of thin material. (Single ply.)
4. Screw specification as above or equivalent fastener.
5. All screws with EPDM sealing washer

† fastener †



# LYSAGHT WEATHERLINE®



LYSAGHT WEATHERLINE® is an attractive and durable interlocking steel panel system with concealed fixings. Made from COLORBOND® steel with a wide range of accessory items. WEATHERLINE® is fixed horizontally on walls in internal or external locations.

<b>Application</b>	Walling
<b>Finishes available</b>	Standard COLORBOND® steel colours and ZINCALUME® steel
<b>BMT</b>	0.42mm

## MATERIAL SPECIFICATION

WEATHERLINE® II is made from:

- Next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397:2011 G550, AM125 (550 MPa minimum yield stress, 125g/m<sup>2</sup> minimum coating mass).
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).
- COLORBOND® steel Matt options may also be available subject to enquiry.

## FIXING DETAILS

WEATHERLINE® shall be fixed in accordance with the details shown in the table.

Wind Classification AS 4055-2012	Clip/Strip	Support Spacing (mm)	Steel Support Fixing		Timber Support Fixing
			Grade, BMT	Fastener	Timber type & Fastener
<b>NON-CYCLONIC UP TO N3</b>	Clip	600	G550, 0.55	#10-16x16 HH Tek®	Softwood or Hardwood use Batten Zips® HH 12-11x40
<b>NON-CYCLONIC UP TO N4</b>	Strip 0.55mm BMT	600	G550, 0.75	#10-16x16 HH Tek®	
<b>CYCLONIC UP TO C2</b>	Strip 1.0mm BMT	600	G550, 1.0	#10-16x16 HH Tek®	Softwood use Batten Zips® HH 12-11x40
<b>CYCLONIC UP TO C2</b>	Strip 1.0mm BMT	450	G550, 0.75	#10-16x16 HH Tek®	Hardwood use #12-11x25 HH Type 17

# THE LYSAGHT ZENITH™ ARCHITECTURAL CLADDING RANGE

## THE NEW LYSAGHT ZENITH™ RANGE OFFERS FIVE STRIKING PROFILES THAT ADD DYNAMIC VISUAL TEXTURE TO ANY ARCHITECTURAL DESIGN

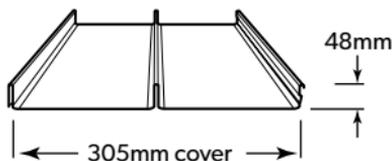
LYSAGHT® steel cladding has long been a valuable design resource for Australian architects, providing as it does aesthetically appealing and versatile facades that bend, often literally, to their creative will and add exciting visual dimensions to their designs.

In the LYSAGHT ZENITH™ cladding range, that design value has reached new heights with profiles that deliver bolder aesthetics than seen before, paired with the exceptional performance you have come to know and expect from LYSAGHT® steel products.

The ZENITH™ range features five elegant profiles:

- LYSAGHT LONGLINE 305®
- LYSAGHT ENSEAM®
- LYSAGHT IMPERIAL™
- LYSAGHT DOMINION®
- LYSAGHT BAROQUE®

# LYSAGHT LONGLINE 305®



LYSAGHT LONGLINE 305® cladding is a concealed fixed roof cladding with bold ribs and wide pans. It is ideal for medium to large commercial projects where special architectural effects are desired. It has also been popular in industrial and residential applications. The unique locking system fixes the cladding to the clip so no fasteners pass through the roofing. Concealed fixing means there are no penetrations so weathertightness is maximised and a high rainfall capacity is achieved. LONGLINE 305® cladding can also be fluted or tapered allowing fanned and rounded plan roof shapes to be clad with ribs radiating from a central point.

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Limited COLORBOND® steel colours, COLORBOND® Ultra steel, COLORBOND® Metallic steel, COLORBOND® steel Matt and ZINCALUME® steel
<b>BMT</b>	0.70mm
<b>Minimum roof slope</b>	1 degree (1:50)

## MATERIAL SPECIFICATION

LONGLINE 305® is made from:

- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).

- COLORBOND® Ultra is pre-painted steel for severe coastal or industrial environments (generally within about 100-200 metres of the source). The painting complies with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011, G550, AM150 (550 MPa minimum yield stress, 150g/m<sup>2</sup> minimum coating mass).
- COLORBOND® steel Matt and COLORBOND® Metallic steel options may also be available subject to enquiry.

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**PLAIN - FLAT PANS**  
**STANDARD WIDTH (COVER 305MM)**




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**FLUTED - SMALL CREASES IN THE CENTRE OF THE PANS (COVER 300MM)**




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**TAPERED - PAN WIDTH REDUCED BY UP TO 50% OF NORMAL WIDTH AT ONE END**

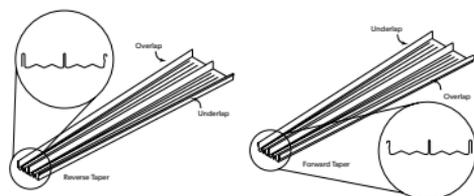
**NARROW END WITH DIMENSION OF APPROX. 265MM**



**NARROW END WITH DIMENSION OF APPROX. 235MM**



**NARROW END WITH DIMENSION OF APPROX. 155MM**



## FIXING DATA

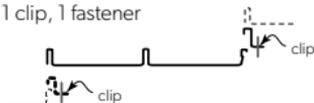
LONGLINE 305® cladding is concealed-fixed to supports. This means that clips are screwed to the supports, and no fastening passes through the sheeting. There are two types of fixing clips - a top finishing clip and a start/finishing clip to fasten the first and last sheets in a roof area.

	<b>Fix to Steel (Total 2.0mm) Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single steel thickness &gt;1.0mm BMT up to 3.0mm BMT</b>
<b>CLIP FIXED</b>	10-16x16, Metal Tekes, WH or 10-16x22, Metal Tekes, WH	10-16x16, Metal Tekes, WH or 10-16x22, Metal Tekes, WH
	<b>Fix to Steel (Total 3.8mm) Lapped thicknesses of &gt;1.00 BMT up to 1.9mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>
<b>CLIP FIXED</b>	10-16x16, Metal Tekes, WH or 10-16x22, Metal Tekes, WH	10-12x25, Type 17, WH
	<b>Fix to Timber Softwood J4</b>	
<b>CLIP FIXED</b>	10-12x35, Type 17, WH	

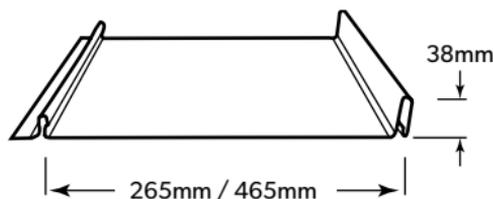
### Notes:

1. For other steel thicknesses not specified please seek advice from screw manufacturer
2. WH = Wafer Head
3. Use one screw per clip
4. As above or equivalent fastener

1 clip, 1 fastener



# LYSAGHT ENSEAM®



LYSAGHT ENSEAM® architectural cladding is a concealed fixed flat panel cladding system. ENSEAM® is structurally sound for direct fixed to steel battens and can also be fixed onto conventional supporting substrate such as plywood or fibre cement panels. The wide flat profile gives a modern architecturally designed premium finish.

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Standard COLORBOND® steel colours, COLORBOND® Ultra steel, COLORBOND® Metallic steel, COLORBOND® steel Matt and ZINCALUME® steel
<b>BMT</b>	0.55mm, 0.75mm
<b>Minimum roof slope</b>	3 degrees (1:20)

## MATERIAL SPECIFICATION

ENSEAM® is made from:

- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).

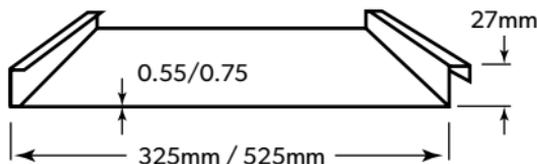
- COLORBOND® Ultra is pre-painted steel for severe coastal or industrial environments (generally within about 100-200 metres of the source). The painting complies with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011, G550, AM150 (550 MPa minimum yield stress, 150g/m<sup>2</sup> minimum coating mass).
- COLORBOND® steel Matt and COLORBOND® Metallic steel options may also be available subject to enquiry.

## FIXING DATA

ENSEAM® is concealed pierce-fixed to batten supports. This means that fastener screws pass through the sheeting at the concealed underlap edge. You can place screws through the slotted holes or directly through the sheet.

Fixing	Application
<b>FIXING TO STEEL</b>	10g-16x16 wafer head metal screw with minimum class 3 coating
<b>FIXING TO PLYWOOD</b>	10g-12x25 wafer head type 17 metal screw with minimum class 3 coating
<b>FIXING TO TIMBER</b>	10g-12x25 wafer head type 17 metal screw with minimum class 3 coating

# LYSAGHT IMPERIAL™



LYSAGHT IMPERIAL™ architectural cladding is a concealed fixed flat panel cladding system. LYSAGHT IMPERIAL™ is structurally sound for direct fixed to steel battens and can also be fixed onto conventional supporting substrate such as plywood or fibre cement panels. The wide flat profile gives a modern architecturally designed premium finish. LYSAGHT IMPERIAL™ cladding has a curving capacity, not easily achieved with all cladding profiles. LYSAGHT IMPERIAL™ cladding can be pre-curved to a radius of 3m.

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Standard COLORBOND® steel colours, COLORBOND® Ultra steel, COLORBOND® Metallic steel, COLORBOND® steel Matt and ZINCALUME® steel
<b>BMT</b>	0.55mm, 0.75mm
<b>Minimum roof slope</b>	1 degree (1:50) for BMT 0.75mm 3 degrees (1:20) for BMT 0.55mm

## MATERIAL SPECIFICATION

LYSAGHT IMPERIAL™ is made from:

- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).

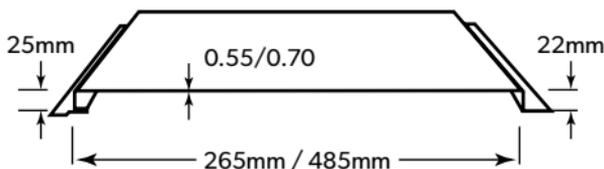
- COLORBOND® Ultra is pre-painted steel for severe coastal or industrial environments (generally within about 100-200 metres of the source). The painting complies with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011, G550, AM150 (550 MPa minimum yield stress, 150g/m<sup>2</sup> minimum coating mass).
- COLORBOND® steel Matt and COLORBOND® Metallic steel options may also be available subject to enquiry.

## FIXING DATA

LYSAGHT IMPERIAL™ is a conceal fixed cladding system utilising 2 type of clips, the fixed clip are usually positioned at building edge and the sliding clip is used at non perimeter areas as well as at building edges.

Application	Fixing to steel	Fixing to plywood/timber
<b>NON-CYCLONIC</b>	Fixed clip: 2x M4.8-16x16 Smooth top flat head metal screw with minimum class 3 coating	Fixed clip: 2x 8g-10x25 countersunk head metal screw with minimum class 3 coating
<b>ROOFING &amp; WALLING</b>		Sliding clip: 3x 8g-10x25 countersunk head metal screw with minimum class 3 coating

# LYSAGHT DOMINION®



LYSAGHT DOMINION® architectural panel is a concealed fixed flat panel wall cladding system. DOMINION® is structurally sound for direct fixed to steel battens and can also be fixed onto conventional supporting substrate such as plywood or fibre cement panels. DOMINION® is a wall cladding system installed with a ventilated air space. It involves laying DOMINION® on a metal framework fixed to the supporting structure. The interlocking groove connecting the panels gives an elegant recessed joint. DOMINION® can be laid vertically or horizontally. The choice of direction implies different aesthetics and technical solutions for the main flashings.

<b>Application</b>	Walling
<b>Finishes available</b>	Standard COLORBOND® steel colours, COLORBOND® Ultra steel, COLORBOND® Metallic steel, COLORBOND® steel Matt and ZINCALUME® steel
<b>BMT</b>	0.55mm, 0.75mm
<b>Minimum roof slope</b>	Not suitable for roofing.

## MATERIAL SPECIFICATION

DOMINION® is made from:

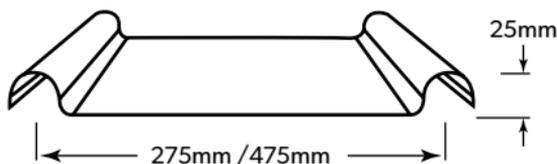
- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).
- COLORBOND® Ultra is pre-painted steel for severe coastal or industrial environments (generally within about 100-200 metres of the source). The painting complies with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011, G550, AM150 (550 MPa minimum yield stress, 150g/m<sup>2</sup> minimum coating mass).
- COLORBOND® steel Matt and COLORBOND® Metallic steel options may also be available subject to enquiry.

## FIXING DATA

DOMINION® cladding is screw-fixed to supports. Engage the overlap leg into the underlap recess, then fix the nominated fastener through both legs into batten or plywood support. When the screw is properly tightened into metal there should be a minimum of three (3) threads protruding past the support being fixed in to. For timber the screw must have a min embedment of 25mm into the timber.

Application	Fixing to steel	Fixing to plywood/timber
<b>NON-CYCLONIC</b>	10g-16x16 wafer head metal screw with minimum class 3 coating	10g-12x25 wafer head type 17 metal screw with minimum class 3 coating

## LYSAGHT BAROQUE®



A heritage-inspired profile, LYSAGHT BAROQUE® features wide, flat pans defined by generous semi-circular ribs. At once delivering a strong linear visual which is gentled by the unusual, rounded rib-form, this profile offers a most unique visual character which sits easily with both traditional and contemporary architecture. LYSAGHT BAROQUE® is installed on a ply substrate with the profile being able to be used as either a roof or wall cladding. It can be made with both ribs and pan Figure 14.2.1 in the one piece or alternatively with only one rib Figure 14.2.3. The profile comes in a maximum sheet length of 4000mm with the double rib profile fixed through the crest of the rib.

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Standard COLORBOND® steel colours, COLORBOND® Ultra steel, COLORBOND® Metallic steel, COLORBOND® steel Matt and ZINCALUME® steel
<b>BMT</b>	0.55mm, 0.75mm
<b>Minimum roof slope</b>	5 degrees (1:12)

## MATERIAL SPECIFICATION

LYSAGHT BAROQUE® is made from:

- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc/magnesium alloy-coated steel complying with AS 1397:2011 G550, AM100 (550 MPa minimum yield stress, 100g/m<sup>2</sup> minimum coating mass).
- COLORBOND® Ultra is pre-painted steel for severe coastal or industrial environments (generally within about 100-200 metres of the source). The painting complies with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011, G550, AM150 (550 MPa minimum yield stress, 150g/m<sup>2</sup> minimum coating mass).
- COLORBOND® steel Matt and COLORBOND® Metallic steel options may also be available subject to enquiry.

## FIXING DATA

LYSAGHT BAROQUE® cladding utilises pierce-fixing as the method of fixing sheets to ply substrate. Pierce-fixing is the method of fixing sheets using fasteners which pass through the sheet. This is different from the alternative method called concealed-fixing. You can place screws through the crests or in the pans/valleys, however, to maximise watertightness, always place roof screws through the crests. For walling, you may fix through either the crest or valley/pan (Figure 14.1.1). Always drive the screws perpendicular to the cladding, and in the centre of the corrugation or rib. The following procedures are described for roofs, but the same general principles apply to walls.

Application	Fixing to steel
<b>NON-CYCLONIC</b>	14G 10x50 Type 17 Hi Grip Hex head with seal Crest fix 14G 10x 25 type 17 hex head with seal Pan fix
<b>ROOFING &amp; WALLING</b>	Additionally 4.8mm aluminium blind rivets to rib brackets for the single rib profile

# THE PERMALITE ALUMINIUM CLADDING RANGE

PERMALITE® aluminium cladding products have been installed in Australia since the 1960s.

The outstanding benefit of PERMALITE® aluminium cladding is its long-term durability in aggressive environments.

Aluminium is a long lasting, durable, lightweight alternative to other cladding materials particularly in corrosive environments. Aluminium provides high thermal insulation and minimal maintenance to remain corrosion-free. It is easier to transport and erect because it is significantly lighter than many alternate cladding materials.

The PERMALITE® architectural panel range are concealed fix systems for both roofing and walling, and are designed to provide stunning architectural appearances. This aesthetic appeal combines with 5251 H32 marine grade aluminium to provide outstanding watertightness and durability and stunning aesthetics. The PERMALITE® architectural panel range accommodates complex roof configurations accommodating smooth transitions between roof planes other building elements.

The PERMALITE® range consists of:

- PERMALITE LT7®
- PERMALITE ALSPAN®
- PERMALITE V-RIB®
- PERMALITE WAVELINE®
- PERMALITE ALSULATE-125®

# PERMALITE WAVELINE®



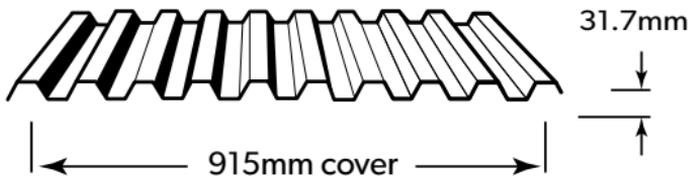
The classic Australian profile is used in traditional as well as modern applications. PERMALITE WAVELINE® is available in 2 widths. Traditional 762mm cover width and our 990mm cover width for greater fixing economy. These cover widths for WAVELINE®, provides a roofing sheet which can also be used effectively on walls.

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Mill finish, five standard PERMALITE® colours. Other colours subjects to MOQ.
<b>BMT</b>	0.70mm, 0.90mm
<b>Cover width</b>	762mm, 990mm
<b>Minimum roof slope</b>	5 degrees (1:12)

## MATERIAL SPECIFICATION

PERMALITE WAVELINE® is made from 5251 Marine Grade Aluminium.

## PERMALITE V-RIB®



PERMALITE V-RIB® is a roofing and walling profile that has a 915mm cover width and in conjunction with its symmetrical profile, provides a roofing sheet which can also be used effectively on walls. A double capillary drain in the rib overlap ensures almost total weather security. With a neat balanced appearance on buildings, this profile is also effectively used as insulation jacketing in power stations and chemical processing plants.

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Mill finish, five standard PERMALITE® colours. Other colours subjects to MOQ.
<b>BMT</b>	0.70mm, 0.90mm, 1.20mm
<b>Cover width</b>	915mm
<b>Minimum roof slope</b>	3 degrees (1:20)

### MATERIAL SPECIFICATION

PERMALITE V-RIB® is made from 5251 Marine Grade Aluminium.

**PERMALITE LT7®**

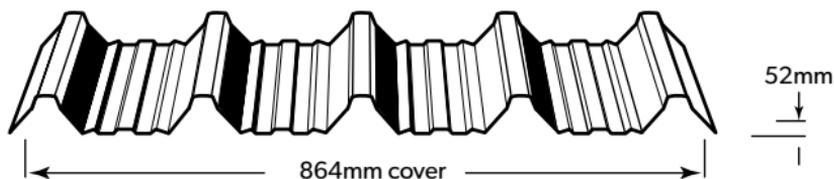
PERMALITE LT7® is the ultimate in cladding flexibility. The versatility of this profile is due to its strength, water carrying capacity, fixing economy and eave closure features. It is widely used for roofing and can be reversed for a bold wall effect.

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Mill finish, five standard PERMALITE® colours. Other colours subjects to MOQ.
<b>BMT</b>	0.70mm, 0.90mm, 1.20mm
<b>Cover width</b>	875mm
<b>Minimum roof slope</b>	1 degree (1:50)

**MATERIAL SPECIFICATION**

LT7® is made from 5251 Marine Grade Aluminium.

# PERMALITE ALSPAN®



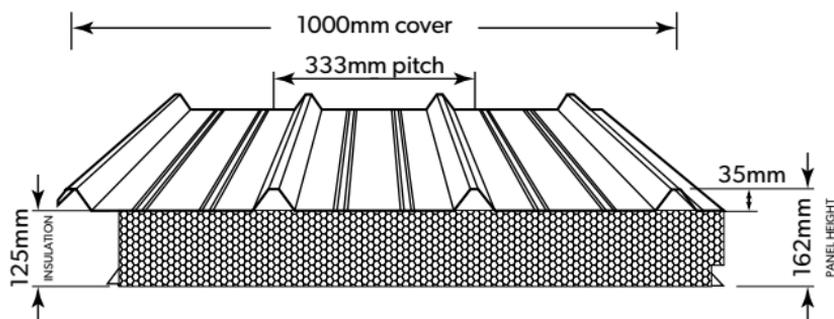
PERMALITE ALSPAN® is a roofing profile made from marine grade aluminium alloy. It was designed specifically to provide a wide spanning capability, to have a high water carrying capacity and to accommodate foot traffic without damage. All of these requirements are realised in the distinctive ribs and wide pans which offer a well-defined presentation of large areas.

<b>Application</b>	Roofing and walling
<b>Finishes available</b>	Mill finish, five standard PERMALITE® colours. Other colours subjects to MOQ.
<b>BMT</b>	0.70mm, 0.90mm, 1.20mm
<b>Cover width</b>	864mm
<b>Minimum roof slope</b>	1 degree (1:50)

## MATERIAL SPECIFICATION

PERMALITE ALSPAN® is made from 5251 Marine Grade Aluminium.

# PERMALITE ALSULATE-125®



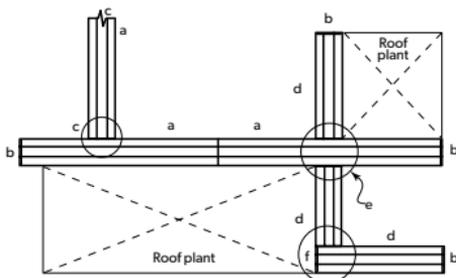
PERMALITE ALSULATE-125® insulated sandwich panel system is a roofing system with both insulative and structural advantages. The clever sandwich design incorporates both roofing and a prefinished ceiling using 5251 H38 Marine grade aluminium to provide outstanding watertightness, durability and stunning aesthetics. A variety of flashings and ridge covers cap off the roof design.

<b>Application</b>	Roofing
<b>Finishes available</b>	Gull Grey or Glacier White top Glacier White bottom
<b>BMT</b>	0.70mm (top/bottom sheets) 125mm EPS foam core
<b>Cover width</b>	1000mm
<b>Minimum roof slope</b>	1 degree

## MATERIAL SPECIFICATION

ALSULATE-125® is made from 5251 Marine Grade Aluminium.

# LYSAGHT ROOFTRAK® 675 & 450



LYSAGHT ROOFTRAK® provides a safe and stable surface for incidental access on flat roofs. It may be installed parallel or at 90° to the ribs of roof sheeting. Rooftrak is supplied in kits that include components and fixings.

ROOFTRAK® 675 is a 675mm wide walkway system. ROOFTRAK® 450 is a cost effective 450mm wide alternate system. Check with governing authorities for use of the narrow version of this product.

<b>Material</b>	Zinc-coated steel to AS 1397 G300, Z450 coating class in 1.2 and 2.0mm thickness.
<b>Widths</b>	675mm (3 sections wide) and 450mm (2 sections wide)
<b>Lengths</b>	Nom. 3m & 6m (Actual 3018 and 6074mm)

Component	Mass
(A) PLANK (MALE/MALE) STANDARD LENGTH 3M* OR 6M+	3.78 kg/m
(B) PLANK (MALE/FEMALE) STANDARD LENGTH 3M* OR 6M+	3.78 kg/m
(C) BLANKING PLATE OR BUTT PLATE G065BP	0.24 kg
(D) SUPPORT BRACKET	0.50 kg
(E) HEEL/TOE END PLATE BRACKET	0.13 kg

# LYSAGHT RAINWATER GOODS

Gutter and downpipe systems made from ZINCALUME® steel or COLORBOND® steel are available in a range of profiles to suit any home design - contemporary to traditional. They offer excellent corrosion resistance with a durable and low maintenance paint finish.

## LYSAGHT® QUAD 115 HI-FRONT GUTTER

A classic guttering profile that is suited to both new homes or for replacing an existing gutter.

- Compatible with NOVALINE® Fascia System
- Available slotted or unslotted
- Available in QLD, NSW, VIC, TAS, SA, NT, ACT
- In SA, QUAD 115 HI-FRONT Gutter is referred to as 'D' Gutter
- In VIC & TAS, QUAD 115 HI-FRONT Gutter is simply referred to as QUAD Gutter
- In ACT, SA, NSW, VIC & TAS, QUAD Gutter is supplied with a flat, unfluted base

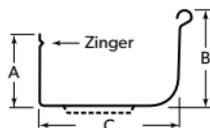
### QUAD 115 HI-FRONT Gutter Dimensions

A = 62mm (nominal)

B = 90mm (nominal)

C = 115mm (nominal)

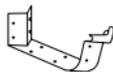
PROFILE SHOWN  
UNSLOTTED



## Accessories QLD & NT



Internal bracket  
ZINCALUME® steel



External corners  
90° and 45°  
Unpainted and PC



Stop end (pair)  
ZINCALUME® steel &  
COLORBOND® steel

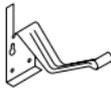
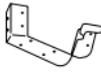
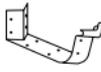


Overstrap  
ZINCALUME® steel

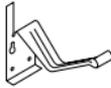
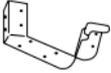
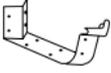


Internal corners  
90° and 45°  
Unpainted and PC

## Accessories NSW & ACT

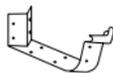
	Internal bracket Plain*		Overstrap Plain*
	External bracket Plain & coloured*		Concealed bracket Plain*
	Stop end (pair) Plain & coloured*		Internal stop end plates (pair) Plain & coloured*
	Internal corners 90° and 45° Plain & coloured* 2 piece cast also available		2 piece cast 90° Internal Corner Plain & coloured
	External corners 90° and 45° Plain & coloured* 2 piece cast also available		2 piece cast 90° External Corner Plain & coloured

## Accessories VIC & TAS

	Internal GP bracket ZINCALUME® steel		Internal corners Diecast 90° and 45° Unpainted & PC
	External T-head bracket Unpainted & PC		External corners Diecast 90° and 45° Unpainted & PC
	Stop end plates (pair) ZINCALUME® steel & COLORBOND® steel		Overstrap for use with NOVALINE® Fascia ZINCALUME® steel

**Accessories SA**

General purpose bracket

External corner:  
Diecast 90° & 45°

External bracket

Overstrap for use with  
NOVALINE fasciaInternal corner:  
Diecast 90° & 45°

Stop end plates (pair)

## LYSAGHT® QUAD 115 LO-FRONT GUTTER

A traditional guttering profile popular as a replacement gutter or for new homes.

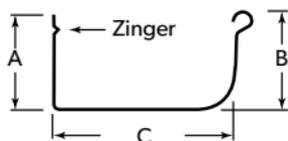
- Compatible with NOVALINE® Fascia System
- Available unslotted only
- Available in NSW & ACT

### QUAD 115 LO-FRONT Gutter Dimensions

A = 78mm (nominal)

B = 74mm (nominal)

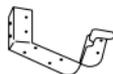
C = 150mm (nominal)



### Accessories



Internal bracket  
Plain



Internal corner  
90° and 45°  
Plain & coloured



External bracket  
Plain & coloured



External corner  
90° and 45°  
Plain & coloured



Stop end plates (pair)  
Plain & coloured

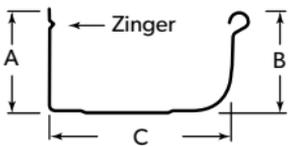
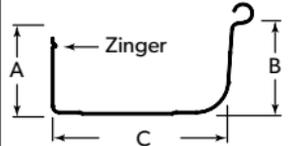


Overstrap  
Plain

## LYSAGHT® QUAD 150 HI- & LO-FRONT GUTTER

Wide base guttering profiles popular where high water carrying capacity is of primary concern.

- Compatible with NOVALINE® Fascia System
- QUAD 150 LO-FRONT Gutter available unslotted only
- QUAD 150 HI-FRONT Gutter available slotted or unslotted
- Available in QLD

QUAD 150 HI-FRONT Gutter Dimensions	QUAD 150 LO-FRONT Gutter Dimensions
A = 62mm (nominal)	A = 78mm (nominal)
B = 90mm (nominal)	B = 74mm (nominal)
C = 150mm (nominal)	C = 150mm (nominal)
 <p>PROFILE SHOWN UNSLOTTED</p>	 <p>PROFILE SHOWN UNSLOTTED</p>

### Accessories

	Internal/External corners		Internal bracket ZINCALUME® steel
	Stop end ZINCALUME® steel & COLORBOND® steel		Overstrap ZINCALUME® steel
	Return stop end ZINCALUME® steel, COLORBOND® steel & Galvanised		Spike bracket
	Overstrap and bracket 2 piece Galvanised		

## LYSAGHT® QUAD 175 GUTTER

An extra-wide base gutter profile ideal for high rainfall regions where high water carrying capacity is required.

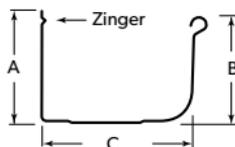
- Compatible with NOVALINE® Fascia System
- Available unslotted only
- Available in QLD

### QUAD 175 Gutter Dimensions

A = 103mm (nominal)

B = 97mm (nominal)

C = 175mm (nominal)



### Accessories



Internal/External corners



Internal bracket  
ZINCALUME® steel



Stop end  
ZINCALUME® steel &  
COLORBOND® steel



Overstrap  
ZINCALUME® steel



Return  
stop end  
ZINCALUME® steel,  
COLORBOND® steel  
& Galvanised



Spike bracket



Overstrap and bracket  
2 piece  
Galvanised

## LYSAGHT® QUAD (D) 125 GUTTER

A traditional, heritage-style guttering ideal to match and replace existing installations.

- Available unslotted only
- Available in SA

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### QUAD (D) 125 Gutter Dimensions

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A = 76mm (nominal)

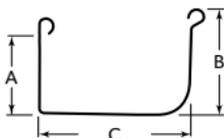
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B = 86mm (nominal)

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C = 127mm (nominal)

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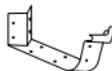


### Accessories

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General purpose bracket



External corner:  
Diecast 90° & 45°



Stop end plates (pair)

---

## LYSAGHT® QUAD SQUARE BEAD GUTTER

A distinctive guttering profile combining the popular QUAD profile with the accent of a square bead.

- Compatible with NOVALINE® Fascia System
- Available slotted or unslotted
- Available in WA

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### QUAD (D) 125 Gutter Dimensions

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A = 65mm (nominal)

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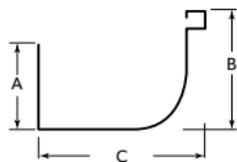
B = 100mm (nominal)

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C = 115mm (nominal)

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PROFILE  
SHOWN  
UNSLOTTED



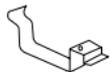
## Accessories

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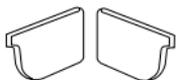
Gutter clip for timber ZINCALUME® steel

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Gutter clips for metal ZINCALUME® steel

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Stop end (pair) ZINCALUME® steel & COLORBOND® steel

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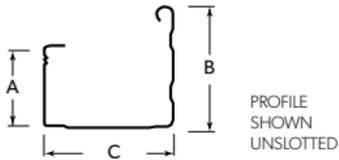
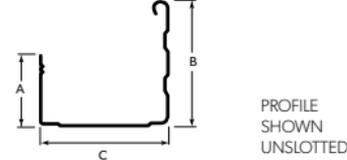
Internal or external gutter mitre available as tradework  
ZINCALUME® steel & COLORBOND® steel

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## LYSAGHT SHEERLINE® GUTTER

Concealed fix fascia gutter popular for patios, pergolas, sheds, high profile roofing laid at low pitches and domestic roofs requiring a large water carrying capacity.

- Compatible with NOVALINE® Fascia System
- Available slotted or unslotted
- Available in NSW, VIC, TAS, SA, ACT

SHEERLINE® Gutter Dimensions (NSW, ACT, VIC, TAS)	SHEERLINE® Gutter Dimensions (SA)
A = 81mm (nominal)	A = 73mm (nominal)
B = 141mm (nominal)	B = 141mm (nominal)
C = 124mm (nominal)	C = 124mm (nominal)
	

### Accessories NSW & ACT



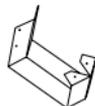
General purpose bracket  
Plain



Internal Corner 90°  
Plain & coloured



Universal gutter clip (SGCI)  
Plain



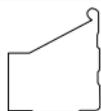
Internal Corner 135°  
Plain & coloured



External end stop (pair)  
Plain & coloured



External Corner 90°  
Plain & coloured



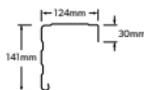
Internal end stop (pair)  
Plain & coloured



External Corner 135°  
Plain & coloured



Zed bracket Hot dipped  
Galvanised



Capping  
Plain & coloured

## Accessories VIC & TAS



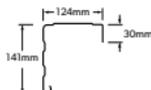
Internal GP bracket  
Unpainted & PC



Fascia style stop end plates (pair)  
ZINCALUME® steel &  
COLORBOND® steel  
(Also available as internal  
stop ends)



SGCI gutter clip  
Unpainted & PC



Capping  
ZINCALUME® steel &  
COLORBOND® steel

## Accessories SA



GP gutter clip



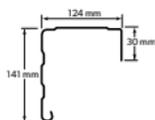
External stop ends



SGCI gutter clip



Overstrap



Capping

## LYSAGHT TRIMLINE® GUTTER

Concealed fix fascia gutter popular for patios, pergolas, sheds, high profile roofing laid at low pitches and domestic roofs requiring a large water carrying capacity.

- Compatible with NOVALINE® Fascia System
- Available slotted or unslotted
- Available in NSW, VIC, TAS, SA, ACT

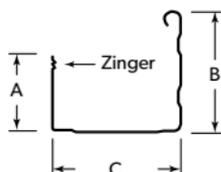
### TRIMLINE® Gutter Dimensions

A = 73mm (nominal)

B = 117mm (nominal)

C = 124mm (nominal)

PROFILE  
SHOWN  
UNSLOTTED



### Accessories QLD & NT



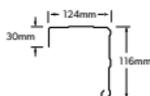
Internal bracket  
ZINCALUME® steel



External end stop  
ZINCALUME® steel &  
COLORBOND® steel



Overstrap  
ZINCALUME® steel



Capping

### Accessories NSW & ACT



General purpose bracket  
Plain & coloured



External  
end stop (pair)  
Plain & coloured



Overstrap  
Plain

## Accessories VIC & TAS



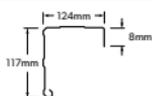
Internal GP bracket  
ZINCALUME® steel



External  
end stop (pair)  
ZINCALUME® steel &  
COLORBOND® steel



Overstrap for use with  
NOVALINE® Fascia  
ZINCALUME® steel



Capping  
ZINCALUME® steel &  
COLORBOND® steel

## LYSAGHT EMLINE® GUTTER

Concealed fix fascia gutter with a generous rainfall carrying capacity.

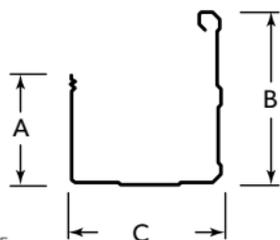
- Compatible with NOVALINE® Fascia System
- Available slotted or unslotted
- Available in QLD, NT

### EMLINE® Gutter Dimensions

A = 89mm (nominal)

B = 140mm (nominal)

C = 125mm (nominal)



PROFILE  
SHOWN  
UNSLOTTED

### Accessories



Overstrap



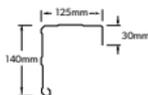
End stop



EMLINE® bracket



Internal/External corners



Capping

## LYSAGHT FITFAST® GUTTER

A high-fronted gutter that is fast and easy to install, featuring a unique mounting bracket ideal where roof overhang prevents connection to fascia.

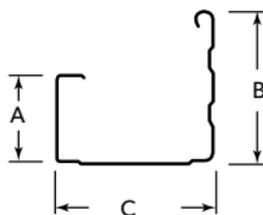
- Available slotted or unslotted
- Available in QLD

### FITFAST® Gutter Dimensions

A = 68mm (nominal)

B = 141mm (nominal)

C = 124mm (nominal)



PROFILE  
SHOWN  
UNSLOTTED

### Accessories



Mounting bracket



End stop

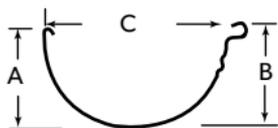
## LYSAGHT® HALF ROUND GUTTER

A modern gutter system with a high rainfall carrying capacity and a curved base for improved self-cleaning and minimal build-up of water and dirt.

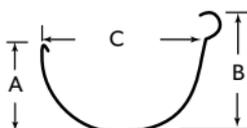
- Available slotted or unslotted in QLD, NSW, VIC, TAS, NT, ACT
- Available unslotted only in SA, WA
- Available in QLD, NSW, VIC, TAS, SA, WA, NT, ACT

HALF ROUND Gutter Dimensions (QLD, NT)	HALF ROUND Gutter Dimensions (NSW, ACT)	HALF ROUND Gutter Dimensions (VIC, TAS)	HALF ROUND Gutter Dimensions (SA)	HALF ROUND Gutter Dimensions (WA)
A = 79mm (nominal)	A = 73mm (nominal)	N/A	A = 83mm (nominal)	A = 75mm (nominal)
B = 105mm (nominal)	B = 97mm (nominal)	N/A	B = 98mm (nominal)	B = 75mm (nominal)
C = 154mm (nominal)	C = 150mm (nominal)	C = 150mm (nominal)	C = 150mm (nominal)	C = 150mm (nominal)

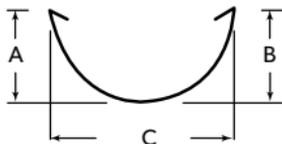
NSW, ACT



QLD, VIC, TAS, SA, NT



WA



PROFILES SHOWN UNSLOTTED

## Accessories QLD & NT



External bracket  
ZINCALUME® steel &  
COLORBOND® steel  
(Half round shown)



Internal bracket  
ZINCALUME® steel &  
COLORBOND® steel  
(Half round flat back shown)



Half round stop ends  
ZINCALUME® steel &  
COLORBOND® steel



Flat back bracket/overstrap



Flat back bracket

## Accessories NSW & ACT



Half round external brackets  
Plain & coloured\*



Cast external corners  
90° and 45°  
Plain & coloured\*



Flat back concealed suspension  
bracket (Flat back general  
purpose bracket) Plain



Cast internal corners  
90° and 45°  
Plain & coloured\*



Flat back overstraps  
Plain\*



End stop (pair)  
Plain & coloured\*

## Accessories VIC & TAS



Half round nozzle 100x75mm  
Unpainted & PC



Half round external bracket  
Unpainted & PC



Half round nozzle 100x50mm  
Unpainted & PC



Half round stop ends (LH/RH)  
ZINCALUME® steel &  
COLORBOND® steel



Half round nozzle 90mm  
diameter

## Accessories SA



Half round  
External bracket



Half round stop ends



Half round  
External corner



Half round  
Internal Corner

## Accessories WA



Half round gutter clip  
Galvanised



Half round stop ends  
ZINCALUME® steel &  
COLORBOND® steel



Half round External corner  
ZINCALUME® steel &  
COLORBOND® steel



Half round Internal corner  
ZINCALUME® steel &  
COLORBOND® steel

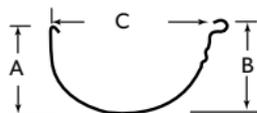
## LYSAGHT® FLATBACK GUTTER

A contemporary styled gutter with a curved base for improved self-cleaning and minimal build-up of water and dirt.

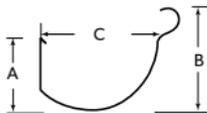
- Available slotted or unslotted in NSW, ACT
- Available unslotted only in QLD, SA, NT
- Available in QLD, NSW, SA, NT, ACT

FLATBACK Gutter Dimensions (NSW, ACT)	FLATBACK Gutter Dimensions (QLD, NT)	FLATBACK Gutter Dimensions (SA)
A = 74mm (nominal)	A = 85mm (nominal)	A = 83mm
B = 97mm (nominal)	B = 95mm (nominal)	B = 98mm
C = 136mm (nominal)	C = 138mm (nominal)	C = 150mm

NSW, ACT



QLD, SA, NT



PROFILES SHOWN UNSLOTTED

### Accessories QLD & NT



Half round external brackets  
Plain & coloured\*



Cast external corners  
90° and 45°  
Plain & coloured\*



Flat back concealed suspension  
bracket (Flat back general  
purpose bracket) Plain



Cast internal corners  
90° and 45°  
Plain & coloured\*



Flat back overstraps  
Plain\*



Flat back stop ends  
ZINCALUME® steel &  
COLORBOND® steel

## Accessories NSW & ACT



Half round external brackets  
Plain & coloured\*



Cast external corners  
90° and 45°  
Plain & coloured\*



Flat back concealed suspension  
bracket (Flat back general  
purpose bracket) Plain



Cast internal corners  
90° and 45°  
Plain & coloured\*



Flat back overstraps  
Plain\*



End stop (pair)  
Plain & coloured\*

## Accessories SA



Flat back GP bracket



Overstrap for Half round flat  
back gutter



Flat back stop ends (pair)

## LYSAGHT® HALF ROUND 190 GUTTER

A modern gutter system with an increased rainfall carrying capacity and a curved base for improved self-cleaning and minimal build-up of water and dirt.

- Available unslotted only
- Available in QLD, NT

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### HALF ROUND 190 Gutter Dimensions

---

A = 90mm (nominal)

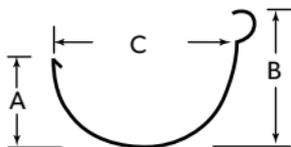
---

B = 110mm (nominal)

---

C = 195mm (nominal)

---



### Accessories

---



Half round stop end  
ZINCALUME® steel &  
COLORBOND® steel



Half round external bracket  
ZINCALUME® steel  
Heavy duty

---

## LYSAGHT® FLATBACK 190 GUTTER

A contemporary styled gutter with significant water carrying capacity featuring a curved base for improved self-cleaning and minimal build-up of water and dirt.

- Available unslotted only
- Available in QLD, NT

---

### HALF ROUND 190 Gutter Dimensions

---

A = 90mm (nominal)

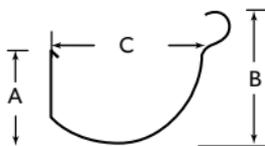
---

B = 110mm (nominal)

---

C = 180mm (nominal)

---



### Accessories

---



Flat back  
stop end  
ZINCALUME® steel &  
COLORBOND® steel



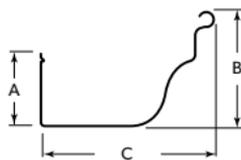
Half round external bracket

---

## LYSAGHT OGEE® GUTTER

A truly distinctive gutter profile with a curved front edge, perfectly suited to heritage homes.

- Compatible with NOVALINE® Fascia System
- Available unslotted only in VIC, TAS
- Available slotted or unslotted in SA
- Available in VIC, TAS, SA



PROFILE SHOWN UNSLOTTED

OGEE® Gutter Dimensions (VIC, TAS)	OGEE® Gutter Dimensions (SA)
A = 65mm (nominal)	A = 64mm (nominal)
B = 80mm (nominal)	B = 98mm (nominal)
C = 115mm (nominal)	C = 145mm (nominal)

### Accessories VIC & TAS



Internal corner Diecast  
90° and 45°  
COLORBOND® steel  
& Unpainted



External corner Diecast  
90° and 45°  
COLORBOND® steel  
& Unpainted



OG overstrap



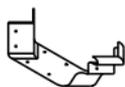
OG external bracket



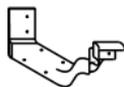
Stop end LH or RH

## Accessories SA

---



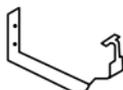
External corner:  
Diecast 90° and 45°



Internal corner:  
Diecast 90° and 45°



OG overstrap



OG external bracket



Stop end plates

## LYSAGHT SHORELINE® GUTTER

A contemporary guttering profile perfect for homes requiring a sleek, modern appearance.

- Compatible with NOVALINE® Fascia System
- Available unslotted only
- Available in SA

---

### SHORELINE® Gutter Dimensions

---

A = 93mm (nominal)

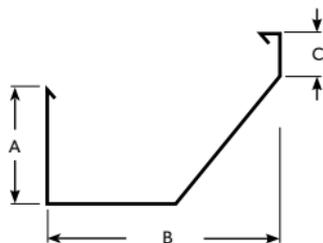
---

B = 190mm (nominal)

---

C = 34mm (nominal)

---



### Accessories

---



Overstrap



Stop end plates

---

## LYSAGHT SHORELINE® MINI GUTTER

A scaled down version of the larger SHORELINE® Gutter whilst offering the same contemporary style.

- Compatible with NOVALINE® Fascia System
- Available unslotted only
- Available in SA

---

### SHORELINE® Mini Gutter Dimensions

---

A = 61mm (nominal)

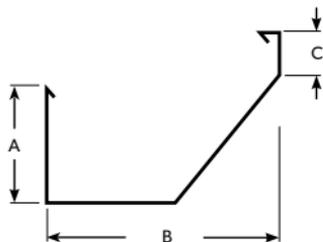
---

B = 145mm (nominal)

---

C = 28mm (nominal)

---



### Accessories

---



Overstrap



Stop end plates

---

## LYSAGHT RANCELINE® GUTTER

A stylish gutter with bold lines and good rainfall carrying capacity.

- Available unslotted only
- Available in WA

---

### RANCELINE® Gutter Dimensions

---

A = N/A

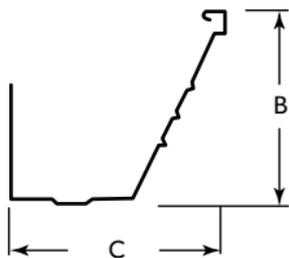
---

B = 104mm (nominal)

---

C = 125mm (nominal)

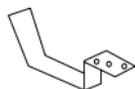
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### Accessories

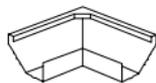
---



Gutter clip for timber



Gutter clip for metal



External or internal mitre



Stop end plate (left or right)

---

## LYSAGHT COLONIAL® GUTTER

Guttering with a distinctive style which accents traditional homes.

- Available unslotted only
- Available in WA

---

### COLONIAL® Gutter Dimensions

---

A = N/A

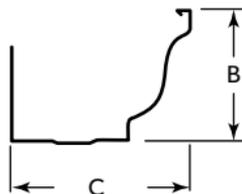
---

B = 94mm (nominal)

---

C = 130mm (nominal)

---



### Accessories



Gutter clip for timber



Gutter clip for metal



External or internal mitre



Stop end plate (left or right)

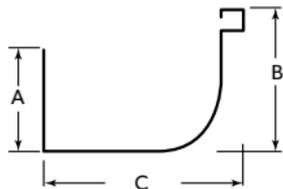
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## LYSAGHT® QUARTER ROUND GUTTER

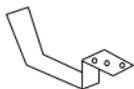
A modern, contemporary gutter with a distinctive design which complements modern homes.

- Available unslotted only
- Available in WA

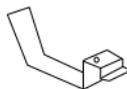
QUARTER ROUND Gutter Dimensions
A = 65mm (nominal)
B = 100mm (nominal)
C = 125mm (nominal)



### Accessories



Gutter clip for timber  
ZINCALUME® steel



Gutter clips for metal  
ZINCALUME® steel



Internal or external gutter mitre  
available as tradework  
ZINCALUME® steel &  
COLORBOND® steel

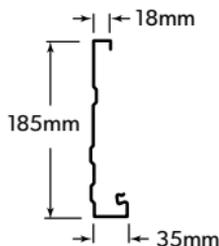


Stop end (pair)  
ZINCALUME® steel &  
COLORBOND® steel

## LYSAGHT NOVALINE® FASCIA

An easy to use and fast to install fascia system compatible with an extensive range of LYSAGHT® gutter profiles. The system includes a spring clip which snaps on to the fascia allowing the gutter to be fixed easily.

- Available in QLD, NSW, VIC, TAS, SA, NT, ACT



### Accessories



Multi Purpose  
Fascia Bracket



Internal Corner



Hip Bracket



External Corner



Spring Clip



Barge Mould Right Hand

## Accessories

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Splice Plate



Barge Mould Left Hand



Apex Cover



End Closer



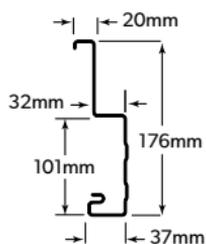
Internal Cover Cap

---

## LYSAGHT NOVALINE® REBATE FASCIA

An easy to use and fast to install fascia system compatible with an extensive range of LYSAGHT® Gutter profiles. The fascia features a rebated front face.

- Available in WA



### Accessories



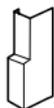
Side Rafter Brackets



Timber Brackets



Splice Brackets



End Closers



Internal Corner



External Corner

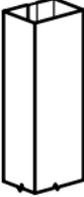


135° Corner

## DOWNPIPES

A wide range of rectangular, square and round downpipes are available to complement all building styles. Dimensions and availability will vary from region to region. Enquire locally for specific dimensions.

Most downpipes and accessories are available in unpainted ZINCALUME® steel and a range of COLORBOND® steel colours.

Rectangular dimensions available	Square dimensions available
	
50mm x 50mm	50mm
75mm x 50mm	75mm
75mm x 75mm	90mm
95mm x 45mm	100mm
100mm x 50mm	125mm
100mm x 75mm	150mm
100mm x 100mm	
100mm x 125mm	
100mm x 150mm	
150mm x 150mm	

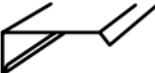
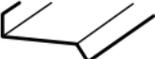
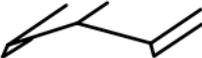
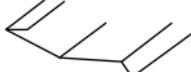
## DOWNPIPE ACCESSORIES

	Astragal/brackets
	Pops
	Unidrop
	Square corner
	Round corner
	Offsets

## FLASHINGS

Lysaght manufactures a range of standard flashings. These illustrations give you an idea of what's available for different areas of your roof. Shapes, dimensions and availability will vary from region to region. Enquire locally for specific dimensions. Lysaght also manufactures a wide range of custom flashings to your dimensioned drawings.

Most flashings are available in a range of finishes, including unpainted ZINCALUME® steel and a range of COLORBOND® steel colours.

Flashing Image	Flashing type
	Barge capping
	Apron flashing
	Ridge capping
	Roll top ridge capping
	Tile flashing
	Valley flashing

# ROOF DRAINAGE

## ROOF DRAINAGE SYSTEM DESIGN

Roof drainage systems should be designed and detailed by a suitably qualified professional. While there may be some variations from state to state, contractors who install guttering systems are generally required to hold an appropriate licence.

In the installation of the roof drainage system, focus should be given to the following;

- Attention to the use of compatible materials for drainage system components, leaf-guard type system components and compatible fasteners/sealants to connect and seal the components.
- The position of the gutter in relation to the fascia (particularly, whether there is a gap between the fascia and the gutter back and whether the gutter front is below the top of the fascia).
- Installation of the specified gutter and downpipes, ensuring that downpipes are installed in the correct locations and numbers.
- Gutter fall, ensuring sufficient fall and that it is in the direction of the downpipes.
- Overflow has been considered and specific details are installed where required as described above (such as when the gutter front is higher than the top of the fascia).

During the installation all debris and loose waste materials (swarf, fasteners, etc.) must be cleaned off at the end of each day and at the completion of the installation to prevent blockages of the drainage system or deterioration of the individual components. Any protective films should also be removed as part of the installation process.

## DESIGN RAINFALL INTENSITIES

### 5 minute duration rainfall intensity

	ARI once in 20 years mm/hr	ARI once in 100 years mm/hr
<b>QLD</b>		
Bamaga	252	298
Brisbane	234	305
Bundaberg	265	340
Cairns	229	278
Cloncurry	218	278
Innisfail	248	301
Ipswich	211	278
Mackay	250	316
Mt Isa	199	260
Noosa Heads	258	331
Rockhampton	229	300
Toowoomba	203	268
Townsville	235	300
Victoria Point	245	320
<b>ACT</b>		
Canberra	143	193
Gungahlin	137	179
Tuggeranong	148	210
<b>NSW</b>		
Albury	139	180
Broken Hill	143	219
Goulburn	121	156
Kiama	226	319
Newcastle	226	316
Orange	142	186

For general reference only – please check with local authorities for most up to date data.

**5 minute duration rainfall intensity**

	<b>ARI once in 20 years mm/hr</b>	<b>ARI once in 100 years mm/hr</b>
Sydney	200	262
Avalon	206	278
Campbelltown	167	222
Penrith	180	244
Windsor	175	233
Tweed Heads	252	330
Wollongong	217	308
<b>VIC</b>		
Ballarat	131	188
Benalla	146	194
Geelong	102	144
Horsham	120	173
Lakes Entrance	145	198
Melbourne	132	187
Hastings	117	145
Sorrento	106	140
Mildura	142	218
Stawell	130	186
<b>TAS</b>		
Burnie	128	180
Flinders Island	122	166
Hobart	85	116
Launceston	90	121
Queenstown	94	120
St. Marys	146	203
<b>WA</b>		
Abydos	199	275

**5 minute duration rainfall intensity**

	<b>ARI once in 20 years mm/hr</b>	<b>ARI once in 100 years mm/hr</b>
Albany	142	217
Broome	252	343
Bunbury	148	215
Carnarvon	142	196
Collie	145	217
Dampier	231	337
Derby	254	343
Geraldton	132	173
Halls Greek	181	237
Hamersley	180	244
Hillside	192	265
Kalgoorlie	116	180
Katanning	125	203
Kununurra	256	347
Marble Bar	205	287
Meekatharra	111	155
Mundaring	139	204
Newman	143	195
Perth	146	214
Port Hedland	233	332
Roy Hill	160	216
Tom Price	164	222
Wittenoom	182	245
<b>SA</b>		
Adelaide	123	186
Arkaroola	134	194
Ceduna	125	200

For general reference only – please check with local authorities for most up to date data.

**5 minute duration rainfall intensity**

	<b>ARI once in 20 years mm/hr</b>	<b>ARI once in 100 years mm/hr</b>
Mt Barker	120	184
Mt Gambier	108	168
Murray Bridge	117	181
Nuriootpa	111	164
Port Augusta	124	189
Port Pirie	125	201
Yorketown	118	197

For general reference only – please check with local authorities for most up to date data.

## RAINWATER RUN-OFF

The drainage or run-off capacity of roof sheeting can limit on the total length of a sheet run and must be considered in roof design and construction.

As a guide, the table below lists the maximum recommended length of roof run for various LYSAGHT® roofing profiles at the roof slopes and rainfall intensities shown. These are based on CSIRO research and Lysaght calculation of the behaviour of roofing profiles under peak rainfall conditions.

The roof run is the total length of roof sheeting draining rainwater in one direction, including any end laps, expansion joints or steps that may be present in the roof. Careful considerations should be given to rainwater diverted around roof penetrations.

## MAXIMUM ROOF LENGTHS FOR DRAINAGE MEASURED FROM RIDGE TO GUTTER (M)

	Peak Rainfall Intensity (mm/h)	Roof Slope					
		1 in 55 (1')	1 in 30 (2')	1 in 20 (3')	1 in 12 (5')	1 in 7.5 (7.5')	1 in 6 (10')
<b>CUSTOM ORB®</b>	100				29	34	38
	<b>CUSTOM BLUE ORB®</b>	150			20	23	25
	200				15	17	19
	250				12	14	15
	300				10	11	13
	400				7	8	10
	500				6	7	8
<b>KLIP-LOK® 406</b>	100	375	467	548	682	813	934
	150	250	311	365	454	542	623
	200	188	234	274	341	406	467
	250	150	187	219	273	235	374
	300	125	156	183	227	271	311
	400	94	117	137	170	203	234
	500	75	93	110	136	163	187
<b>KLIP-LOK 700 HI-STRENGTH®</b>	100	344	428	502	624	745	856
	150	229	285	334	416	496	571
	200	172	214	251	312	372	428
	250	137	171	201	150	298	342
	300	115	143	167	208	248	285
	400	86	107	124	156	186	214
	500	69	86	100	125	149	171
<b>LONGLINE 305® (NOT TAPERED)</b>	100	219	273	320	398	475	546
	150	146	182	213	265	317	364
	200	110	136	160	199	237	273
	250	88	109	128	159	190	218
	300	73	91	107	133	158	182
	400	55	68	80	100	119	136
	500	44	55	64	80	95	109

	Peak Rainfall Intensity (mm/h)	Roof Slope					
		1 in 55 (1')	1 in 30 (2')	1 in 20 (3')	1 in 12 (5')	1 in 7.5 (7.5')	1 in 6 (10')
<b>SPANDEK®</b>	100			111	133	154	173
	150			74	89	103	115
	200			55	67	77	86
	250			44	53	62	69
	300			37	44	51	58
	400			28	33	39	43
	500			22	22	31	35
<b>TRIMDEK®</b>	100		220	257	320	382	439
	150		146	172	214	255	293
	200		110	129	160	191	220
	250		88	103	128	163	176
	300		73	86	107	127	146
	400		55	64	80	96	110
	500		44	51	64	76	88
<b>KLIP-LOK CLASSIC® 700</b>	100	247	308	361	449	536	616
	150	165	205	241	300	357	411
	200	124	154	181	225	268	308
	250	99	123	144	180	214	246
	300	82	103	120	150	179	205
	400	74	93	108	135	161	185
	500	49	62	72	90	107	123
<b>CUSTOM ORB ACCENT® 21</b>	100			41	54		
	150			27	36		
	200			20	27		
	250			16	21		
	300			13	18		
	400			10	13		

	Peak Rainfall Intensity (mm/h)	Roof Slope					
		1 in 55 (1')	1 in 30 (2')	1 in 20 (3')	1 in 12 (5')	1 in 7.5 (7.5')	1 in 6 (10')
<b>CUSTOM ORB ACCENT® 35</b>	100		90	103	124	143	161
	150		60	69	82	95	107
	200		45	51	62	72	64
	250		36	41	49	57	64
	300		30	34	41	48	54
	400		23	26	31	36	40
	500		18	21	25	29	32
<b>LYSAGHT ENSEAM® 265MM COVER</b>	100			160	199	238	273
	150			107	133	158	182
	200			80	100	119	137
	250			64	80	95	109
	300			53	66	79	91
	400			40	50	59	68
	500			32	40	48	55
<b>LYSAGHT IMPERIAL™ 325MM &amp; 525MM COVER</b>	100	221	276	323	402	479	551
	150	148	184	215	268	320	367
	200	111	138	161	201	240	276
	250	89	110	129	161	192	220
	300	74	92	108	134	160	184
	400	55	69	81	101	120	138
	500	44	55	65	80	96	110
<b>LYSAGHT BAROQUE® 275MM &amp; 475MM COVER  DOUBLE RIB</b>	100				27	32	37
	150				18	22	25
	200				14	16	19
	250				11	13	15
	300				9	11	12
	400				7	8	9
	500				5	6	7

	Peak Rainfall Intensity (mm/h)	Roof Slope					
		1 in 55 (1')	1 in 30 (2')	1 in 20 (3')	1 in 12 (5')	1 in 7.5 (7.5')	1 in 6 (10')
<b>LYSAGHT BAROQUE® 275MM &amp; 475MM COVER</b> <b>SINGLE RIB</b>	100				29	35	40
	150				20	23	27
	200				15	17	20
	250				12	14	16
	300				10	12	13
	400				7	9	10
	500				6	7	8

Some lengths in this table may exceed the maximum allowable transport length.

Data are based on work of CSIRO and lysaght.

## GUTTER SIZES FOR VARIOUS RAINFALL INTENSITIES AND ROOF CATCHMENT AREAS PER DOWNPIPE

Rainfall Intensity (mm/hr)	Roof Catchment Area				
	10m <sup>2</sup>	20m <sup>2</sup>	50m <sup>2</sup>	100m <sup>2</sup>	200m <sup>2</sup>
	<b>Cross Sectional Area of Gutter (mm<sup>2</sup>) Required to drain above roof catchment area into one downpipe</b>				
80	1300	220	4600	8000	14000
90	1420	2400	5100	8750	15220
100	1540	2600	5500	9450	16430
110	1630	2800	5890	10150	17630
120	1740	2990	6280	10850	18820
130	1850	3180	6670	11530	20000
140	1950	3370	7050	12210	21170
150	2050	3560	7430	12890	22390
160	2150	3750	7810	13570	23490
175	2300	4030	8370	14570	25210
200	2550	4480	9290	16220	28060
225	2800	4920	10200	17820	30860
275	3300	5760	12000	20920	36400
325	3780	6560	13750	23920	41700
425	4650	8060	16800	29250	51000

Note: For internal box gutters add 25mm of freeboard depth to cross sectional areas give in this table.

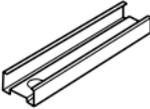
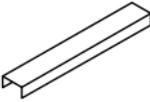
# HOUSE FRAMING COMPONENTS

Lysaght manufactures a number of components that are for use in the fabrication of wall, roof and floor frames. Framing made from TRUECORE® steel won't warp, twist, shrink rot or split. By the very nature of steel it is termite resistant and won't become fuel for fire. With an assurance of consistent quality and distinctive blue resin surface, TRUECORE® steel is an ideal framing solution.

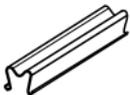
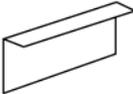
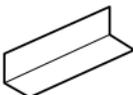
## LYSAGHT SUPRAFRAME®

An engineered wall framing system. Availability varies nationally.

### Components

Component	BMT	Section	Stocked Lengths*	Pack Sizes
<b>BOXED STUD</b> 				50
	0.48	75 x 38	Made to order*	50
	0.48	90 x 38	2408, 2443, 2708, 2743, 7500	40
<b>OPEN STUD</b> 	0.55	75 x 38	2408, 2443, 2708, 2743, 7500	60
	0.55	90 x 38	Made to order*	60
	0.75	75 x 38	Made to order*	60
	0.75	90 x 38	Made to order*	60
<b>PLATE</b> 	0.75	75 x 35	7500	50
	0.75	75 x 65	7500	50
	1.0	75 x 65	7500	50
	0.75	90 x 35	7500	50
	1.0	90 x 65	7500	50

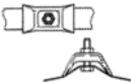
\* Non-standard lengths: 1800mm minimum, 12000mm maximum

Component	BMT	Section	Stocked Lengths*	Pack Sizes
<b>NOGGING</b> 	0.48	20 x 22	6100	20
<b>LINTEL</b> 	1.0	200 x 35	6000	25
	1.5	200 x 35	6000	25
<b>LINTEL</b> 	1.0	35 x 35	5800	40

\* Non-standard lengths: 1800mm minimum, 12000mm maximum

## Accessories

Accessory	Description	Pack Sizes
<b>NOGGING CLIP</b> 	-	900
<b>PLUMBING GROMMET</b> 	-	2000

Accessory	Description	Pack Sizes
<b>ELECTRICAL GROMMET</b> 	-	2000
<b>BRICK TIE</b> 	Galvanised steel	500
	Stainless steel	500
<b>TENSIONER SET</b> 	-	100

## LYSAGHT SUPRATRUSS®

An engineered roof framing system. Availability varies nationally.

### Components

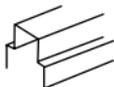
Component	BMT	Section	Stocked Lengths*	Pack Sizes
<b>SUPRATRUSS® CHORD</b> 	0.6	75 x 38	7500	50
<b>SUPRATRUSS® WEB</b> 	0.75	51 x 28	48 Made to order	50
<b>BOXED RAFTER</b> 	0.48	70 x 38	Made to order	50
	0.48	75 x 38	7500	50
	0.48	90 x 38	7500	40

\* Non-standard lengths: 1800mm minimum, 12000mm maximum

## Accessories

Accessory	Description	Pack Sizes
<b>UNIVERSAL BRACKET 70</b> 	-	100

## STEEL BUILDING FRAME SYSTEM

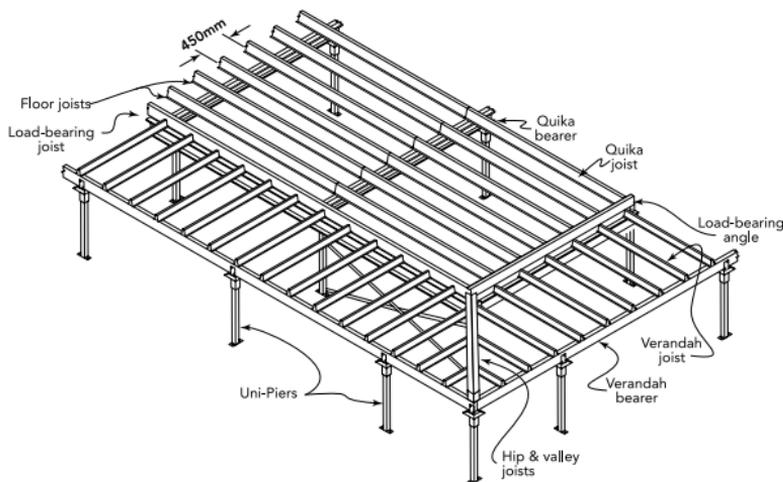
Profile	Section	Dimensions D & B	Steel Base Thickness	Material to AS1397-1977 Steel Grade and Zinc Coating Class
	Standard Plate	78 x 31mm	1.22mm	G300, Z200
	Stud	75 x 32mm	1.2mm	G300, Z200
	Nogging	75 x 34mm	1.2mm	G300, Z200
	Light Duty Stand	75 x 32mm	0.8mm	G300, Z200
	Junction Stud	75 x 38mm	1.2mm	G300, Z200
	Stiffened Plate	79 x 75mm	1.6mm	G450, Z200
	Brick Wall Tie	-	-	-

Note: Check with your local Lysaght branch for availability in your state.

# LYSAGHT QUIKA-FLOOR® SYSTEM

LYSAGHT QUIKA-FLOOR® is a fully engineered and certified sub floor system with pre-cut components that save time and labour costs. It is the steel alternative to conventional timber bearers and joists and is termite, fire and corrosion resistant. Availability varies nationally.

## QUIKA-FLOOR® components



- Galvanised piers, each adjustable up to 200mm
- Galvanised steel bearers, generally 150mm deep
- ZINCALUME® steel joists, 120mm deep
- Accessories such as load bearing angles, angle bracing, bracketry and screws.

When designing for verandahs LYSAGHT FIRMLOK® can be substituted for aesthetic appeal.

## UNI-PIER®

Uni-Piers are hot-dipped galvanised piers and can be purchased separately to the LYSAGHT QUIKA-FLOOR® system.

- Suitable for steel or timber bearers
- Sized to suit 200mm to 5000mm
- Head adjustment up to 200mm
- Integrated ant cap
- Hot dipped galvanised finish for use in many corrosive environments
- Available in 2 sizes:
  - Builders Grade (65 x 65 x 2mm)
  - Heavy Grade (75 x 75 x 2.5mm)

Availability varies nationally.

# TOPSPAN® SECTIONS

Lysaght manufactures a range of light steel TOPSPAN® sections, all produced from TRUECORE® or ZINCALUME® steel. Being lighter than timber, they offer an economical alternative that will nest together making storage, transport, carrying and handling easier. Consistent straightness simplifies alignment, sections can be lapped, and fastening is quick and easy using self-drilling screws.

Versatile TOPSPAN® profiles are a lightweight alternative to timber battens or smaller light gauge purlins. Their applications include sheds, garages, carports, ceiling and roof battens, as well as racking, fencing and handyman projects.

## TOPSPAN® 22

LYSAGHT TOPSPAN® 22 ceiling batten is an economical alternative to timber battens.

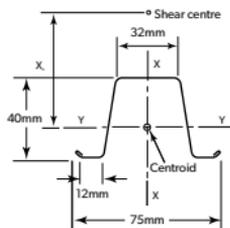
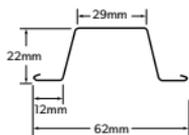
### Material Specifications

LYSAGHT TOPSPAN® 22 Ceiling Battens are made from TRUECORE® steel (aluminium/zinc coated) complying with AS1397 G550, AM150.

Base Metal Thickness (mm)	0.42
Yield Strength (MPa)	550
Coating Mass (g/m <sup>2</sup> )	150
Mass (kg/m)	0.35

## TOPSPAN® 40

LYSAGHT TOPSPAN® 40 steel roof batten is an economical alternative to timber battens for residential tile or steel roofs.



## Material Specifications

LYSAGHT TOPSPAN® 40 light steel sections are made from TRUECORE® steel complying with AS 1397 G550, AM150.

Base Metal Thickness (mm)	0.48	0.55	0.75
Yield Strength (MPa)	550	550	550
Coating Mass (g/m <sup>2</sup> )	150	150	150
Mass (kg/m)	0.60	0.67	1.91

## Maximum Span

Point Load = 1.1 kN (strength criteria only)      Maximum Span (mm)

Section	TS4048	TS 4055	TS 4075
3 span Continuous	900	1200	1800

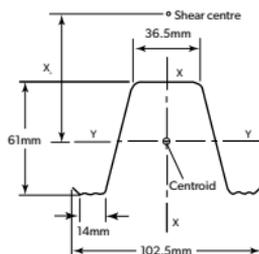
## LYSAGHT TOPSPAN® 40 SECTION PROPERTIES

Catalogue Number	Base Metal Thickness t (bmt) (mm)	Area (mm <sup>2</sup> )	Mass per unit length (kg/m)	Second Moment of Area (Full)		Centre of Gravity y (mm)
				I <sub>x</sub> 10 <sup>6</sup> (mm <sup>4</sup> )	I <sub>y</sub> 10 <sup>6</sup> (mm <sup>4</sup> )	
TS 4048	0.48	76.8	0.60	0.058	0.020	33.34
TS 4055	0.55	83	0.67	0.039	0.020	31.84
TS 4075	0.75	113	0.91	0.054	0.028	31.84

Catalogue Number	Section Modulus (Full)		Radius of Gyration		Torsion Constant J (mm <sup>4</sup> )	Warping Constant I <sub>w</sub> 10 <sup>6</sup> (mm <sup>6</sup> )	Mono-symmetry Constant (mm)
	Z <sub>x</sub> 10 <sup>3</sup> (mm <sup>3</sup> )	Z <sub>y</sub> 10 <sup>3</sup> (mm <sup>3</sup> )	r <sub>x</sub> (mm)	r <sub>y</sub> (mm)			
TS 4048	1.293	0.998	27.3	16.3	5.98	3.407	96.04
TS 4055	1.082	0.969	21.87	15.75	8.37	3.418	80.43
TS 4075	1.475	1.322	21.84	15.72	21.23	4.661	80.43

## TOPSPAN® 61

LYSAGHT TOPSPAN® 61 is an economical, light weight steel section. Being strong and rigid, the LYSAGHT TOPSPAN® 61 section may be used for many applications as an alternative to light gauge purlins and girts of steel or timber.



### Material Specification

LYSAGHT TOPSPAN® 61 light steel sections are made from ZINCALUME® steel complying with AS 1397 G550, AM125.

<b>Base Metal Thickness (mm)</b>	0.60	0.75	1.00	1.20
<b>Yield Strength (MPa)</b>	550	550	550	550
<b>Coating Mass (g/m<sup>2</sup>)</b>	125	125	125	125
<b>Mass (kg/m)</b>	0.95	1.18	1.56	1.87

### Maximum Span

Point Load = 1.1 kN (strength criteria only)      Maximum Span (mm)

Section	TS6160	TS6175	TS6110	TS6112
Single Span	1400	2400	3600	5000
2-span Continuous	1800	2600	4000	5000
2/3 span Lapped Continuous	2000	2700	4200	5600

Point Load = 1.4 kN (strength criteria only)      Maximum Span (mm)

Section	TS6160	TS6175	TS6110	TS6112
Single Span	1100	1800	3000	4000
2-span Continuous	1300	2000	3400	4500
2/3 span Lapped Continuous	1500	2200	3500	4600

## LYSAGHT TOPSPAN® 61 SECTION PROPERTIES

Catalogue Number	Base Metal Thickness t (bmt) (mm)	Area (mm <sup>2</sup> )	Mass per unit length (kg/m)	Second Moment of Area (Full)		Centre of Gravity y (mm)
				I <sub>x</sub> 10 <sup>6</sup> (mm <sup>4</sup> )	I <sub>y</sub> 10 <sup>6</sup> (mm <sup>4</sup> )	
TS 6160	0.60	117	0.95	0.094	0.059	46.49
TS 6175	0.75	146	1.18	0.117	0.074	46.49
TS 6110	1.00	195	1.56	0.157	0.099	46.49
TS 6112	1.20	234	1.87	0.188	0.119	46.49

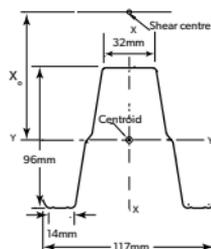
Catalogue Number	Section Modulus (Full)		Radius of Gyration		Torsion Constant J (mm <sup>4</sup> )	Warping Constant I <sub>w</sub> 10 <sup>6</sup> (mm <sup>6</sup> )	Mono-symmetry Constant (mm)
	Z <sub>x</sub> 10 <sup>3</sup> (mm <sup>3</sup> )	Z <sub>y</sub> 10 <sup>3</sup> (mm <sup>3</sup> )	r <sub>x</sub> (mm)	r <sub>y</sub> (mm)			
TS 6160	1.849	1.976	28.31	22.58	14.08	10.750	115.9
TS 6175	2.312	2.437	28.39	22.63	27.42	13.468	115.9
TS 6110	3.083	3.239	28.37	22.62	65.00	17.957	115.9
TS 6112	3.698	3.951	28.32	22.58	112.70	21.500	115.9

## TOPSAN® 96

LYSAGHT TOPSPAN® 96 is a 96mm deep profile used as a roof purlin or girt. It is largely used in rural shed applications.

### Material Specifications

LYSAGHT TOPSPAN® 96 Ceiling Battens are made from ZINCALUME® steel complying with AS 1397 G550, AM125.



Base Metal Thickness (mm)	0.75	1.0	1.2
Yield Strength (MPa)	550	550	550
Coating Mass (g/m <sup>2</sup> )	125	125	125
Mass (kg/m)	1.68	2.22	2.66

## Maximum Span

Point Load = 1.4 kN (strength criteria only)      Maximum Span (mm)

Section	TS 9675	TS 9610	TS 9612
Single Span	3000	5000	6500
2-span Continuous	3300	4500	4500
2/3 span Lapped Continuous	3500	5800	6800

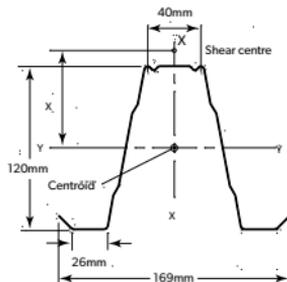
## LYSAGHT TOPSPAN® 96 SECTION PROPERTIES

Catalogue Number	Base Metal Thickness t (bmt) (mm)	Area (mm <sup>2</sup> )	Mass per unit length (kg/m)	Second Moment of Area (Full)		Centre of Gravity y (mm)
				I <sub>x</sub> 10 <sup>6</sup> (mm <sup>4</sup> )	I <sub>y</sub> 10 <sup>6</sup> (mm <sup>4</sup> )	
TS 9675	0.75	208	1.68	0.205	0.242	71.76
TS 9610	1.00	277	2.22	0.273	0.323	71.76
TS 9612	1.20	322	2.66	0.328	0.388	71.76

Catalogue Number	Section Modulus (Full)		Radius of Gyration		Torsion Constant J (mm <sup>4</sup> )	Warping Constant I <sub>w</sub> 10 <sup>6</sup> (mm <sup>6</sup> )	Mono-symmetry Constant (mm)
	Z <sub>x</sub> 10 <sup>3</sup> (mm <sup>3</sup> )	Z <sub>y</sub> 10 <sup>3</sup> (mm <sup>3</sup> )	r <sub>x</sub> (mm)	r <sub>y</sub> (mm)			
TS 9675	3.533	4.922	31.43	34.19	38.91	55.08	160.6
TS 9610	4.711	6.563	31.43	34.19	92.22	73.44	160.6
TS 9612	5.653	7.875	31.93	34.73	159.40	88.12	160.6

## TOPSPAN® 120

LYSAGHT TOPSPAN® 120 is an improved light gauge purlin for use as a substitute for the smaller traditional purlin profiles. The top hat shaped profile has web stiffening and top flange grooves to improve stiffness. It is commonly used in the rural, residential and small commercial market for sheds, garages and awnings where longer spans or strength is required. TOPSPAN® 120 is also used in flooring and shelving applications.



## Material Specification

LYSAGHT TOPSPAN® 120 light steel sections are made from ZINCALUME® steel complying with AS 1397 G550, AM125.

Base Metal Thickness (mm)	0.70	0.90	1.00
Yield Strength (MPa)	550	550	550
Coating Mass (g/m <sup>2</sup> )	125	125	125
Mass (kg/m)	2.07	2.64	2.93

## Maximum Span

Point Load = 1.4 kN (strength criteria only)      Maximum Span (mm)

Section	TS12070	TS12090	TS12010
Single Span	3200	5600	6800
2-span Continuous	4200	6000	6000
2/3 span Lapped Continuous	4600	7000	7500

## LYSAGHT TOPSPAN® 120 SECTION PROPERTIES

Catalogue Number	Base Metal Thickness t (bmt) (mm)	Area (mm <sup>2</sup> )	Mass per unit length (kg/m)	Second Moment of Area (Full)		Shear Centre to Centroid distance X <sub>c</sub> (mm)
				I <sub>x</sub> 10 <sup>6</sup> (mm <sup>4</sup> )	I <sub>y</sub> 10 <sup>6</sup> (mm <sup>4</sup> )	
TS 12070	0.70	256	2.07	0.486	0.491	80.87
TS 12090	0.90	329	2.64	0.630	0.638	80.87
TS 12010	1.00	365	2.93	0.694	0.701	80.87

Catalogue Number	Section Modulus (Full)		Radius of Gyration		Torsion Constant J (mm <sup>4</sup> )	Warping Constant I <sub>w</sub> 10 <sup>6</sup> (mm <sup>6</sup> )	Mono-symmetry Constant (mm)
	Z <sub>x</sub> 10 <sup>3</sup> (mm <sup>3</sup> )	Z <sub>y</sub> 10 <sup>3</sup> (mm <sup>3</sup> )	r <sub>x</sub> (mm)	r <sub>y</sub> (mm)			
TS 12070	5.77	7.64	43.4	43.5	42.26	319.9	187.2
TS12090	7.48	9.81	43.8	44.1	88.7	422.1	187.4
TS 12090	8.25	10.92	43.6	43.3	123.2	457.0	187.2

# HOME IMPROVEMENTS

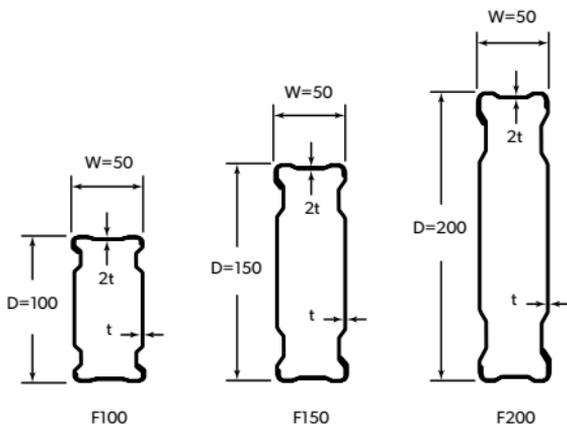
Additions to homes have become a popular method for adding value to property and improving lifestyle. Lysaght has introduced a range of products to use for additions such as patios, carports and extensions.

It also offers a complete solution known as LYSAGHT LIVING®

## LYSAGHT FIRMLOK®

LYSAGHT FIRMLOK® is a light, strong structural beam, useful in a wide range of applications including verandahs, flooring, carports and patios. It is designed for maximum aesthetic and structural performance. The unique interlocking Cee profiles provide a universal structural member with excellent torsional resistance and spanning capacity. They do not warp or split, no painting is required and they are easily fixed with standard self drilling screws.

### Schematics



Section	Dimensions D x W (mm)	Metal Thickness (mm)	Section Area (mm) <sup>2</sup>	Mass
F10011	100 X 50 (nom)	0.55	234.3	1.94
F15015	150 X 50 (nom)	0.75	393.0	3.21
F15015	200 X 50 (nom)	1.00	62.0	5.01

## Specification

LYSAGHT FIRMLOK® beams are made from next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel complying with AS 1397L2011 G550, AM125 (55MPa minimum yield stress, 125h/m<sup>2</sup> minimum coating mass).

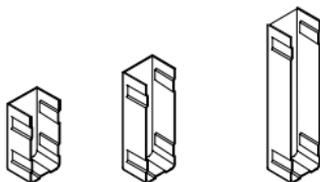
The base metal thicknesses are 0.55, 0.75 and 1.00mm.

LYSAGHT FIRMLOK® beams are also available in several high gloss colours of COLORBOND® steel which complies with AS/NZS 2728:2013.

Please check with your local Lysaght branch for stock length availability on your area.

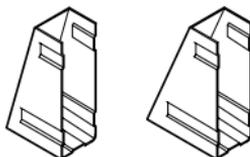
### A variety of accessories are available:

#### Universal Connector



FLUB100ZL05 – 100 purlin / rail  
 FLUB150ZL05 – 150 purlin / rail  
 FLUB200ZL05 – 200 purlin / rail

#### Rafter Connector

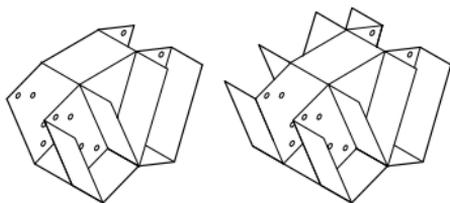


FLUB100ZL15 – 15° pitch, 100 rafter  
 FLUB150ZL15 – 15° pitch, 150 rafter  
 FLUB200ZL15 – 15° pitch, 200 rafter  
 FLUB100ZL225 – 22.5° pitch, 100 rafter  
 FLUB150ZL225 – 22.5° pitch, 150 rafter  
 FLUB200ZL225 – 22.5° pitch, 200 rafter

## 1.2 FIRMLOK® COMPONENTS

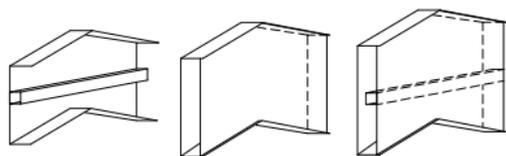
Not all components available in all regions – contact your nearest Lysaght branch for more information.

### Delta Integrated Connector (22.5° pitch only)



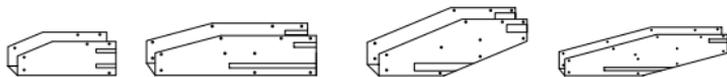
CC10 – 100 rafter & purlin, end frame  
 CC15X – 150 rafter & purlin, end frame  
 CCD10 – 100 rafter & purlin, internal frame  
 CCD10X – 150 rafter & purlin, internal frame

### Apex Connector



FLAB100Z15 – 15° pitch, 100 rafter  
 FLAB150Z15 – 15° pitch, 150 rafter  
 FLAB200Z15 – 15° pitch, 200 rafter  
 FLAB100Z225 – 22.5° pitch, 100 rafter  
 FLAB150Z225 – 22.5° pitch, 150 rafter  
 FLAB200Z225 – 22.5° pitch, 200 rafter

## Collar-tie Connector



CTC10 – 22.5° pitch, 100 collar-tie

CTC15 – 22.5° pitch, 150 collar-tie

CTC1015 – 15° pitch, 100 collar-tie

CTC1515 – 15° pitch, 150 collar-tie

## Bolt



M8/M10 cup/hex head bolts, standard /Nylock nut & washer, Grade 4.6 / S

## Metal screw



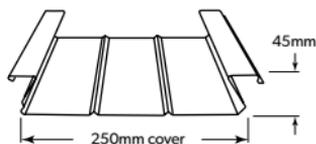
12g-14x20mm hex head tek

12g-24x32mm hex head tek

12g-14x80mm hex head tek

Note: for cladding fasteners, refer to cladding section of this document. Some component are subjected to availability, check with your local lysaght branch.

# LYSAGHT FLATDEK®



FLATDEK® is a long-span cladding particularly suited to home improvement projects like room additions, carports and awnings. The underside of FLATDEK® features clean uninterrupted lines, with an attractive gloss finish ensuring visual appeal.

<b>Application</b>	Roofing (light foot or no foot installation)
<b>Finishes available</b>	A range of COLORBOND pre-painted steel colours with a range of top side/bottom side colour combinations, with a gloss finish on the underside.
<b>BMT</b>	0.42mm
<b>Minimum roof slope</b>	2 degrees (1:30)
<b>Lengths</b>	Available custom cut.

## MATERIAL SPECIFICATIONS

FLATDEK® is made from:

- COLORBOND® is pre-painted steel for exterior roofing and walling. The painting complies with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011. Minimum yield strength is G550 (550 MPa). Minimum coating mass is AM100 (100g/m<sup>2</sup>). The base metal thickness is 0.42mm.

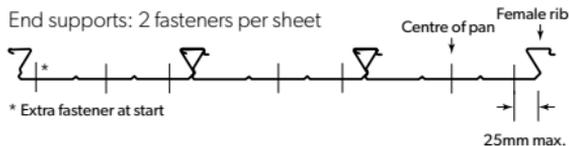
## FIXING DATA

The unique overlapping dovetail ribs of the FLATDEK® profile can be easily fitted together by hand. FLATDEK® is simply and economically fixed on top of its supporting members using self-drilling screws in the pans. This method, using the recommended fasteners, is appropriate for open sided awnings where a high degree of weather tightness is not required.

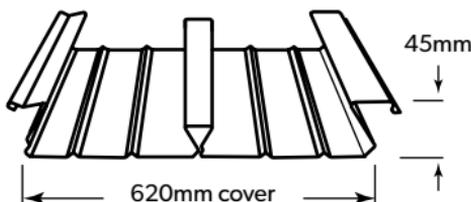
	<b>Fix to Steel (Total 2.0mm) Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>	<b>Fix to Timber Softwood J4</b>
<b>PAN FIXED</b>	12-14x20, Metal Tek's, HH with EPDM seal or Roof Zips M6-11x25 with EPDM seal	12-14x20, Metal Tek's, HH with EPDM seal	M5.5-11x35 Batten Zip 16mm bonded Aluminium EPDM washer	M5.5-11x35 Batten Zip 16mm bonded Aluminium EPDM washer

### Notes:

1. Values given are: gauge-threads per inch x lengths (mm). HH = Hex. Head. Finish is Coating Class 4.
2. When fixing to FIRMLOK®, tighten until washer is just gripped enough to give a weathertight seal. Don't tighten any more.
3. Screw specification as above or equivalent fastener. Refer to Timber Code AS1720.2 for timber grades.
4. For awnings with double spans of 4000mm or more for wind class 3, 3 sides blocked, use 3 fasteners per pan for middle supports. For single spans for wind categories up to N4, 3 sides blocked use 2 fasteners per span.



## FLATDEK® II



FLATDEK® II is a long-span cladding particularly suited to home improvement projects such as room additions, carports and awnings. The underside of FLATDEK® II features clean uninterrupted lines, with an attractive gloss finish ensuring visual appeal.

<b>Application</b>	Roofing
<b>Finishes available</b>	A range of COLORBOND pre-painted steel colours with a range of top side/bottom side colour combinations, with a gloss finish on the underside.
<b>BMT</b>	0.42mm
<b>Minimum roof slope</b>	2 degrees (1:30)

### MATERIAL SPECIFICATION

FLATDEK® II is made from:

- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011. Minimum yield strength for FLATDEK® II is G550 (550 MPa) Minimum coating mass is AM100 (100g/m<sup>2</sup>).

## FIXING DATA

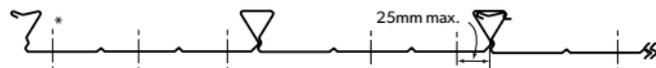
The unique overlapping dovetail ribs of the FLATDEK® II profile can be easily fitted together by hand. FLATDEK® II is simply and economically fixed on top of its supporting members using self-drilling screws in the pans. This method, using the recommended fasteners, is appropriate for open sided awnings where a high degree of weather tightness is not required.

	<b>Fix to Steel (Up To Total 2.0mm) Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>	<b>Fix to Timber Softwood J4</b>
<b>PAN FIXED</b>	12-14x20, Metal Teks, HH with EPDM seal or Roof Zips M6-11x25 with EPDM seal	12-14x20, Metal Teks, HH with EPDM seal	M5.5-11x35 Batten Zip 16mm bonded Aluminium EPDM washer	M5.5-11x35 Batten Zip 16mm bonded Aluminium EPDM washer

Notes:

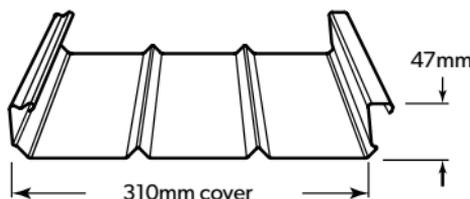
1. Values given are: gauge-threads per inch x lengths (mm). HH = Hex. Head. Finish is Coating Class 4.
2. When fixing to FIRMLOK®, tighten until washer is just gripped enough to give a weathertight seal.  
Don't tighten any more.
3. Screw specification as above or equivalent fastener. Refer to Timber Code AS1720.2 for timber grades.
4. For awnings with double spans >3700mm for N4 wind category, 2 & 3 sides blocked, use 3 fasteners per span for middle supports. (E.g. FIRMLOK® F100 beams). For single spans for wind categories up to N4, 3 sides blocked use 2 fasteners per pan.

### Fastener locations



\* Extra fastener at the start. Supports: 2 fasteners per pan.

## FLATDEK® 310



FLATDEK® 310 is a long-span cladding particularly suited to home improvement projects like room additions, carports and awnings. The underside of FLATDEK® 310 features clean uninterrupted lines, with an attractive gloss finish ensuring visual appeal.

<b>Application</b>	Roofing
<b>Finishes available</b>	A range of COLORBOND pre-painted steel colours with a range of top side/bottom side colour combinations, with a gloss finish on the underside.
<b>BMT</b>	0.42mm
<b>Minimum roof slope</b>	2 degrees (1:30)

### MATERIAL SPECIFICATION

FLATDEK® 310 is made from:

- COLORBOND® pre-painted steel complying with AS/NZS 2728:2013 and the steel base is an aluminium/zinc alloy-coated steel complying with AS 1397:2011. Minimum yield strength for FLATDEK® 310 is G550 (550 MPa) Minimum coating mass is AM100 (100g/m<sup>2</sup>).

## FIXING DATA

FLATDEK® 310 is simply and economically fixed on top of its supporting members using self-drilling screws (teks) in the pans. This method, using the recommended fasteners, is appropriate for open sided awnings where a high degree of weather tightness is not required.

	<b>Fix to Steel Single &amp; lapped steel thickness ≥0.55 up to 1.0mm BMT</b>	<b>Fix to Steel Single steel thickness ≥1.0mm BMT up to 3.0mm BMT</b>	<b>Fix to Timber Hardwood J1-J3</b>	<b>Fix to Timber Softwood J4</b>
<b>PAN FIXED</b>	12-14x20, Metal Teks, HH with EPDM seal	12-14x20, Metal Teks, HH with EPDM seal	M5.5-11x40 Batten Zip with 16mm bonded Aluminium EPDM washer	M5.5-11x40 Batten Zip with 16mm Bonded Aluminium EPDM washer



## LYSAGHT LIVING®

The LYSAGHT LIVING® range includes an extensive selection of patios, verandahs, carports, home extensions and decks.

For home improvement options as attractive and engineered as they are affordable, you won't find better than the LYSAGHT LIVING® range.

Key features include:

- Available as free standing or attached structures in a wide variety of choices
- Designed using industry leading software
- Engineered and tested to Australian Standards
- Supplied with full documentation to facilitate council approvals
- Made using components that are 100% termite, warp and rot resistant
- Available as either a DIY kit or fully supplied and installed by experienced distributors
- Available with your choice of COLORBOND® steel, translucent sheeting or mix and match
- Available in a wide choice of colours and cladding profiles, including insulated panels
- Low maintenance and prepainted – manufactured to last
- Constructed using LYSAGHT SmartParts™ connectors for structural accuracy and durability
- Every LYSAGHT LIVING® structure comes with a 20 Year Structural Performance Warranty\*

(\*Please refer to website for warranty terms and conditions)

## LYSAGHT SmartParts™

LYSAGHT SmartParts™ simplify construction for building professionals and ensure DIY projects can achieve the same quality finish. These engineered and tested brackets are pre-welded and pre-drilled to maximise assembly accuracy and minimise construction time.

**Cc Builder®**

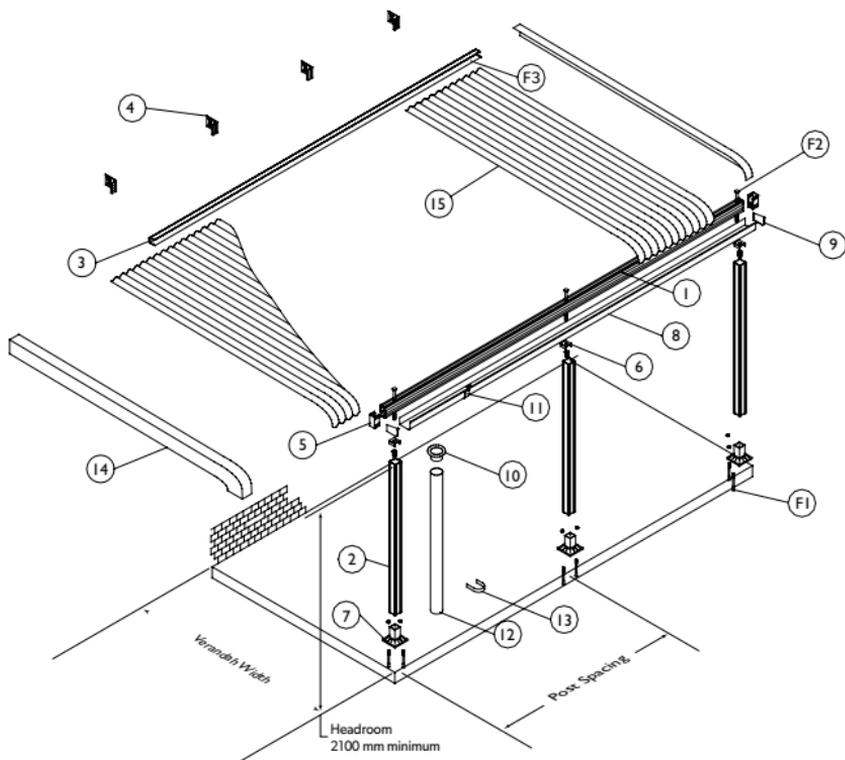
Each LYSAGHT LIVING® structure has met rigorous engineering standards thanks to our industry-leading Cc Builder® software. The software ensures accurate engineering and designs through its XCC (Exact Connection Checking), XPD (Exact Pitch Design) and XBD (Exact Beam Design) engines.

Spanning capabilities, connection strength and structural integrity are guaranteed when your home addition is designed with Cc Builder®.

## CONVENTIONAL BULL NOSE VERANDAH WITH LYSAGHT FIRMLOK® & LYSAGHT CUSTOM BLUE ORB®

Using LYSAGHT FIRMLOK® and CUSTOM BLUE ORB® and our Patio post you can also build a verandah with a traditional bullnose design.

### Verandah Arrangement



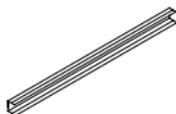
## Verandah Components



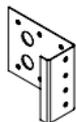
1  
FIRMLOK® beam



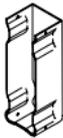
2  
Post



3  
Receiver Channel



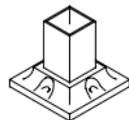
4  
140 Universal Bracket



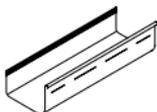
5  
FIRMLOK® End Cap



6  
Post Top Insert



7  
Post Foot



8  
Gutter



9  
Gutter End Stop



10  
Gutter Spout Outlet



11  
Gutter Bracket



12  
Downpipe



13  
Downpipe Strap



14  
Curved Barge Capping

15 Roof Sheeting CUSTOM BLUE ORB® 0.6 mm BMT (Curved)



F1 M8 x 75mm Screw anchors  
F3 Bulb-Tite® Rivets 5.2mm  
F4 Self drilling screws various siz



F2 M8 Cuphead Bolt

# LYSAGHT FENCING RANGE

The LYSAGHT® product range offers a number of fencing systems that are stylish, strong and durable providing security, privacy and low maintenance requirements. LYSAGHT® steel fencing is manufactured using 100% Australian-made COLORBOND® steel meaning it won't crack, chip, peel or warp ensuring a long, low maintenance life.

The LYSAGHT® fencing range offers a number of styles including: the original durable LYSAGHT NEETASCREEN®, the attractive mini corrugated LYSAGHT MINISCREEN®, the 'similar on both sides' LYSAGHT SMARTASCREEN® and the traditional corrugated LYSAGHT CUSTOMSCREEN®. In addition, recently released LYSAGHT SLATSCREEN® & LYSAGHT LOUVRESCREEN® are contemporary screening systems suitable for boundary or feature fences, and as screens for patios, carports, garbage bins and pool filters. With a double sided finish, the use COLORBOND® steel ensures both neighbours get the benefit of an attractive long lasting fence. Also available are a range of Plus options & Accessories including Lattice, Slats, Pickets, Plinths & Gates, to add additional function and appeal to your fence. Lysaght also offers fencing systems for the Cyclonic regions of Far North Queensland and Western Australia.

## 10 Year Warranty

Lysaght warrants that a LYSAGHT® fence is free from all defects in materials and manufacture, will not suffer perforation from natural weathering, and will resist the maximum basic wind speeds applicable to the wind region when installed and maintained in accordance with specifications.

The LYSAGHT® 10 Year Fencing Warranty is the warranty of choice for complete peace of mind because it covers all the fence components.

## COLORBOND® steel

Our fencing is made of COLORBOND® steel with a two-sided prepainted finish. This ensures both neighbours get the benefit of an attractive long lasting finish.

The availability of the standard colour range may vary from state to state, with some states offering an extended non-standard range.

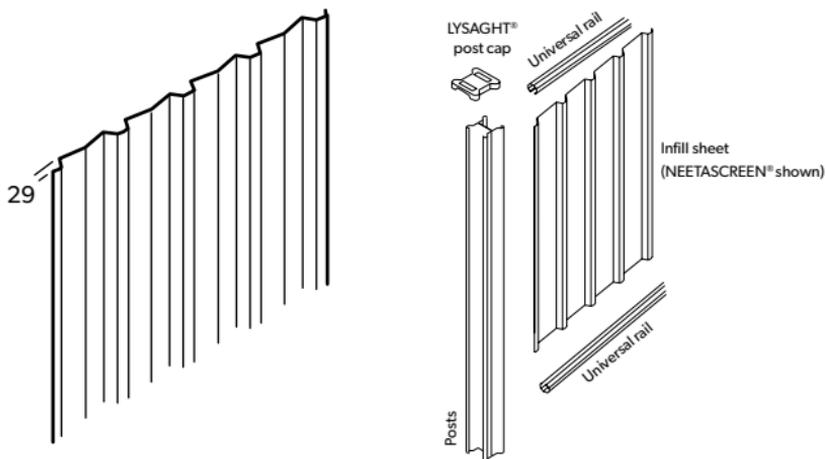
Check your local supplier or Lysaght branch to discover the colour availability in your area.

## LYSAGHT NEETASCREEN® FENCING

The original boundary fence produced by Lysaght. The LYSAGHT NEETASCREEN® fence uses an attractive trapezoidal profile and can be either stepped or raked for sloping terrain. LYSAGHT® fencing components have been designed to ensure maximum flexibility and strength. The fence rails are designed to allow for a fence rake of 1 in 20 (117mm in 2350mm) without the need to cut the infill sheets.

The attractive octagonal fence post provides the backbone of the fencing system. NEETASCREEN® is also available in the Plus range.

### Components



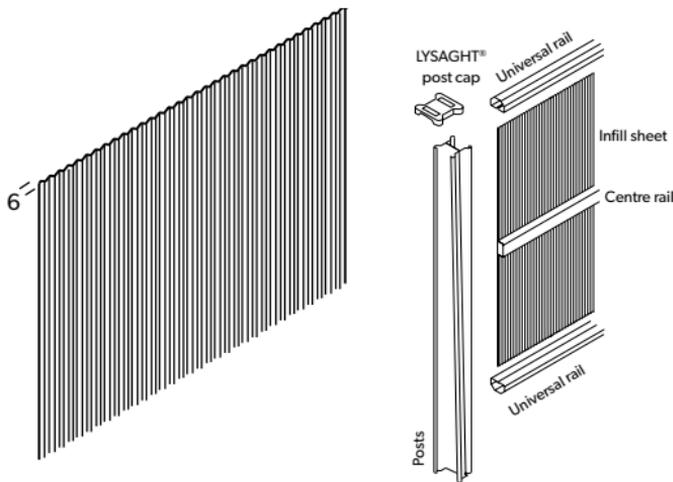
### Size Availability

The nominal heights of fences are 1200, 1500, 1800 and 2100mm from top rail to bottom of bottom rail. The bottom rail should be a minimum of 50mm above ground level. Standard panel widths are 2350mm.

## LYSAGHT MINISCREEN® FENCING

Using the attractive LYSAGHT MINI ORB® profile this fence offers a stylish and attractive finish whilst still offering the strength of LYSAGHT® fence systems. Use the Plus lattice for an even more stylish finish.

### Components



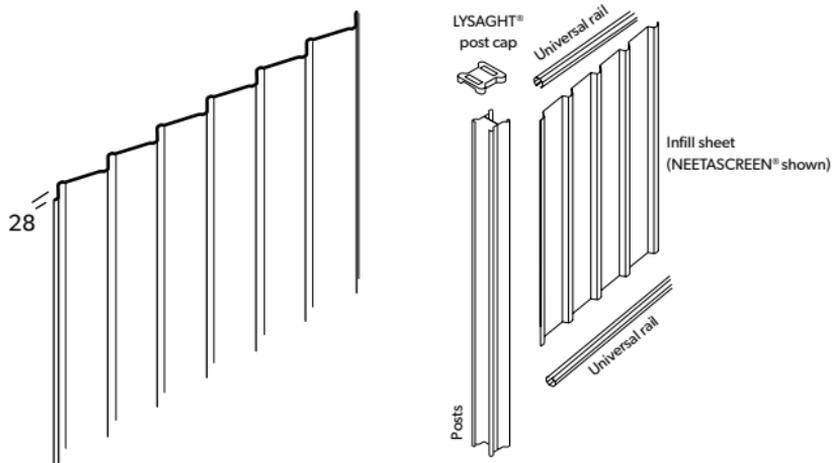
### Size Availability

The nominal heights of fences are 1200, 1500, 1800 and 2100mm from top rail to bottom of bottom rail. The bottom rail should be a minimum of 50mm above ground level. Standard panel widths are 2350mm.

## LYSAGHT SMARTASCREEN® FENCING

LYSAGHT SMARTASCREEN® keeps neighbours happy with its stylish appearance on both sides. This innovative panel fencing made of COLORBOND® steel offers clean attractive lines with a unique subtle textured finish.

### Components



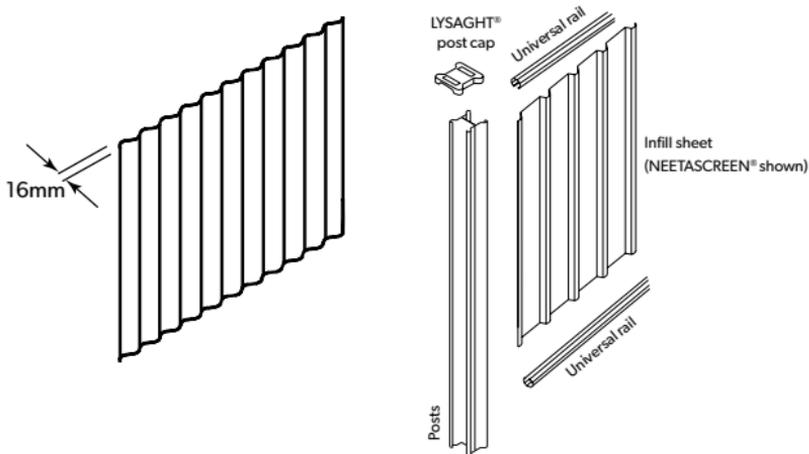
### Size Availability

The nominal heights of fences are 1200, 1500, 1800 and 2100mm from top rail to bottom of bottom rail. The bottom rail should be a minimum of 50mm above ground level. Standard panel widths are 2350mm.

## LYSAGHT CUSTOMSCREEN® FENCING

LYSAGHT CUSTOMSCREEN® is the new fencing profile designed to match the traditional style of the LYSAGHT CUSTOM ORB® profile. Also available in the "PLUS" range, this fence system will add style and value to any property.

### Components



### Size Availability

The nominal heights of fences are 1200, 1500, 1800 and 2100mm from top rail to bottom of bottom rail. The bottom rail should be a minimum of 50mm above the ground level. Standard panel widths are 2350mm.

## LYSAGHT SLATSCREEN® / LOUVRESCREEN®

Make the fence a feature with LYSAGHT SLATSCREEN® or LYSAGHT LOUVRESCREEN® - the elegant and modern slat screening for your home.

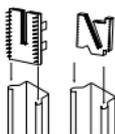
With a contemporary designer look that also promotes natural light and airflow a LYSAGHT SLATSCREEN® fence is suitable for boundary or feature fences or as a screen for patios, carports, garbage bins and pool filters.

With a semi-open design of horizontal slats, LYSAGHT LOUVRESCREEN® provides privacy whilst also allowing light and airflow into your property.



### Slat Infill

- Made with 0.55mm BMT COLORBOND® steel
- Features a similar look on both sides

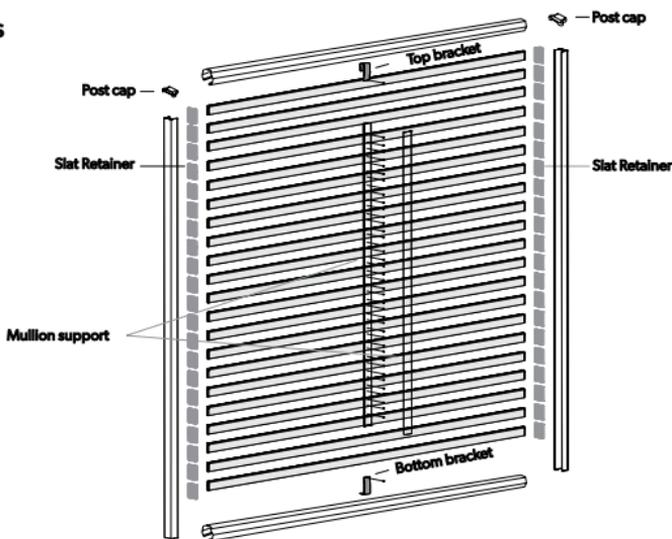


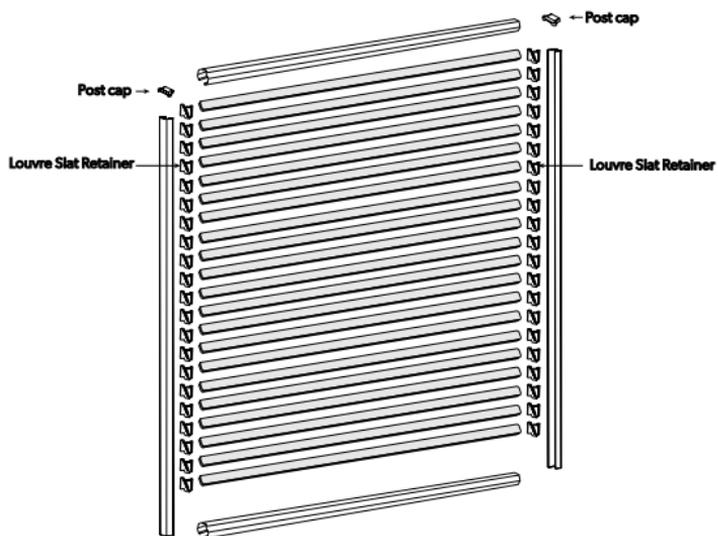
### Slat Retainers

- Different retainer options for LYSAGHT SLATSCREEN® & LYSAGHT LOUVRESCREEN®
- Made from a durable plastic material in black

## LYSAGHT SLATSCREEN®

### Components

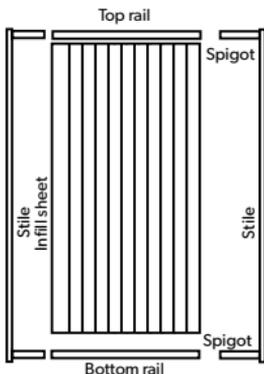


**LYSAGHT LOUVRESCREEN®****Components**

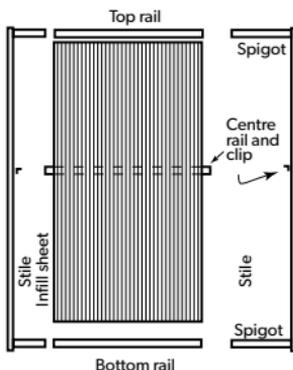
## LYSAGHT GATES

LYSAGHT® gates are designed to perfectly complement our range of steel boundary fence products. All gates come with the flexibility of our fencing profiles to fit perfectly with your lifestyle and requirements.

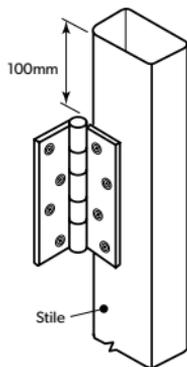
**NEETASCREEN®,  
SMARTASCREEN®,  
CUSTOMSCREEN®**



**MINISCREEN®**



### Fixing of hinges



### Fasteners



(All gate types) Self-drilling, self tapping hex. washer-head screws 10-16x16



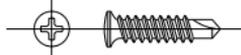
(Extra wide gates only) Self-drilling, self tapping, hex. head screw 12-14 x 45 or RoofZips M6-11x50 or AutoTek's M5.5-14x50

**Ripple Screws**  
(MINISCREEN® range only)

RippleZip® screw or M4.8-16x25



Ripple Tek® screw 10-16x20



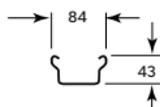


## STANDARD COMPONENTS

Standard Post

**LYSAGHT® Posts****Standard length:**

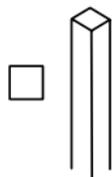
2100, 2400, 2700 &amp; 3000



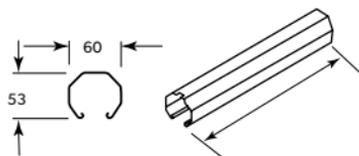
Square (Tubular) Post

**60x60x1.6, 65x65x2.5****Standard lengths:**

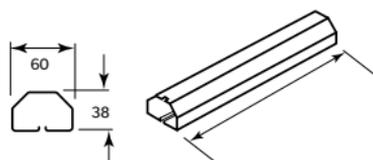
2400, 3000



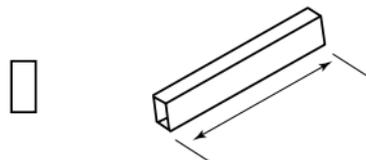
Rails

**NEETASCREEN®, SMARTSCREEN®****Universal Rail**

Post Caps

**LYSAGHT® Post Cap****MINISCREEN® Universal Rail**

Square (Tubular) Post Cap

**(for square post) 60x60, 65x65****MINISCREEN® Centre Rail**

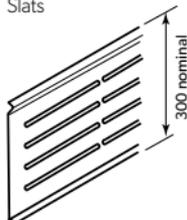
## THE PLUS RANGE

Each LYSAGHT® fence style can be accessorised with the addition of lattice. This is known as the “PLUS” range and gives the standard design a distinctive look.

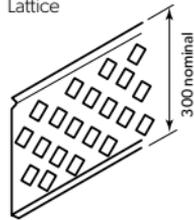
Existing LYSAGHT® fences can also be converted to a “PLUS” design. Information on how to convert your fence is available through your local Lysaght branch or at [www.lysaght.com](http://www.lysaght.com)

### Components

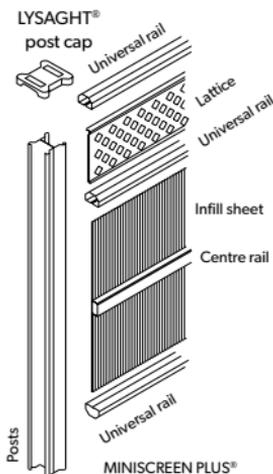
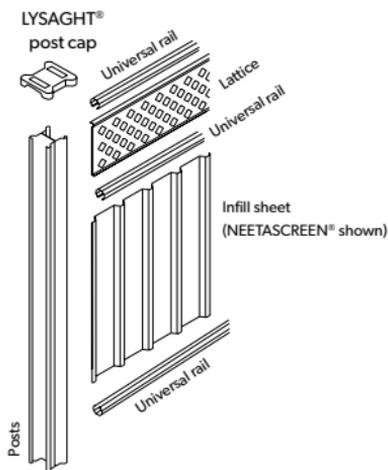
Slats



Lattice



### Installation with Plus Options



## CYCLONIC FENCE RANGE

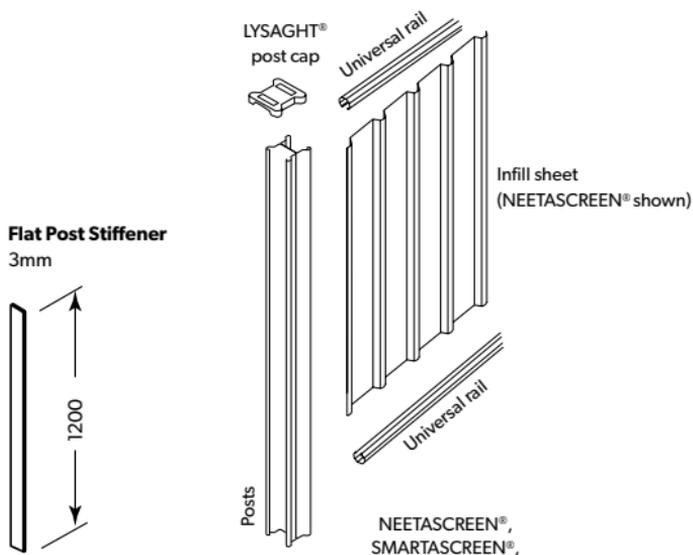
LYSAGHT® Cyclonic fences are specifically designed not to fly apart during a cyclone. This means they are much safer than standard fences. However, cyclonic wind conditions can be so extreme that LYSAGHT® Cyclonic fences cannot be guaranteed to survive a cyclone. Gates and their installation must be engineered for each individual application.

### LYSAGHT TYPE 3 NEETASCREEN® (AVAILABLE IN FAR NORTH QLD)

The modular LYSAGHT TYPE 3 NEETASCREEN® fence is one of the most versatile and durable fencing systems on the market. Made using COLORBOND® pre-painted steel, the vertical ribbed LYSAGHT NEETASCREEN® panels provide strength and simple assembly.

LYSAGHT TYPE 3 NEETASCREEN® also offers the option of a Plus style.

#### Components



## LYSAGHT CYCLONIC FENCING (AVAILABLE IN WA)

Specifically designed for Western Australia's climate and legislation Lysaght has introduced LYSAGHT cyclonic fencing. Using the familiar NEETASCREEN® profile this fence offers outstanding strength and simple installation.

### Components



Domed Cap



Rectangular post:  
100x50mm 2.0,  
2.5, 3.5mm BMT

Standard lengths:  
2400, 2700 &  
3000mm

**NEETALOK®**  
brackets



**NEETALOK®**  
raking adaptors



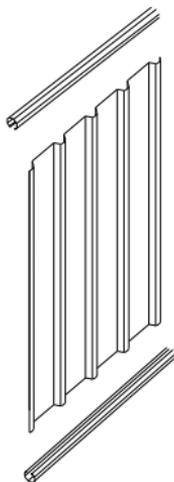
Self-drilling self  
tapping Hex.  
Washer-Head  
Screws  
12-14x20  
12-14x42



Domed Cap



Square post  
(optional  
at corner  
junctions)  
Minimum  
60x60x1.6



**NEETASCREEN®**

Universal Rail  
Standard length:  
2350mm  
(2 pieces)

**NEETALOK®**

Standard post  
Standard lengths:  
2100, 2400, 2700  
& 3000mm



Lysaght  
post cap  
(cut in  
half)



**NEETASCREEN®**

Standard post.  
Standard lengths:  
2100, 2400,  
2700 & 3000mm

# POLYMER COATED STEEL WATER TANKS

## AQUAPLATE® POLYMER COATED STEEL FOR WATER TANKS

AQUAPLATE® polymer coated steel has been specifically developed for the fabrication of water tanks and is the only product recommended by BlueScope for this application.

The interior coating on AQUAPLATE® steel is a food grade polymer film lamination that makes the tanks tolerant to a wide range of water qualities and catchment materials. It is a tough, abrasion resistant film that is produced to meet Australian Standard 2070, Part 2 – Plastic Materials for Food Contact Use. (The film is not UV resistant and must not be exposed to direct sunlight for extended periods). AQUAPLATE® rainwater tanks from BlueScope Water are approved to AS4020:1999, products approved for storing water fit for human consumption.

Care must be taken with the application of products for surfaces used to collect drinking water. Appropriate coated steel products from BlueScope Steel have been accredited to Australian Standard AS 4020:1999. These include COLORBOND® steel and COLORBOND® steel premium products, ZINCALUME® steel and GALVABOND® steel, all of which can be used in conjunction with a polymer coated steel tank. For health reasons lead, copper and treated timber catchments are not recommended for the collection of drinking water.

Variation in water quality can affect the performance of (non-AQUAPLATE® steel) steel tanks. However, there is minimal impact from water quality on the service life of a tank made from AQUAPLATE® steel. This is due to the presence of the food grade polymer lining, which acts as a barrier to prevent metal to water contact.

## **GUIDELINES FOR USING TANKS MADE FROM AQUAPLATE® STEEL**

You can obtain the maximum life and water quality, from tanks made from AQUAPLATE® steel by considering the following pointers.

### **Do:**

- Discard the first fill of water to ensure roofs, gutters, tanks and pipes are clean
- Install anodised aluminium mesh inlet strainers above the water level
- Install gauze filters on all outlets and overflows to keep out mosquitos
- Install the tank away from trees that may drop leaves and clog the strainer

### **Don't:**

- Allow tank overflow to run down the exterior tank wall
- Enter the tank unless necessary. The polymer lining can be easily damaged by tools, ladders and footwear. If entry is required, use rubber soled shoes, rubber ladder footings and great care
- Collect water from lead, copper, or copper treated timber
- Store water over 65 degrees Celsius
- Expose the polymer lining to prolonged contact with alkalis, mineral acids, petrol, kerosene, mineral turps, alcohol or water solutions of inorganic compounds
- Permit any contact with low organic weight organic acids (acetic, lactic, formic, stearic), aromatic hydrocarbons (toluene), chlorinated hydrocarbons (111 trichloroethane), ketones (methyl ethyl ketone) or esters (cellusolve acetate)

## INSTALLATION, CARE & MAINTENANCE OF TANKS

### First Fill

As with all water tanks, it is essential that at least a portion of the first fill be drained from the tank. This is advisable for health reasons, as the roof or gutter catchment could have toxic matter on or in it. The tank itself may also have residuals within it as a result of manufacture and transportation. If the roof is painted, check the paint is suitable for the collection of drinking water.

### Location of Tank

Ideally, the tank should be installed in a shady location away from trees from which leaves and debris could clog the strainer or contaminate the water.

### Tank Base

The tank must be totally supported by a firm, flat, stable platform, the dimensions of which must be larger than the diameter of the tank.

AQUAPLATE® steel tanks are supplied with a protective membrane under the base, and it is recommended they are placed directly onto a concrete or timber base.

Tank stands must be engineered to safely support the tank when full of water, bearing in mind that water has a mass of 1 kilogram per litre.

### Water Connection

Copper piping must not be connected directly to AQUAPLATE® steel tanks. If copper outlet pipes are involved, there must be at least two metres of plastic pipe between the tank and the copper. Copper must not be used for recirculating water to an AQUAPLATE® steel tank.

### Liquids other than Water

AQUAPLATE® steel and the range of water storage tanks from BlueScope Water have been developed specifically for the storage of potable water from most sources, and all warranties refer to water. However, its suitability for storing other liquids is recognised. Enquiries should be made to BlueScope Steel or BlueScope Water for advice regarding other specific storage needs.

# STRUCTURAL SOLUTIONS

Zeds and Cee purlins are widely accepted by the construction industry and are highly efficient, versatile and robust cladding support systems.

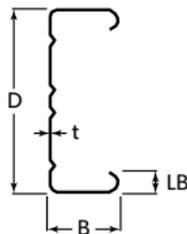
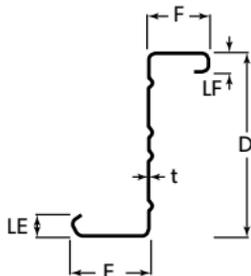
LYSAGHT SUPAZED® and LYSAGHT SUPACEE® purlins are the next steps forward in purlin and girt design, delivering more performance per weight of steel than any previous purlin design.

The lightweight structural steel members are designed in accordance with the Cold Formed Steel Structures AS/NZS 4600 - 1996 utilising high strength zinc-coated steel.

## SUPACEE® AND SUPAZEDS®

The efficiency of the SupaPurlin® profiles delivers significant savings. Performance improvements can be achieved over traditional zed and cee purlin designs, when using LYSAGHT SUPAZED® and LYSAGHT SUPACEE® Purlins. The result is increased purlin spacing, increased purlin spans (frame or rafter spacing) and fewer rows of bridging.

t	=	thickness (base metal)
D	=	Depth
B	=	Flange width
LB	=	Lip height
E	=	Lower flange width
LE	=	Lip height
F	=	Upper flange width
LF	=	Lip height



## DIMENSIONS FOR SUPAZED® PURLINS

Catalogue Number	t (mm)	D (mm)	Mass per Unit length (kg/m)	E (mm)	LE (mm)	F (mm)	LF (mm)
SZ 15010	1.0	152	2.38	63	17	48	16
SZ 15012	1.2	152	2.89	66	18.5	49	16.5
SZ 15015	1.5	152	3.58	66.5	18	49.5	17
SZ 15019	1.9	152	4.51	67.5	19	50.5	18
SZ 15024	2.4	152	5.67	70	20	52	19
SZ 20012	1.2	203	3.62	76	19.5	62	19.5
SZ 20015	1.5	203	4.49	77	20	63	20
SZ 20019	1.9	203	5.73	79.5	21.5	63.5	21
SZ 20024	2.4	203	7.20	81.5	22	65	22
SZ 25015	1.5	254	5.16	78.5	19.5	67	20
SZ 25019	1.9	254	6.50	78.5	21	65	21
SZ 25024	2.4	254	8.16	80.5	22	66	22
SZ 30019	1.9	300	8.02	103.5	25	88	26
SZ 30024	2.4	300	10.09	104.5	26.5	87.5	27
SZ 30030	3.0	300	12.56	106.5	28	88	28
SZ 35024	2.4	350	12.20	131.5	28.5	114	31
SZ 35030	3.0	350	15.19	134	30	115	31
*SZ 40024	2.4	400	13.16	131.5	28.5	114	31
*SZ 40030	3.0	400	16.39	134	30	115	31
*SZ 40032	3.2	400	17.46	134.5	30.5	115.5	31

\* Subject to enquiry

## DIMENSIONS FOR SUPACEE® PURLINS

Catalogue Number	t (mm)	D (mm)	Mass per Unit length (kg/m)	E (mm)	LE (mm)	F (mm)	LF (mm)
SC 15010	1.0	152	2.38	57.5	17.5	48	16
SC 15012	1.2	152	2.89	60.5	18	49	16.5
SC 15015	1.5	152	3.58	61	18.5	49.5	17
SC 15019	1.9	152	4.51	62	19	50.5	18
SC 15024	2.4	152	5.67	63	20	52	19
SC 20012	1.2	203	3.62	70	21	62	19.5
SC 20015	1.5	203	4.49	70.5	21.5	63	20
SC 20019	1.9	203	5.73	73	23	63.5	21
SC 20024	2.4	203	7.20	74.5	24	65	22
SC 25015	1.5	254	5.16	72	22.5	67	20
SC 25019	1.9	254	6.50	72.5	23	65	21
SC 25024	2.4	254	8.16	74	24	66	22
SC 30019	1.9	300	8.02	97.5	27.5	88	26
SC 30024	2.4	300	10.09	100	28.5	87.5	27
SC 30030	3.0	300	12.56	100.5	29.5	88	28
SC 35024	2.4	350	12.20	124	33.5	114	31
SC 35030	3.0	350	15.19	125.5	34.5	115	31
*SC 40024	2.4	400	13.16	124	33.5	114	31
*SC 40030	3.0	400	16.39	125.5	34.5	115	31
*SC 40032	3.2	400	17.46	126.5	34.5	115.5	31

\* Subject to enquiry

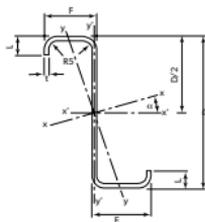
### Material Specification

LYSAGHT SUPAZED® and LYSAGHT SUPACEE® are roll-formed from GALVSPAN® steel complying with AS1397 - 2001 in the following grades:

- 1.0mm BMT: AS 1397/G550 Z350
- 1.2mm BMT: AS 1397/G500 Z350
- 1.5, 1.9, 2.4, 3.0mm BMT: AS 1397/G450 Z350

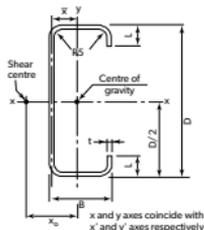
## ZED SECTIONS

LYSAGHT® Zed Sections feature one broad and one narrow flange, sized so that two sections of the same size fit together snugly, making them suitable for lapping. LYSAGHT® Zed Sections of the same depth and different thicknesses can be lapped in any combination.



## CEE SECTIONS

LYSAGHT® Cee Sections have equal flanges and are suitable for simply supported spans. For shorter spans they may be used continuously over two or more spans with the ends butted, thus producing reduced deflection compared with simple spans. They cannot be lapped.



Catalogue Number	t (mm)	D (mm)	Mass per Unit length (kg/m)	Zeds			Ceess	
				E (mm)	F (mm)	L (mm)	B (mm)	L (mm)
Z/C10010	1.0	102	1.78	53	49	12.5	51	12.5
Z/C10012	1.2	102	2.10	53	49	12.5	51	12.5
Z/C10015	1.5	102	2.62	53	49	13.5	51	13.5
Z/C10019	1.9	102	3.29	53	49	14.5	51	14.5
Z/C15012	1.2	152	2.89	65	61	15.5	64	14.5
Z/C15015	1.5	152	3.59	65	61	16.5	64	15.5
Z/C15019	1.9	152	4.51	65	61	17.5	64	16.5
Z/C15024	2.4	152	5.70	66	60	19.5	64	18.5
Z/C20015	1.5	203	4.49	79	74	15.0	76	15.5
Z/C20019	1.9	203	5.74	79	74	18.5	76	19.0
Z/C20024	2.4	203	7.24	79	73	21.5	76	21.0
Z/C25019	1.9	254	6.50	79	74	18.0	76	18.5
Z/C25024	2.4	254	8.16	79	73	21.0	76	20.5
Z/C30024	2.4	300	10.09	100	93	27.0	96	27.5
Z/C30030	3.0	300	12.76	100	93	31.0	96	31.5
Z/C35030	3.0	350	15.23	129	121	30.0z	125	30.0

\* Subject to enquiry

## Material Specification

LYSAGHT® Zed and Cee sections are roll-formed from GALVSPAN® steel complying with AS1397 - 2001. In the grades shown, the numbers prefixed with G indicate minimum yield stress in MPa. The numbers prefixed with Z indicate minimum coating mass in g/m<sup>2</sup>.

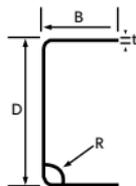
- 1.0mm BMT: G550, Z350\*
- 1.2mm BMT: G500, Z350\*
- 1.5, 1.9, 2.4 & 3.0mm BMT: G450, Z350\*

\* All BMTs in Townsville have Z450 coating.

## LYSAGHT® COLD FORM SECTIONS

LYSAGHT® Cold Formed steel channels and angles are roll-formed from zinc coated and uncoated material. These sections have many uses in the construction, general fabrication and home handy-person fields.

Please check with your local Lysaght branch for availability in your area.



## PLAIN CHANNELS – DIMENSIONS & PROPERTIES

### Tolerances

Web:	+ 2mm – 1 mm for LC 12730, LC 15230 ± 1mm for all other sections.
Flange:	± 2 mm
Length:	± 15 mm

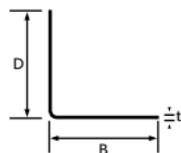
Catalogue Number	Nominal Dimensions				Section Area (mm <sup>2</sup> )	Mass	
	D (mm)	B (mm)	R (mm)	t (mm)		Galv. (kg/m)	Black (kg/m)
LC05130	51	25	3.2	3.0	270	2.15	2.12
LC06425	64	23	2.5	2.5	250	2.00	1.96
LC07630	76	38	3.2	3.0	420	3.34	3.30
LC08330	83	34	3.2	3.0	420	3.34	3.30
LC08930	89	31	3.2	3.0	420	3.34	3.30
LC09530	95	37	3.2	3.0	465	3.70	3.65
LC10330	103	34	3.2	3.0	465	3.70	3.65
LC10230	102	55	3.2	3.0	600	4.78	4.71
LC12730	127	50	3.2	3.0	660	5.26	5.18
LC15230	152	51	3.2	3.0	735	5.86	5.77

## PLAIN CHANNELS – DIMENSIONS & PROPERTIES

### Tolerances

Legs:  $\pm 1.5$  mm, equal within 1 mm for equal angles.

Length: + 15 mm - 0



Catalogue Number	Nominal Dimensions			Section Area (mm <sup>2</sup> )	Mass	
	D (mm)	B (mm)	t (mm)		Galv. (kg/m)	Black (kg/m)
LA4630	46	35	3.0	225	1.79	1.77
LA5130	51	30	3.0	225	1.79	1.77

### Specification

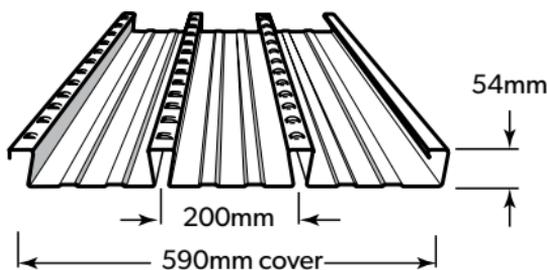
LYSAGHT® cold formed steel channels and angles are available either zinc coated or uncoated in base metal thicknesses (BMT) of 1.0 mm, 1.6 mm, 2.5 mm and 3.0 mm depending on section type. The materials used are zinc coated steel to AS 1397 - G300 - Z275 (300 MPa minimum yield stress 275g/m<sup>2</sup> minimum coating mass).

In addition, subject to minimum quantity order, LYSAGHT® cold formed steel channels and angles can be produced from higher yield stress uncoated and zinc coated steels to meet more demanding design requirements.

# STRUCTURAL STEEL DECKING

## LYSAGHT BONDEK®

LYSAGHT BONDEK® profiled steel decking is a highly efficient, versatile and robust formwork, reinforcement and ceiling system for concrete slabs. It is a profile steel sheeting widely accepted by the building and construction industry to offer efficiency and speed of construction.



### Physical Properties

Thickness (mm)	Mass		Yield Strength MPa	Coverage (m <sup>2</sup> /t)
	(kg/m <sup>2</sup> )	(kg/m)		
0.60	8.52	5.03	550	117.31
0.75	10.50	6.20	550	95.24
0.90*	12.48	7.36	550	80.16
1.00	13.79	8.14	550	72.52

\* The availability of 0.9mm BONDEK® formwork is subject to enquiry  
 Note: Self weight is given for Z350 coating class.

### Specification

BONDEK® steel decking is roll-formed from DECKFORM® zinc-coated, hot dipped, high-tensile steel, in base metal thicknesses (BMT) of 0.60, 0.75, 0.9 and 1.0mm. The steel strip conforms to AS1397 grade G550, Z350. (550 MPa minimum yield strength. 350g/m<sup>2</sup> minimum coating mass).

## Interlocking Sheets

### Method 1

Position BONDEK® sheet parallel with previously-laid sheet. Interlock sheets by applying pressure to either position.



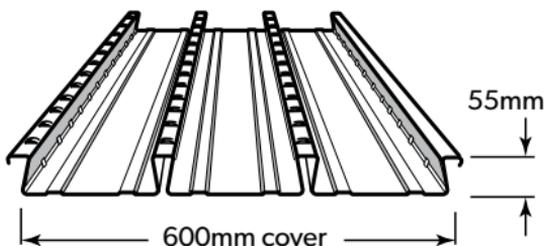
### Method 2

Position BONDEK® sheet at an angle. Interlock sheets by lowering sheet through an arc.



# LYSAGHT BONDEK PLUS®

LYSAGHT BONDEK PLUS® is a traditional flat pan or 're-entrant' profile that provides unmatched performance in suspended concrete slabs. BONDEK PLUS® is used in both concrete and steel frame construction and utilises patented technology to achieve superior spanning capabilities, less deflection and greater composite strength than similar re-entrant profiles.

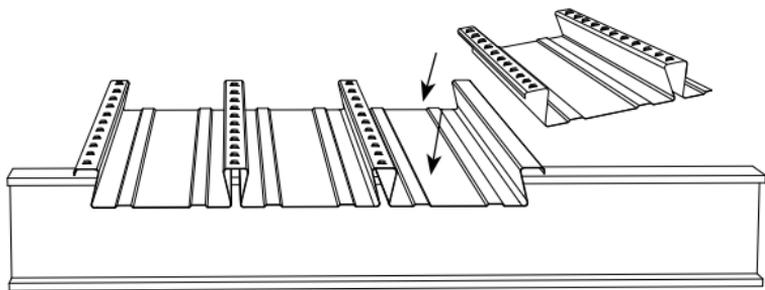


## Physical Properties

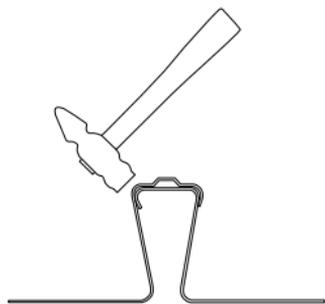
Thickness (mm)	Mass		Yield Strength MPa	Coverage (m <sup>2</sup> /t)
	(kg/m <sup>2</sup> )	(kg/m)		
0.60	8.38	5.03	550	119.3
0.75	10.32	6.19	550	96.9
1.00	13.56	8.14	550	73.7

## Interlocking Sheets

1. Place the BONDEK PLUS® sheet over the supports ensuring a minimum end bearing of 50mm. If supporting on a brick or masonry wall, provide a separating strip such as malthoid.

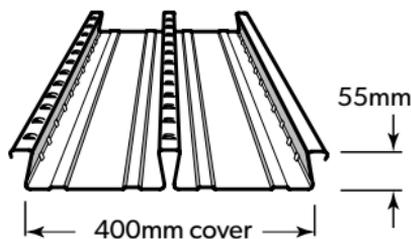


2. Tap the female rib with a hammer at a 45° angle to lock it into place.



# LYSAGHT BONDEK PLUS® 2P

LYSAGHT BONDEK PLUS® 2P is a traditional flat pan or 're-entrant' profile that provides unmatched performance in suspended concrete slabs. BONDEK PLUS® 2P is used in both concrete and steel frame construction and utilises patented technology to achieve superior spanning capabilities, less deflection and greater composite strength than similar re-entrant profiles.

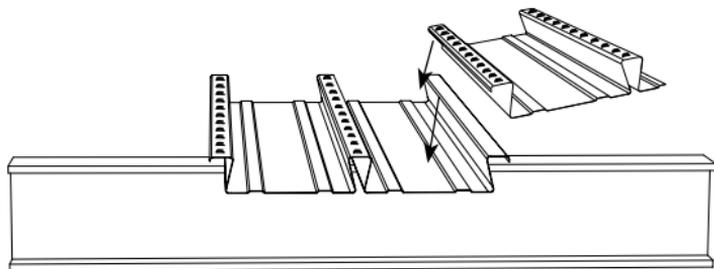


## Physical Properties

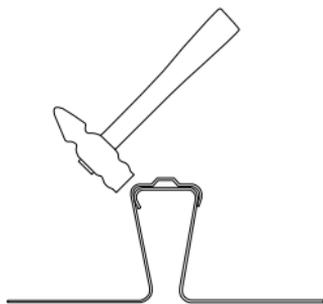
Thickness (mm)	Mass		Yield Strength MPa	Coverage (m <sup>2</sup> /t)
	(kg/m <sup>2</sup> )	(kg/m)		
0.60	8.57	3.43	550	116.65
0.75	10.56	4.22	550	94.70
1.00	13.87	5.55	550	72.09

## Interlocking Sheets

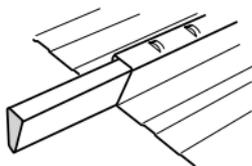
1. Place the BONDEK PLUS® 2P sheet over the supports ensuring a minimum end bearing of 50mm. If supporting on a brick or masonry wall, provide a separating strip such as malthoid.



2. Tap the female rib with a hammer at a 45° angle to lock it into place.

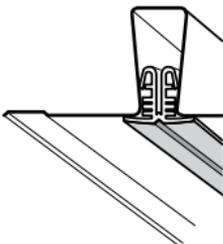


## BONDEK® Accessories



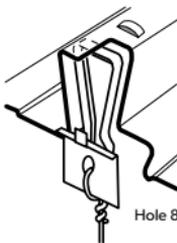
### BONFILL®

Polystyrene foam stops concrete and air entering ends of ribs. Stock length: 1200mm. Required: 300mm per sheet of BONDEK®.



### BONSTRIP®

Plastic trim to cover gaps formed by ribs. Used when underside of BONDEK® forms an exposed ceiling. Stock length: 3000mm. Allows plasterboard to be fixed to BONDEK®.

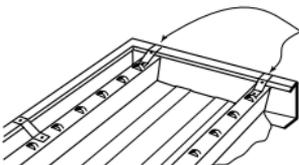


Hole 8mm diameter

### BONWEDGE®

Lightweight bracket for rods to suspend ceilings or services (other than fire sprinkler systems). Max. load: 100kg.

CONFIGURATION	LOADING	SAFE LOAD
		kN
Single BONWEDGE®	Eccentric	1.0
Double BONWEDGE®	Eccentric	1.3
Double BONWEDGE®	Central	1.7



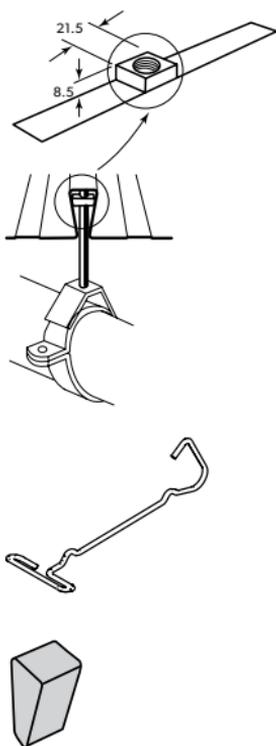
### EDGEFORM

A galvanised section that creates a permanent formwork at the slab edges—cut, mitred and screwed on site. 1.0mm BMT - up to 145mm slab depth. 1.2mm BMT - 150 - 175mm slab depth.

Brackets from builders strapping

Straps formed on-site using builders strapping to secure top flange of the Edgeform.

25mm x 1.0mm fixed with #10-16x16 hex. head Tek screws with drill point. Required: one every 600mm or less if aesthetics are required.

**BON-NUT**

Heavy duty square nut to suspend ceilings or services. Glued to a paper strip it makes insertion easy. Threads: M8, M10 and M12. M6 is available for light loads only (2.7 kN or less).

BONDEK® BMT	SAFE LOAD
	kN
0.75	4.4
1.00	6.7

**PT HOLD DOWN CLIP**

Allows hold down of post-tensioning ducts.

**RIB END PLUG  
(QLD, VIC & NSW)**

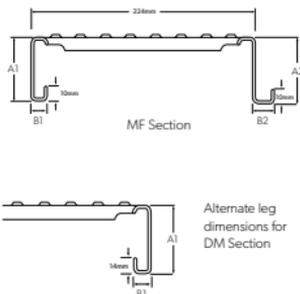
Polyethylene end plug minimises concrete slurry seeping through.

# LYSAGHT STEEL GRATING

## LYSAGHT INTERLOK® II

LYSAGHT INTERLOK® II steel grating is a long-length, roll-formed, interlocking grating system suitable for numerous underfoot applications such as walkways, catwalks, platforms, ramps, decking and for rack shelving.

It is available in two profiles, two thicknesses and two surfaces, and is nominally 225mm wide.



**Material** INTERLOK® II is made from ZINCFORM® steel conforming to AS 1397-2001 Zinc-coated, and zinc/aluminium coated steel sheet G300, Z450, coating class in 1.2 mm thickness (2.0mm subject to enquiry)

**Stock Lengths** 6073mm, other lengths by arrangement

**Surface Finishes** Regular or anti-skid

**Leg shapes** Double male or male/female

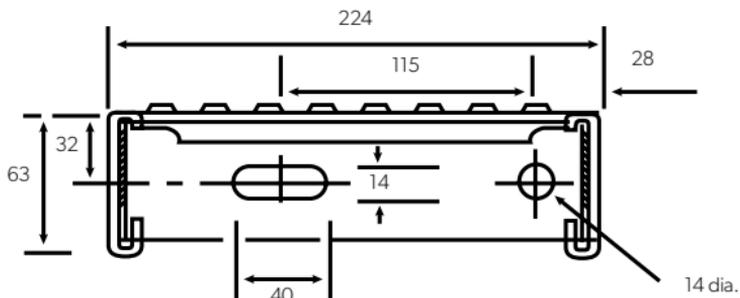
### Masses

Catalogue Number	Thickness Finish (mm)	Dimensions (mm)				Mass per unit length (kg/m)	Mass per unit area (kg/m <sup>2</sup> )
		A1	A2	B1	B2		
G06512	1.2 GALV	63	65	15	20	3.86	17.22
G06520	2.0 GALV	64	66	16	21	6.31	28.15

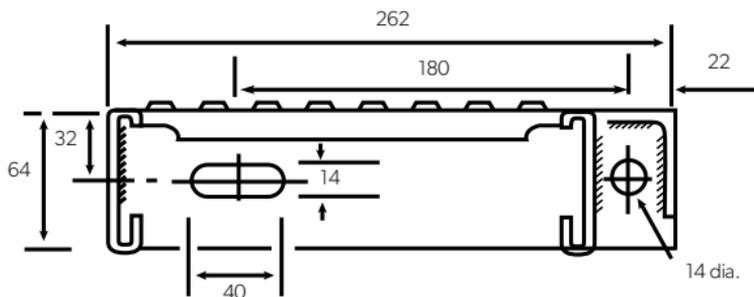
Note: Self weight is given for Z450 coating class.

A range of stair treads and accessories is also available. Stair treads, landings and all load impact areas are recommended to use the 2.00mm BMT thickness INTERLOK® II.

### LYSAGHT INTERLOK® II Stair Treads



Heavy Duty stair treads made from G06520 grating with welded 3.0mm carrier plates.



Extra Heavy Duty stair treads made from G06520 grating with welded 3.0mm carrier plates and floor plate nosing.

# STRUCTURAL STEEL

This section covers the wide range of hot rolled structural steel shapes and sections available in Australia. They include Universal Sections, Taper Flange Beams, Parallel Flange Channels, Equal and Unequal Angles, Rounds, Squares and Flats.

These products are available through BlueScope Distribution, Metalcorp Steel and many other steel distributors Australia-wide.

## BlueScope Distribution

[www.bluescopedistribution.com.au](http://www.bluescopedistribution.com.au)

T: 13 72 82 (Freecall)

E: [sales@bluescopesteel.com.au](mailto:sales@bluescopesteel.com.au)

## Metalcorp Steel

[www.metalcorpsteel.com.au](http://www.metalcorpsteel.com.au)

T: 1300 306 204 (Freecall)

E: [sales@metalcorpsteel.com.au](mailto:sales@metalcorpsteel.com.au)

InfraBuild Steel is the main manufacturer of these products which are readily available Australia-wide from steel stockists and distributors.

Generally the products are made to comply with AS/NZS 3679. 1-300, and the InfraBuild registered trademark for this grade of their products is 300PLUS®.

Tables of information are provided in this section as a guide to the range and specification of structural steel products generally available.

InfraBuild Steel offers detailed information on the size ranges, specifications and availability of their products, as well as technical advice and service, and it is recommended that any issues or queries to do with these products be raised directly with them or their appointed distributors.

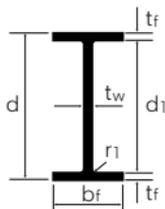
Contact can be made as follows:

## InfraBuild Steel

[www.infrabuild.com](http://www.infrabuild.com)

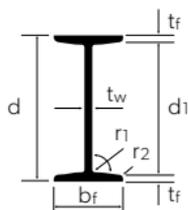
T: 1800 1 STEEL (1800 178335) (Freecall)

## UNIVERSAL SECTIONS



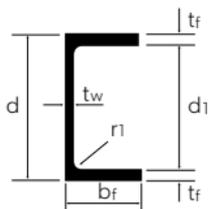
300PLUS® Steel Sections (kg/m)	Depth of Section d (mm)	Flange		Web Thickness $t_w$ (mm)	Root Radius $r_1$ (mm)	Depth Between Flanges $d_1$	Gross Area of Cross Section $A_g$ (mm) <sup>2</sup>
		Width $b_f$ (mm)	Thickness $t_f$ (mm)				
410 UB 59.7	59.7	178	12.8	7.8	11.4	381	7640
410 UB 53.7	53.7	178	10.9	7.6	11.4	381	6890
360 UB 56.7	359	172	13.0	8.0	11.4	333	7240
360 UB 50.7	356	171	11.5	7.3	11.4	333	6470
360 UB 44.7	352	171	9.7	6.9	11.4	333	5720
310 UB 46.2	307	166	11.8	6.7	11.4	284	5930
310 UB 40.4	304	165	10.2	6.1	11.4	284	5210
310 UB 32.0	298	149	8.0	5.5	13.0	282	4080
250 UB 37.3	256	146	10.9	6.4	8.9	234	4750
250 UB 31.4	252	146	8.6	6.1	8.9	234	4010
250 UB 25.7	248	124	8.0	5.0	12.0	232	3270
200 UB 29.8	207	134	9.6	6.3	8.9	188	3820
200 UB 25.4	203	133	7.8	5.8	8.9	188	3230
200 UB 22.3	202	133	7.0	5.0	8.9	188	2870
200 UB 18.2	198	99	7.0	4.5	11.0	184	2320
180 UB 22.2	179	90	10.0	6.0	8.9	159	2820
180 UB 18.1	175	90	8.0	5.0	8.9	159	2300
180 UB 16.1	173	90	7.0	4.5	8.9	159	2040
150 UB 18.0	155	75	9.5	6.0	8.0	136	2300
150 UB 14.0	150	75	7.0	5.0	8.0	136	1780
150 UC 37.2	162	154	11.5	8.1	8.9	139	4730
150 UC 30.0	158	153	9.4	6.6	8.9	139	3860
150 UC 23.4	152	152	6.8	6.1	8.9	139	2980
100 UC 14.8	97	99	7.0	5.0	10.0	83.0	1890

## TAPER FLANGE BEAMS



300PLUS® Steel Sections	Mass per Metre (kg/m)	Depth of Section d (mm)	Flange		Web Thick- ness $t_w$ (mm)	Radii		Depth Between Flanges $d_1$ (mm)	Gross Area of Cross Section $A_g$ (mm) <sup>2</sup>
			Width $b_f$ (mm)	Thick- ness $t_f$ (mm)		Root $r_1$ (mm)	Toe $r_2$ (mm)		
125 TFB	13.1	125	65.0	8.5	5.0	8.0	4.0	108	1670
100 TFB	7.2	100	45.0	6.0	4.0	7.0	3.0	88	917

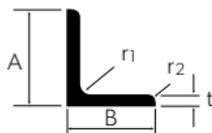
## PARALLEL FLANGE CHANNELS



Steel Grade AS/NZS 3679.1-300	Mass per Metre (kg/m)	Depth of Section d (mm)	Flange		Web Thick- ness $t_w$ (mm)	Root Radius $r_1$ (mm)	Depth Between Flanges $d_1$	Gross Area of Cross Section $A_g$ (mm) <sup>2</sup>
			Width $b_f$ (mm)	Thick- ness $t_f$ (mm)				
380 PFC	55.2	380	100	17.5	10.0	14.0	345	7030
300 PFC	40.1	300	90	16.0	8.0	14.0	268	5110
250 PFC	35.5	250	90	15.0	8.0	12.0	220	4520
230 PFC	25.1	230	75	12.0	6.5	12.0	206	3200
200 PFC	22.9	200	75	12.0	6.0	12.0	176	2920
180 PFC	20.9	180	75	11.0	6.0	12.0	158	2660
150 PFC	17.7	150	75	9.5	6.0	10.0	131	2250
125 PFC	11.9	125	65	7.5	4.7	8.0	110	1520
100 PFC	8.33	100	50	6.7	4.2	8.0	86.6	1060
75 PFC	5.92	75	40	6.1	3.8	8.0	62.8	757

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## EQUAL ANGLES

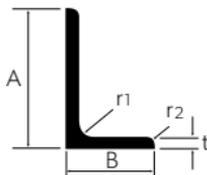


Steel Grade AS/ NZS 3679.1-300	Nominal Thickness (mm)	Mass Per Metre (kg/m)	Actual Thickness (t,mm)	Radii	
				Root $r_1$ (mm)	Toe $r_2$ (mm)
200 x 200	26	76.8	26.0	18.0	5.00
	20	60.1	20.0	18.0	5.00
	18	54.4	18.0	18.0	5.00
	16	48.7	16.0	18.0	5.00
	13	40.0	13.0	18.0	5.00
150 x 150	19	42.1	19.0	13.0	5.00
	16	35.4	15.8	13.0	5.00
	12	27.3	12.0	13.0	5.00
	10	21.9	9.50	13.0	5.00
125 x 125	16	29.1	15.8	10.0	5.00
	12	22.5	12.0	10.0	5.00
	10	18.0	9.50	10.0	5.00
	8	14.9	7.80	10.0	5.00
100 x 100	12	17.7	12.0	8.00	5.00
	10	14.2	9.50	8.00	5.00
	8	11.8	7.80	8.00	5.00
	6	9.16	6.00	8.00	5.00
90 x 90	10	12.7	9.50	8.00	5.00
	8	10.6	7.80	8.00	5.00
	6	8.22	6.00	8.00	5.00
75 x 75	10	10.5	9.50	8.00	5.00
	8	8.73	7.80	8.00	5.00
	6	6.81	6.00	8.00	5.00
	5	5.27	4.60	8.00	5.00

Steel Grade AS/ NZS 3679.1-300	Nominal Thickness (mm)	Mass Per Metre (kg/m)	Actual Thickness (t,mm)	Radii	
				Root r <sub>1</sub> (mm)	Toe r <sup>2</sup> (mm)
65 x 65	10	9.02	9.50	6.00	3.00
	8	7.51	7.80	6.00	3.00
	6	5.87	6.00	6.00	3.00
	5	4.56	4.60	6.00	3.00
55 x 55	6	4.93	6.00	6.00	3.00
	5	3.84	4.60	6.00	3.00
50 x 50	8	5.68	7.80	6.00	3.00
	6	4.46	6.00	6.00	3.00
	5	3.48	4.60	6.00	3.00
	3	2.31	3.00	6.00	3.00
45 x 45	6	3.97	6.00	5.00	3.00
	5	3.10	4.60	5.00	3.00
	3	2.06	3.00	5.00	3.00
40 x 40	6	3.50	6.00	5.00	3.00
	5	2.73	4.60	5.00	3.00
	3	1.83	3.00	5.00	3.00
30 x 30	6	2.56	6.00	5.00	3.00
	5	2.01	4.60	5.00	3.00
	3	1.35	3.00	5.00	3.00
25 x 25	6	2.08	6.00	5.00	3.00
	5	1.65	4.60	5.00	3.00
	3	1.12	3.00	5.00	3.00

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## UNEQUAL ANGLES



Steel Grade AS/ NZS 3679.1-300	Nominal Thickness (mm)	Mass Per Metre (kg/m)	Actual Thickness (t,mm)	Radii	
				Root $r_1$ (mm)	Toe $r_2$ (mm)
150 x 100	12	22.5	12.0	10.00	5.00
	10	18.0	9.50	10.00	5.00
150 x 90	16	27.9	15.8	10.00	5.00
	12	21.6	12.0	10.00	5.00
	10	17.3	9.50	10.00	5.00
	8	14.3	7.80	10.00	5.00
125 x 75	12	17.7	12.0	8.00	5.00
	10	14.2	9.50	8.00	5.00
	8	11.8	7.80	8.00	5.00
	6	9.16	6.00	8.00	5.00
100 x 75	10	12.4	9.50	8.00	5.00
	8	10.3	7.80	8.00	5.00
	6	7.98	6.00	8.00	5.00
75 x 50	8	7.23	7.80	7.00	3.00
	6	5.66	6.00	7.00	3.00
	5	4.40	4.60	7.00	3.00
65 x 50	8	6.59	7.80	6.00	3.00
	6	5.16	6.00	6.00	3.00
	5	4.02	4.60	6.00	3.00

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## MERCHANT BAR PRODUCTS - ROUNDS

Steel Sections (mm)	Rounds			
	Length (m/t)	Cross Section (sq. mm)	Surface Area (sq. mm/m)	Mass (kg/m)
10	1612	79	31429	0.616
12	1126	113	37714	0.887
13	959	133	40857	1.04
14	827	154	44000	1.21
15	721	177	47143	1.39
16	633	201	50286	1.58
17	561	227	53429	1.78
18	500	255	56571	1.99
19	449	284	59714	2.23
20	405	314	62857	2.46
22	335	380	69143	2.98
24	282	453	75429	3.55
27	222	573	84857	4.49
30	180	707	94286	5.55
33	149	856	103714	6.71
36	125	1018	113143	7.99
39	107	1195	122571	9.38
42	92	1386	132000	10.9
45	80	1591	141429	12.5
48	70	1810	150857	14.2
50	65	1964	157143	15.4
56	52	2464	176000	19.3
60	45	2829	188571	22.2
65	38	3320	204286	26.0
75	29	4420	235714	34.7
90	20	6364	282857	49.9

Manufactured by InfraBuild Steel.

## MERCHANT BAR PRODUCTS - SQUARES

Steel Sections (mm)	Square Edge Flats and Slit Flats			
	Length (m/t)	Cross Section (sq. mm)	Surface Area (sq. mm/m)	Mass (kg/m)
150 x 5 SLTF	170	750	310000	5.89
150 x 6 SLTF	142	900	312000	7.07
150 x 8	106	1200	316000	9.42
150 x 10	85	1500	320000	11.8
150 x 12	71	1800	324000	14.1
150 x 16	53	2400	332000	18.8
150 x 20	42	3000	340000	23.6
150 x 25	34	3750	350000	29.4
180 x 6 SLTF	118	1080	372000	8.48
180 x 10 SLTF	71	1800	380000	14.1
180 x 12 SLTF	59	2160	384000	17.0
200 x 6 SLTF	106	1200	412000	9.42
200 x 8 SLTF	80	1600	416000	12.6
200 x 10 SLTF	64	2000	420000	15.7
200 x 12 SLTF	53	2400	424000	18.8
250 x 6 SLTF	85	1500	512000	11.8
250 x 8 SLTF	64	2000	516000	15.7
250 x 10 SLTF	51	2500	520000	19.6
250 x 12 SLTF	42	3000	524000	23.6
300 x 6 SLTF	71	1800	612000	14.1
300 x 8 SLTF	53	2400	616000	18.8
300 x 10 SLTF	42	3000	620000	23.6
300 x 12 SLTF	35	3600	624000	28.3

Manufactured by InfraBuild Steel.

# REINFORCING BARS

Two types of class N hot-rolled reinforcing bars are currently produced in Australia. These are a quenched and tempered bar and micro-alloyed or conti-stretch bar.

Quenched and tempered rebar is available in straight lengths and sizes from 12mm to 40mm diameter.

Micro-alloyed or conti-stretch bar is available in straightened coil form and in sizes of 10mm, 12mm and 16mm diameter. These products are available through BlueScope Distribution, Metalcorp Steel and many other steel distributors Australia wide.

## BlueScope Distribution

[www.bluescopedistribution.com.au](http://www.bluescopedistribution.com.au)

T: 13 72 82 (Freecall)

E: [sales@bluescopesteel.com.au](mailto:sales@bluescopesteel.com.au)

## Metalcorp Steel

[www.metalcorpsteel.com.au](http://www.metalcorpsteel.com.au)

T: 1300 306 204 (Freecall)

E: [sales@metalcorpsteel.com.au](mailto:sales@metalcorpsteel.com.au)

The main manufacturer of these products is InfraBuild. A technical note on Bending, Rebending and Welding these bars is available from:

## InfraBuild Construction Solutions

[www.infrabuild.com/en-au/resource-centre](http://www.infrabuild.com/en-au/resource-centre)

T: (02) 8424 9800

Reinforcing bar complies with Australian Standard, Steel Reinforcing Materials, AS/NZS 4671:2001, grade 500N in all respects including tensile properties, bending properties, chemical composition and deformation pattern.

500N reinforcing bar is fully weldable under the conditions of Australian Standard, AS1554 Part 3: 2002, Welding of Reinforcing Steel Structural Steel.

For details of reinforcing bars certified to comply to AS4671 by the Australian Certification Authority For Reinforcing Steels, refer to the ACRS website at

[www.acrs.net.au](http://www.acrs.net.au)

## Reinforcement

Concrete is strong in compression but needs the addition of steel reinforcing bars to carry the tensile forces resulting from: the dead load of a member, the application of external loads, or from shrinkage of the concrete as it dries out.

As determination of the amount and positioning of the reinforcement requires specialist knowledge, we suggest you visit the InfraBuild Construction Solutions website at [www.infrabuild.com/en-au/products-services/by-product/reinforcing-products](http://www.infrabuild.com/en-au/products-services/by-product/reinforcing-products) and use the reinforcement area calculator.

Once determined the steel reinforcement must be accurately placed and firmly supported and tied to prevent displacement during concreting operations. Tie wires used to bind the reinforcement in place should be trimmed off and bent back away from the concrete surface.

For slabs in domestic floors, driveways and paths, the reinforcement is used to control the cracking of the concrete surface. It should be located in the top third of the slab but with appropriate cover to protect it against corrosion.

Bar Size (mm)	Bar Type QT / MA / CS	Mass per metre (kg/m)	Cross-sectional area (mm <sup>2</sup> )	Minimum hole dia for clearance (mm)
10	MA / CS	0.617	78.5	12
12	QT / MA / CS	0.888	113	15
16	QT / MA / CS	1.58	201	20
20	QT	2.47	314	25
24	QT	3.55	452	29
28	QT	4.83	616	34
32	QT	6.31	804	39
36	QT	7.99	1020	44
40	QT	9.86	1260	49

QT = Quenched and Tempered, MA = Microalloyed, CS = Conti-stretch

## BENDING PROPERTIES

Diameter	AS4671 Requirements	AS3600 Limits (kg/m)	Galvanised Bars
≤ 16mm	Not Stated	5d generally, but 4d for fitments	5d x 180 deg
≥ 20mm	4d x 180 deg	5d generally, but 4d for fitments	8d x 180 deg

Note: The bending limits shown in this column have been specified in AS 3600 to minimise spalling of the galvanised coating.

## REBENDING PROPERTIES

Diameter	AS4671 Requirements	QT Capability	MA / CS Capability	AS3600 Limits
≤ 16mm	4d	2d x 180 deg	3d x 180 deg	4d
20 ≥ d ≤ 24	Not Specified	3d x 180 deg	-	5d
28 ≥ d ≤ 36	Not Specified	6d	-	6d

QT = Quenched and Tempered, MA = Microalloyed, CS = Conti-stretch

Based on a 90 degree bend, ageing at 100°C for 1 hour and then rebent to straight as per AS4671.

### Plain round bars - R250N Grade

Grade AS4671-R250N is available in 10,12,16, 20, 24, 28, 32 and 36mm diameters.

Material complying with AS3679.1, Grade 250 is deemed to comply with this designation.

### Deformed rebar reinforcement - D250S Grade

Grade D250S to AS4671 available in 12mm diameter only for swimming pools.

Class L Ribbed Reinforcing Mesh - Refer to Concrete Section-Reinforcing Mesh for Concrete.

### Deformed rebar reinforcement - D250S Grade

Grade D250S to AS4671 available in 12mm diameter only for swimming pools.

Class L Ribbed Reinforcing Mesh - Refer to Concrete Section-Reinforcing Mesh for Concrete.

### Deformed steel reinforcing bars for concrete

All details for Steel Reinforcing Bars for Concrete are contained in AS 4671.

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## REINFORCING MESH FOR CONCRETE

Reinforcing mesh is manufactured in accordance with AS4671 from cold rolled steel wire conforming with AS4671.

Product Code	Mesh Specification				Approx. Mass of 2.4m x 6m sheets		Cross-sectional area	
	Longitudinal Wires		Cross Wires		Area (kg/m <sup>2</sup> )	Sheet (kg)	Longitudinal (mm <sup>2</sup> /m)	Cross Wires (mm <sup>2</sup> /m)
	No x size (mm)	@ pitch (mm)	No x size (mm)	@ pitch (mm)				
<b>RECTANGULAR MESHES (RL)</b>								
<b>RL1218</b>	25 x 11.90	100	30 x 7.60	200	10.5	157	1112	227
<b>RL1118</b>	25 x 10.70	100	30 x 7.60	200	8.8	130	899	227
<b>RL1018</b>	25 x 9.50	100	30 x 7.60	200	7.3	109	709	227
<b>RL918</b>	25 x 8.60	100	30 x 7.60	200	6.3	93	581	227
<b>RL818</b>	25 x 7.60	100	30 x 7.60	200	5.3	79	454	227
<b>RL718</b>	25 x 6.75	100	30 x 7.60	200	4.6	67	358	227
<b>SQUARE MESHES (SL) WITH EDGE LAPPING WIRES</b>								
<b>SL102</b>	10 x 9.50	200	30 x 9.50	200	5.6	80	354	354
	+4 x 6.75	100						
<b>SL92</b>	10 x 8.60	200	30 x 8.60	200	4.6	66	354	290
	+4 x 6.00	100						
<b>SL82</b>	10 x 7.60	200	30 x 7.60	200	3.6	52	227	227
	+4 x 5.37	100						
<b>SL72</b>	10 x 6.75	200	30 x 6.75	200	2.8	41	179	179
	+4 x 4.77	100						
<b>SL62</b>	10 x 6.00	200	30 x 6.00	200	2.2	33	141	141
	+4 x 6.75	100						
<b>SL52</b>	10 x 4.77	200	30 x 4.77	200	1.4	20	89	89
	+4 x 6.00	100						
<b>SL63 (WA)</b>	6 x 6.00	300	30 x 6.00	300	1.5	21 (2.3 sheet width)	94	94
	+4 x 4.00	100						
<b>SL53 (WA)</b>	6 x 4.77	300	20 x 4.77	300	1.0	15 (2.3 sheet width)	60	60
	+4 x 4.00	100						

Product Code	Mesh Specification				Approx. Mass of 2.4m x 6m sheets		Cross-sectional area	
	Longitudinal Wires		Cross Wires		Area (kg/m <sup>2</sup> )	Sheet (kg)	Longitudinal (mm <sup>2</sup> /m)	Cross Wires (mm <sup>2</sup> /m)
	No x size (mm)	@ pitch (mm)	No x size (mm)	@ pitch (mm)				
<b>SQUARE MESHES</b>								
<b>SL81</b>	25 x 7.60	100	60 x 7.60	200	7.1	105	454	454
<b>TRENCH MESHES (TM) STRIP WIDTHS 200MM, 300MM, 400MM</b>								
<b>L12TM</b>	3, 4 or 5 x 11.90	100	4.77	300	-	-	-	-
<b>L11TM</b>	3, 4 or 5 x 10.70	100	4.77	300	-	-	-	-
<b>L8TM</b>	3, 4 or 5 x 7.60	100	4.77	300	-	-	-	-

The main manufacturer of reinforcing mesh is InfraBuild Construction Solutions. Information regarding location of stockists, availability of product range, technical information etc can be found in their respective web sites or by direct enquiry.

# SURFACE PROTECTION GUIDE FOR STRUCTURAL STEEL

In selecting a suitable surface treatment, the following choices need to be made:

1. The appropriate Atmospheric Classification
2. The Level of Exposure of Structural Steelwork

Once this is complete, the appropriate specification can be easily selected by working through the following information.

It should be noted that steel does not require corrosion protection in many interior situations.

## ATMOSPHERIC CLASSIFICATION

### Mild

Areas remote from the coast, industrial activity and the tropics. Also, sparsely settled regions such as outback Australia and rural communities away from the coast

### Moderate

Areas which have light industrial pollution or very light marine influence, or both. Suburbs of cities on sheltered bays such as Melbourne, Adelaide and Hobart (except areas right near the coast) and most inland cities.

### Tropical

Coastal areas of north Queensland, Northern Territory and northwest Western Australia, except where directly affected by salt spray

### Industrial

Areas around major industrial complexes such as Port Pirie and Newcastle. There are few such areas in Australia. Areas within major industrial complexes are beyond the scope of this booklet

## Marine

Areas influenced to a moderate extent by coastal salts. The extent depends on winds, topography and vegetation. For sheltered areas, such as those around Port Phillip Bay, this classification extends from 100m from the beach to 1km inland. However, for most ocean front areas, such as those that occur along the southwest corner of Western Australia, the southeast coast of South Australia, the New South Wales coast and the surf beach regions of Queensland, it generally extends from 1km from the coast to about 10km inland. Much of Perth, the Gold Coast, Wollongong, Sydney and Newcastle are in this zone. (Note: In exceptional circumstances, this area can extend 50km inland.)

## Severe Marine

Around sheltered bays, the region extends inland about 100m. In ocean fronted areas, the region extends from the beach front to 1 km inland. However, it is heavily dependent on prevailing winds, extent of wave and marine, surf and land topography.

NOTE: For further detail on these environments, please refer to the Australian Standard AS/NZS 2312:2002. For specific guidance on extent of zones, contact Australian Corrosion Association (03) 9874 0800.

## LEVELS OF EXPOSURE OF STRUCTURAL STEELWORK

### 1. Fully enclosed

Steelwork is sealed within the building envelope. Includes air conditioned buildings, sealed houses, etc.

### 2. Partially exposed

Steelwork is predominantly enclosed, but some exposure to the environment is inevitable. For example, warehouses with large doors, garages, roof steelwork above perforated eaves soffit sheeting, etc.

### 3. Fully exposed

In this instance, steelwork is exposed to elements such as sun, wind, rain, wind blown pollutants, etc. This includes roofed structures with no walls, balconies, open carports, etc.

EXCLUSIONS – Swimming pools, industrial activities involving contaminants.

Classification	1. Fully Enclosed	2. Partially Enclosed	3. Fully Exposed
Mild	A	A	B
Moderate	A	A	B
Tropical	A	B	B
Industrial	A	B	C
Marine	A	B*	D
Severe Marine	B	C	B

\* - Specification C may be required locally at zones extending 2 - 3 metres from openings, depending on conditions. (For instance, prevailing wind, size of opening and duration of exposure.)

SPECIFICATION	DULUX	INTERNATIONAL PROTECTIVE COATINGS	JOTUN	WATTYL	
<b>A</b>	No treatment required	-	-	-	
<b>B</b>	Hand/power tool clean to AS 1627.2 St1 (AS 1627.9 visual standard). One coat (50µm) alkyd primer (Zinc Phosphate)	Luxaprime Zinc Phosphate	Interprime 198	Jotaprime 250	1624 H Primer
<b>C</b>	Abrasive blast to AS 1627.4 Sa2 1/2 (AS 1627.9 visual standard). One coat (75µm) inorganic Zinc Silicate to AS/ NZS 3750 Part 15 types 1 to 6 (ES600 is type 4).	Zincanode 304	Interzinc 86	Jotaprime 15	Galvit ES600
<b>D</b>	Galvanised to AS 1650 Part 1;	-	-	-	
	OR Abrasive blast to AS 1627.4 Sa2 1/2 (AS 1627.9 visual standard). One coat (75µm) D inorganic Zinc Silicate, plus one coat (50µm) Acrylic Gloss;	75µm Zincanode 304 125µm Durebuild STE 40µm Dulux Weathershield	Interzinc 86 + Intercryl 853	Jotaprime15 + Jotacote 604	Galvit ES600+ Industrial Acrylic
	OR Abrasive blast to AS 1627.4 Sa2 1/2 (AS 1627.9 visual standard). One coat (300µm) epoxy mastic	75µm Zincanode 304 125µm Durebuild STE 40µm Dulux Weathershield	Interseal 670	Jotamastic 87	Epinelastic Mastic STC

NOTE: The above recommendations are only sufficient to protect steel members and an additional coating may be required to obtain the desired colour and gloss.

# STRUCTURAL STEEL IN HOUSING

Steel beams are commonly used in home building to provide a safe and economic means of spanning wide openings, and supporting heavy loads.

This section contains useful excerpts from the InfraBuild Steel publication "Structural Steel in Housing" which has been compiled to assist builders, draftspersons and designers, and is obtainable from:

## InfraBuild Steel

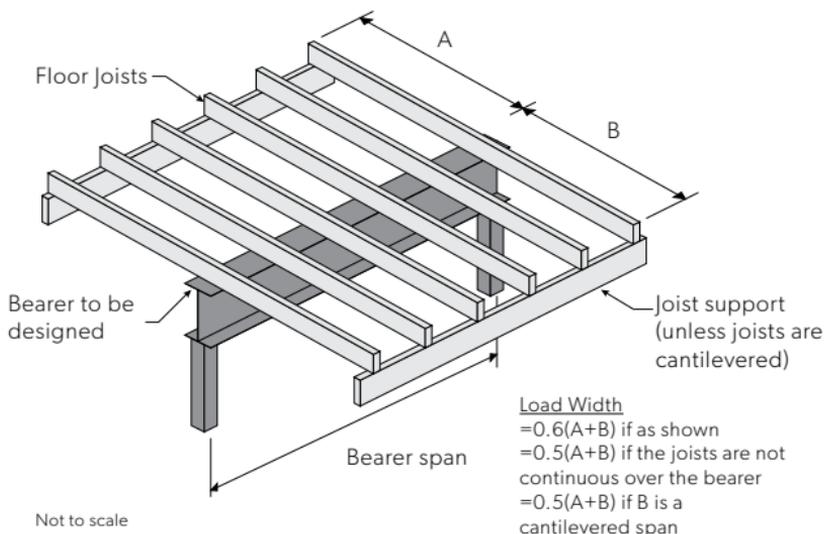
[www.infrabuild.com](http://www.infrabuild.com)

T: 1800 1 STEEL (1800 178335) (Freecall)

In using the tables published here, the following design assumptions should be carefully noted:

1. 300PLUS® Steel must be specified, unless noted otherwise.
2. All roof structure tables conform to wind classification up to and including category N3 (or W41N).
3. All applied loads are uniformly distributed along the span of the member
4. End supporting bearing distance for single spans is to be at least that of the width of the member or 70mm, whichever is less. For continuous spans, internal bearing is to be at least two times the width of the member.
5. Joist, bearers and lintels are to be restrained from lateral movement or twisting along their length by other construction, as set out by AS 4100. For example, this criterion is usually met where rafters or joists prevent the top flange of the member from moving laterally.
6. For continuous floor bearers, the variation in span length should not be more than 10%.
7. Effective spacing is a measure of the width of the load area being supported by the member.

## BEARERS



Example: (Refer to diagram on above)

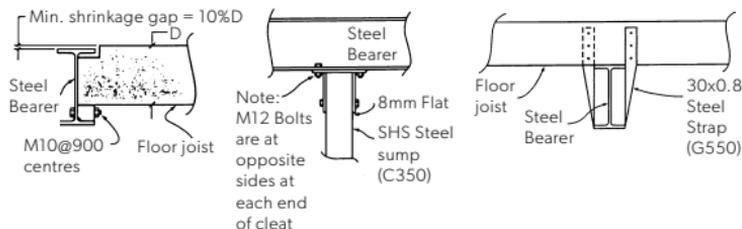
- Joists cantilevered
- Span of bearer = 5.0m
- A = 5.6m
- B = 3.4m
- Load width =  $A^2 / 2B$   
 $= 5.62 / (2 \times 3.4)$   
 $= 4.6\text{m}$

Use a load width of 4.8 in the adjacent table: a 200UB18.2 will span 5.0m.

Notes:

1. Allowance has been made in the table for a non-load bearing stud wall (not shown) within the floor area supported by the bearer.
2. The single span bearer case is shown. For continuous Bearers over multiple spans, the variation in span between supports should not be more than 10%.
3. The top flange of the bearer is assumed to be continuously laterally supported by floor joists spaced at 450mm centres.

## CONSTRUCTION EXAMPLES



## BEARER SUPPORTING A TIMBER FLOOR AND NON LOAD BEARING STUD WALL - SINGLE SPAN

Section Designation	Load Width (m)					
	1.8	2.4	3.0	3.6	4.2	4.8
	MAXIMUM SPAN OF BEARER (m)					
125TFB	4.1	3.8	3.6	3.4	3.2	3.1
150UB14.0	4.5	4.2	4.0	3.8	3.7	3.6
180UB16.1	5.1	4.7	4.5	4.3	4.1	4.0
200UB18.2	5.6	5.2	5.0	4.7	4.6	4.4
200UB25.4	6.1	5.7	5.5	5.2	5.0	4.9
250UB25.7	6.7	6.3	6.0	5.8	5.6	5.4
250UB31.4	7.0	6.6	6.3	6.1	5.9	5.7
310UB32.0	7.7	7.3	6.9	6.7	6.4	6.2
310UB40.4	8.2	7.7	7.4	7.1	6.9	6.7
100PFC	3.1	2.9	2.7	2.5	2.4	2.3
125PFC	4.0	3.7	3.5	3.3	3.1	3.0
150PFC	4.8	4.5	4.2	4.0	3.9	3.8
180PFC	5.4	5.1	4.8	4.6	4.4	4.3
200PFC	5.8	5.4	5.2	5.0	4.8	4.6
230PFC	6.3	5.9	5.6	5.4	5.2	5.0
250PFC	7.0	6.6	6.3	6.1	5.9	5.7
300PFC	7.9	7.4	7.1	6.8	6.6	6.4

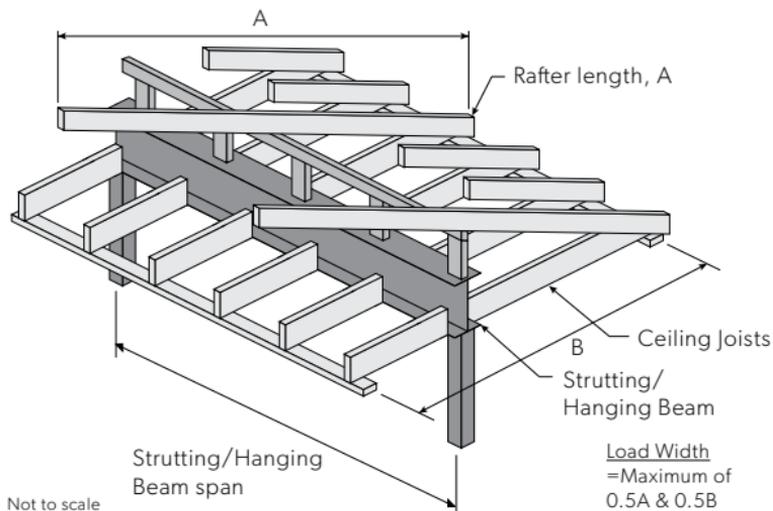
## BEARER SUPPORTING A TIMBER FLOOR AND NON LOAD BEARING STUD WALL - CONTINUOUS SPAN

Section Designation	Load Width (m)					
	1.8	2.4	3.0	3.6	4.2	4.8
	MAXIMUM SPAN OF BEARER (m)					
125TFB	4.7	4.4	4.2	3.9	3.6	3.4
150UB14.0	5.2	4.9	4.6	4.4	4.0	3.8
180UB16.1	5.9	5.5	5.2	5.0	4.7	4.4
200UB18.2	6.5	6.1	5.7	5.5	5.3	5.0
200UB25.4	7.2	6.7	6.3	6.1	5.8	5.6
250UB25.7	7.9	7.4	7.0	6.7	6.5	6.2
250UB31.4	8.4	7.8	7.4	7.1	6.8	6.6
310UB32.0	9.1	8.5	8.1	7.7	7.5	7.2
310UB40.4	9.7	9.2	8.7	8.3	8.0	7.8
100PFC	3.6	3.4	3.0	2.8	2.6	2.4
125PFC	4.6	4.3	4.0	3.7	3.4	3.2
150PFC	5.5	5.2	4.9	4.7	4.5	4.3
180PFC	6.3	5.9	5.6	5.3	5.1	4.9
200PFC	6.8	6.3	6.0	5.7	5.5	5.4
230PFC	7.4	6.9	6.5	6.3	6.0	5.8
250PFC	8.4	7.8	7.4	7.1	6.8	6.6
300PFC	9.3	8.8	8.3	8.0	7.7	7.5

### Notes on Tables:

1. The tables apply for 300PLUS® steel only. For details of your nearest 300PLUS® structural steel supplier, call InfraBuild Steel Direct toll free on 1800 1 STEEL (1800 1 78335), or visit our website at [www.infrabuild.com](http://www.infrabuild.com)

## STRUTTING/HANGING BEAMS



Example: (Refer to diagram on above)

- Required beam span = 4.5m
- A = 7.6m
- B = 7.4m
- Load width = 0.5A  
= 0.5 x 7.6  
= 3.8m

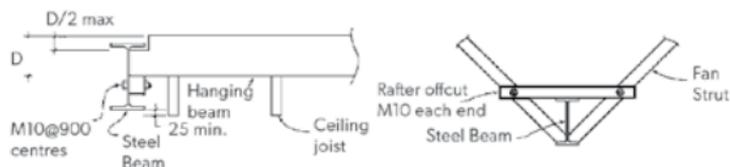
Use a load width of 4.2 in the adjacent table: a 200UB25.4 will span 4.7m and requires a M10 anchor rod.

Use a load width of 4.8 in the adjacent table: a 200UB18.2 will span 5.0m.

Notes:

1. The roof load is assumed to be evenly distributed along the Strutting Hanging Beam.
2. The bottom flange of the Strutting/Hanging Beam is assumed to be continuously laterally supported by ceiling joists at 600mm max centres.

## CONNECTION EXAMPLES



## STRUTTING/HANGING BEAM SUPPORTING A STEEL SHEET ROOF AND CEILING - NORMAL WIND N3

Section Designation	Load Width (m)					
	1.8	2.4	3.0	3.6	4.2	4.8
	MAXIMUM SPAN OF BEARER (m)					
125TFB	4.4*	4.0*	3.7*	3.5*	3.3*	3.2*
150UB14.0	4.5*	4.1*	3.8*	3.6*	3.4*	3.2*
180UB16.1	5.0*	4.6*	4.2*	4.0*	3.8*	3.7*
200UB18.2	5.4*	5.0*	4.6*	4.4*	4.2*	4.0*
200UB25.4	6.9*	6.3*	5.9*	5.6*	5.3*	5.1*
250UB25.7	6.8*	6.2*	5.8*	5.5*	5.3*	5.0*
250UB31.4	-	7.1*	6.7*	6.3*	6.0*	5.8*
310UB32.0	-	7.1*	6.7*	6.4*	6.1*	5.8*
310UB40.4	-	-	8.0*	7.5*	7.2+	6.9+
310UB46.2	-	-	-	8.2*	7.8+	7.5+
100PFC	3.5	3.2*	2.9*	2.8*	2.6*	2.5*
125PFC	4.5*	4.1*	3.8*	3.6*	3.4*	3.2*
150PFC	5.7*	5.2*	4.9*	4.6*	4.4*	4.2*
180PFC	6.3*	5.7*	5.3*	5.0*	4.8*	4.6*
200PFC	6.6*	6.1*	5.6*	5.3*	5.1*	4.8*
230PFC	6.8*	6.2*	5.8*	5.5*	5.2*	5.0*
250PFC	-	-	7.4*	7.0*	6.6*	6.3+
300PFC	-	-	7.7*	7.3*	7.0*	6.7+

## STRUTTING/HANGING BEAM SUPPORTING A TILED ROOF AND CEILING - NORMAL WIND N3

Section Designation	Load Width (m)					
	1.8	2.4	3.0	3.6	4.2	4.8
	MAXIMUM SPAN OF BEARER (m)					
125TFB	3.8	3.5	3.2	3.0*	2.9*	2.7*
150UB14.0	3.9	3.6	3.3	3.1*	3.0*	2.8*
180UB16.1	4.4	4.0	3.7*	3.5*	3.3*	3.2*
200UB18.2	4.8	4.4	4.1*	3.8*	3.7*	3.5*
200UB25.4	6.1	5.6*	5.2*	4.9*	4.7*	4.5*
250UB25.7	6.0	5.5*	5.1*	4.9*	4.6*	4.4*
250UB31.4	6.9	6.3*	5.9*	5.6*	5.3*	5.1*
310UB32.0	6.9	6.4*	5.9*	5.6*	5.4*	5.2*
310UB40.4	-	7.5*	7.1*	6.7*	6.4*	6.1*
310UB46.2	-	8.2*	7.6*	7.2*	6.9*	6.6*
100PFC	3.0	2.8	2.5	2.4	2.3	2.2
125PFC	3.9	3.6	3.3	3.1*	2.9*	2.8*
150PFC	5.0	4.6	4.3*	4.0*	3.8*	3.6*
180PFC	5.5	5.0*	4.7*	4.4*	4.2*	4.0*
200PFC	5.8	5.3*	4.9*	4.6*	4.4*	4.2*
230PFC	6.0	5.5*	5.1*	4.8*	4.6*	4.4*
250PFC	7.6*	7.0*	6.5*	6.1*	5.8*	5.6*
300PFC	-	7.3*	6.8	6.5*	6.1*	5.9*

Notes on Tables:

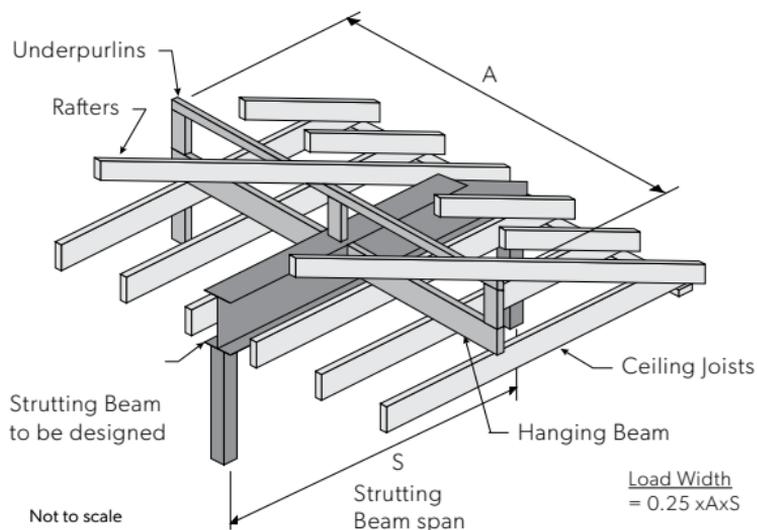
1. The tables apply for 300PLUS® steel only. For details of your nearest 300PLUS® structural steel supplier, call InfraBuild Steel Direct toll free on 1800 1 STEEL (1800 1 78335), or visit our website at [www.infrabuild.com](http://www.infrabuild.com)

2. No symbol next to the span indicates that only nominal holding down is required (uplift is less than 5kN)

\* indicates a M10 holding down rod is required (uplift is between 5 and 19 kN)

+ indicates a M12 holding down rod is required (uplift is between 19 and 27kN)

## STRUTTING BEAMS



Example: (Refer to diagram above)

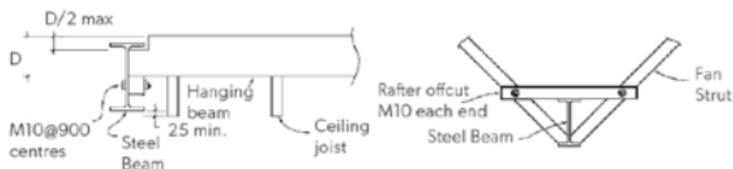
- Spans  $S = 6.1\text{m}$
- $A = 7.0\text{m}$
- Load width =  $0.25 \times A \times S$   
 $= 0.25 \times 7.0 \times 6.1$   
 $= 10.7\text{m}^2$

Use load area of 13 sq metres in the adjacent table a 200UB22.3 will span 6.4m and requires a M10 anchor rod.

Notes:

1. The length of the Rafters and Ceiling Joists are assumed to be within 15% of the strutting beam.
2. Both Flanges of the Strutting Beam are assumed to be fully restrained at mid-span.

## CONNECTION EXAMPLES



## STRUTTING BEAM SUPPORTING A STEEL SHEET ROOF AND CEILING - NORMAL WIND N3

Section Designation	Load Width (m <sup>2</sup> )					
	10	13	16	19	22	25
	MAXIMUM SPAN OF BEARER (m)					
125TFB	5.0*	4.7*	4.2*	3.6*	3.1*	2.8*
150UB14.0	5.7*	5.2*	4.6*	4.2*	3.9*	3.6*
180UB16.1	6.7*	6.2*	5.7*	5.2*	4.8*	4.5*
200UB18.2	7.5*	7.1*	6.7*	6.1*	5.7*	5.4*
200UB25.4	-	-	7.5*	7.2*	6.9*	6.7*
250UB25.7	-	-	8.6*	8.2*	7.8*	7.6*
250UB31.4	-	-	-	8.7*	8.4*	8.1*
310UB32.0	-	-	-	-	9.4*	9.1*
100PFC	3.5*	2.6*	2.1*	1.8*	1.5*	1.4*
125PFC	4.9*	4.5*	3.9*	3.3*	2.8*	2.5*
150PFC	6.1*	5.8*	5.4*	5.1*	4.9*	4.5*
180PFC	-	6.8*	6.4*	6.1*	5.8*	5.6*
200PFC	-	7.5*	7.1	6.7*	6.4*	6.2*
230PFC	-	-	7.9*	7.5*	7.2*	6.9*
250PFC	-	-	-	-	8.4*	8.1*
300PFC	-	-	-	-	-	-

## STRUTTING BEAM SUPPORTING A TILED ROOF AND CEILING - NORMAL WIND N3

Section Designation	Load Width (m <sup>2</sup> )					
	10	13	16	19	22	25
	MAXIMUM SPAN OF BEARER (m)					
125TFB	4.1	3.7*	3.0*	2.5*	2.2*	2.0*
150UB14.0	4.8	4.2*	3.8*	3.2*	2.8*	2.3*
180UB16.1	5.5	5.1*	4.7*	4.3*	3.8*	3.4*
200UB18.2	6.3	5.9*	5.5*	5.0*	4.7*	4.4*
200UB25.4	7.1	6.6*	6.2*	5.9*	5.6*	5.5*
250UB25.7	8.1	7.6*	7.1*	6.8*	6.5*	6.2*
250UB31.4	-	8.1*	7.7*	7.3*	6.9*	6.7*
310UB32.0	-	-	8.6*	8.1*	7.8*	7.5*
310UB40.4	-	-	-	9.0*	8.6*	8.3*
310UB46.2	-	-	-	-	9.0*	8.7*
100PFC	2.4	1.8*	1.5*	1.3*	1.1*	-
125PFC	4.0	3.4*	2.7*	2.3*	2.0*	1.8*
150PFC	5.1	4.7*	4.4*	4.1*	3.5*	3.1*
180PFC	6.1	5.6*	5.3*	5.0*	4.6*	4.1*
200PFC	6.7	6.2*	5.8*	5.5*	5.3*	5.0*
230PFC	7.4	6.9*	6.5*	6.2*	5.9*	5.7*
250PFC	-	-	7.7*	7.3*	7.0*	6.7*
300PFC	-	-	-	8.5*	8.1*	7.8*

Notes on Tables:

1. The tables apply for 300PLUS® steel only. For details of your nearest 300PLUS® structural steel supplier, call InfraBuild Steel Direct toll free on 1800 1 STEEL (1800 1 78335), or visit our website at [www.infrabuild.com](http://www.infrabuild.com)

2. No symbol next to the span indicates that only nominal holding down is required (uplift is less than 5kN).

\* indicates a M10 holding down rod is required (uplift is between 5 and 19 kN)

## LINTELS SUPPORTING ROOFS AND MASONRY WALL

Before using the table on the following page, please note the design assumptions made on page 262, along with the following points:

1. These span tables provide details for building houses using standard practices and traditional materials.
2. Point loads are not covered by these tables.
3. These tables cover normal loads (roof, ceiling and floors), which must be uniformly distributed, on the masonry over an opening.
4. A minimum of three courses of brickwork are required over the opening for load bearing walls.
5. For lintels to be used in a lower floor of two storey construction refer to as structural engineer.
6. Long Leg of angles must be vertical.
7. Each Angle or Flat can carry a maximum 110mm wall thickness.
8. For Clear span < 1000mm, minimum Bearing Length at each end = 100mm.
9. For Clear span > 1000mm, minimum Bearing Length at each end = 150mm.
10. All lintels should be propped during brickwork construction.
11. The maximum rafter spacing should not be greater than 600mm.
12. There must be at least three courses of brickwork over span opening.
13. All loads are uniformly distributed (point loads are not allowed).
14. The effective roof load width must not exceed 4.8m.
15. For lintels supporting masonry in a lower floor of two storey construction, refer to a structural engineer.

## CONSTRUCTION TYPES



### Construction Type A:

Typical brick veneer construction with non load bearing brickwork and roof supported on internal timber or steel frame.



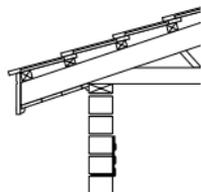
### Construction Type B:

Cavity wall construction with timber or steel truss tiled roof supported equally on both leaves of brickwork.



### Construction Type C:

Light weight metal sheet roof supported on single leaf of brickwork.



### Construction Type D:

Tiled roof with timber or steel ceiling supported on single leaf of brickwork.

## LINTELS SUPPORTING ROOFS & MASONRY WALLS

300PLUS® Steel Sections	Mass	Construction Type			
	(kg/m)	A	B	C	D
		MAXIMUM SPAN OF LINTEL (mm)			
90 x 90 x 6EA	8.22	3010	2050	2050	1570
90 x 90 x 8EA	10.6	3010	2170	2170	1810
100 x 100 x 6EA	9.16	3130	2290	2290	1810
100 x 100 x 8EA	11.8	3370	2410	2410	1930
125 x 75 x 6UA	9.16	3610	2530	2650	2050
150 x 90 x 8UA	14.3	4210	3370	3370	2770
150 x 100 x 10UA	18	4330	3490	3610	3010

# STRUCTURAL & PIPELINE PRODUCTS

A comprehensive range of rectangular, square and circular hollow sections are supplied in Australia for construction, fluid and gas conveyance, architectural and other uses.

These are available through BlueScope Distribution, Metalcorp Steel and many other steel distributors Australia-wide.

## **BlueScope Distribution**

[www.bluescopedistribution.com.au](http://www.bluescopedistribution.com.au)

T: 13 72 82 (Freecall)

E: sales@bluescopesteel.com.au

## **Metalcorp Steel**

[www.metalcorpsteel.com.au](http://www.metalcorpsteel.com.au)

T: 1300 306 204 (Freecall)

E: sales@metalcorpsteel.com.au

There is also some availability directly from the manufacturers - Australian Tube Mills and Orrcon.

## **Australian Tube Mills**

[www.austubemills.com](http://www.austubemills.com)

T: 1800 281 424 (Freecall)

E: info@austubemills.com

## **Orrcon**

[www.orrcon.com.au](http://www.orrcon.com.au)

T: 1300 677 266 (Freecall)

E: info@orrcon.com.au

These companies can provide details of the location of their appropriate stockists and distributors.

It is strongly recommended that any queries concerning suitability for application, availability of particular sizes, grades and finishes and other specific detail, be referred to the manufacturers, who can provide authoritative information as well as technical service for their products.

**The following tables should therefore be taken only as a general guide to hollow section availability.**

Hollow sections are also available in a wide range of finishes, many of these being the manufacturer's branded products. The main ones are listed below, and for their availability on a particular section, reference should be made to the manufacturer's literature.

## AUSTRALIAN TUBE MILLS

### SupaGal®

Internal and external surfaces protected by a hot dip galvanised coating 100g/m<sup>2</sup> minimum coating mass each surface complying with Section 3 of AS/NZS 4792 (ZB 125/125). Weld protected by zinc hot spraying, and finished product is given a light over coat as protection against rust.

### DuraGal® - No Internal Coat

External Surface - In line hot dipped galvanised over a prepared metal surface to produce a fully bonded coating with a minimum average coating mass of 100g/m<sup>2</sup> in accordance with AS/NZS 4792 ILG100.

### DuraGal® - With Internal Coat

External Surface - as for DuraGal® above

Internal Surface - A 35 micron aim DFT of zinc phosphate is applied over a prepared metal surface equivalent to AS 1627.4 class 2.5.

### Galtube Plus

External Surface - in-line hot dip galvanised over a prepared metal surface, to produce a fully bonded coating with a minimum average coating mass of 125g/m<sup>2</sup>, in accordance with AS/NZS 4792 ILG 125

Internal Surface - A 35 micron aim DFT of zinc phosphate paint applied over a prepared metal surface equivalent to AS 1627.4 class 2.5.

### KleenKote®

External surface protected by an alkyd modified acrylic primer averaging 8-10 microns coating thickness (aim 12 microns).

Colour: typically RHS and SHS available in blue and black; CHS available in red.

### Tubeline - Blue Plus

A smooth, even coat, 6 to 12, or 15 to 20 microns DFT of general purpose paint applied to external surface as a temporary rust preventative.

**Tubeline - Red Painted**

A smooth, even coat 6 to 12 microns DFT of general purpose paint applied to external surface as a temporary rust preventative.

**Tubeline - Clear Coat**

A smooth, even coat of clear polymer applied to the external surface to act as a temporary rust preventative.

**Tubeline - No Oil or Paint**

Both the internal and external surfaces of the hollow section are supplied in the as rolled condition without protective coatings. The ends are not colour coded.

**Tubeline - Galvanised**

All surfaces are hot dip galvanised with a minimum average coating of 300g/m<sup>2</sup> in accordance with AS/NZS 4792 HDG300.

**Hot Dipped Galvanised**

Internal and external surfaces protected by a hot dip galvanised coating 300g/m<sup>2</sup> minimum coating mass each surface complying with section 2 of AS/NZS 4792 (HDG300). Finished product is given a clear polymer coat as protection against white rust.

**LiteOil**

External surface given a light oil coating to prevent short term corrosion in transit from the mill, through warehousing and distribution and on to the end user.

The coating is a mineral based oil, diluted with solvents and is easily removed by alkali solution, or kerosene.

**Uncoated**

Bare tubular steel products with no oil, paint, galvanised or other coating.

**ORRCON****ALLGAL®**

External and internal surfaces electro galvanised with a total minimum zinc coating weight (total amount distributed over both surfaces) of 100g/m<sup>2</sup>. The welded area is recoated with a zinc/aluminium alloy to replace the material that the weld has burned away. The external surface of the hollow section is coated with a clear polymer coating called Clear-Tec.

**SmartCOTE®**

External coating of a water based primer, average coating thickness 7 – 15 microns. Colour: RHS blue, SHS and CHS black or red.

**N.O.P.C.**

Certain products also available with no oil, paint or coating.

## RECTANGULAR HOLLOW SECTIONS (RHS)

Available Grades: AS 1163-C350L0 & AS 1163 C350L0/C450L0  
(DualGrade)

Available Finishes: Plain, Painted and Galvanised

(refer individual manufacturer's specifications)

### 8.0 METRE LENGTHS

Size (mm) d x b x t	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Approx mass per pack (tonnes)	Aus Tube Mills	Orrcon
38 x 25 x 2.0	1.80	556	72	1.04	•	•
50 x 20 x 1.6	1.63	615	96	1.25	•	
50 x 20 x 2.0	1.99	503	96	1.53	•	
50 x 20 x 2.5	2.42	413	72	1.39	•	
50 x 20 x 3.0	2.83	353	72	1.63	•	
50 x 25 x 1.6	1.75	571	96	1.35	•	•
50 x 25 x 2.0	2.15	465	96	1.65	•	•
50 x 25 x 2.5	2.62	382	72	1.51	•	•
50 x 25 x 3.0	3.07	326	60	1.47	•	•
65 x 35 x 2.0	2.93	341	54	1.27	•	•
65 x 35 x 2.5	3.60	278	54	1.56	•	•
65 x 35 x 3.0	4.25	235	45	1.53	•	•
65 x 35 x 4.0	5.35	187	35	1.50	•	•
75 x 25 x 1.6	2.38	420	65	1.24	•	•
75 x 25 x 2.0	2.93	341	65	1.53	•	•
75 x 25 x 2.5	3.60	278	48	1.38	•	•
75 x 50 x 1.6	3.01	332	54	1.30	•	•
75 x 50 x 2.0	3.72	269	42	1.25	•	•
75 x 50 x 2.5	4.58	218	42	1.54	•	•
75 x 50 x 3.0	5.42	185	35	1.52	•	•
75 x 50 x 4.0	6.92	145	28	1.55	•	•
75 x 50 x 5.0	8.35	120	24	1.60	•	•
75 x 50 x 6.0	9.67	103	20	1.55	•	•

Size (mm) d x b x t	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Approx mass per pack (tonnes)	Aus Tube Mills	Orrcon
76 x 38 x 2.5	4.15	241	45	1.49	•	
76 x 38 x 3.0	4.90	204	40	1.57	•	
76 x 38 x 4.0	6.23	161	32	1.59	•	
100 x 50 x 1.6	3.64	275	32	0.93	•	•
100 x 50 x 2.0	4.50	222	32	1.15	•	•
100 x 50 x 2.5	5.56	180	32	1.42	•	•
100 x 50 x 3.0	6.60	152	32	1.69	•	•
100 x 50 x 3.5	7.53	133	24	1.45	•	•
100 x 50 x 4.0	8.49	118	24	1.63	•	•
100 x 50 x 5.0	10.3	97	18	1.49	•	•
100 x 50 x 6.0	12.0	83	15	1.44	•	•
102 x 76 x 3.5	9.07	110	20	1.45	•	
102 x 76 x 5.0	12.5	80	16	1.60	•	
102 x 76 x 6.0	14.7	68	12	1.41	•	
125 x 75 x 2.0	6.07	165	24	1.17	•	•
125 x 75 x 2.5	7.53	133	24	1.45	•	•
125 x 75 x 3.0	8.96	112	20	1.43	•	•
125 x 75 x 4.0	11.6	86	15	1.40	•	•
125 x 75 x 5.0	14.2	70	15	1.70	•	•
125 x 75 x 6.0	16.7	60	12	1.60	•	•
127 x 51 x 3.5	9.07	110	21	1.52	•	
127 x 51 x 5.0	12.5	80	18	1.80	•	
127 x 51 x 6.0	14.7	68	14	1.64	•	
150 x 50 x 2.0	6.07	165	21	1.02	•	•
150 x 50 x 2.5	7.53	133	24	1.45	•	•
150 x 50 x 3.0	8.96	112	21	1.50	•	•
150 x 50 x 4.0	11.6	86	15	1.40	•	•
150 x 50 x 5.0	14.2	70.2	15	1.71	•	•
150 x 50 x 6.0	16.7	59	15	2.04	•	•
150 x 76 x 5.0	16.4	61	12	1.57	•	•
150 x 76 x 6.0	19.4	52	9	1.40	•	•

## 8.0 &amp; 12.0 METRE LENGTHS

Size (mm) d x b x t	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Approx mass per pack – 8.0m lengths (tonnes)	Aus Tube Mills	Orrcon
150 x 100 x 4.0	14.8	68	12	1.42	•	•
150 x 100 x 5.0	18.2	55	12	1.74	•	•
150 x 100 x 6.0	21.4	46	9	1.54	•	•
150 x 100 x 8.0	27.7	36	6	1.33	•	
150 x 100 x 9.0	30.6	33	6	1.47	•	•
150 x 100 x 10.0	33.4	30	4	1.60	•	
200 x 100 x 4.0	17.9	56	8	1.15	•	•
200 x 100 x 5.0	22.1	45	8	1.41	•	•
200 x 100 x 6.0	26.2	38	8	1.67	•	•
200 x 100 x 8.0	33.90	30	6	1.63	•	
200 x 100 x 9.0	37.7	27	6	1.81	•	•
200 x 100 x 10.0 (12.0 metres)	41.3	24	2	0.99	•	
250 x 150 x 5.0	29.9	33	6	1.44	•	•
250 x 150 x 6.0	35.6	28	4	1.14	•	•
250 x 150 x 8.0	46.5	22	4	1.49	•	
250 x 150 x 9.0	51.8	19	4	1.66	•	•
250 x 150 x 10.0 (12.0 metres)	57.00	18	2	1.37	•	
250 x 150 x 12.5 (12.0 metres)	69.40	14	2	1.67	•	
250 x 150 x 16.0 (12.0 metres)	85.5	12	1	1.03	•	
300 x 200 x 6.0	45.0	22	1	0.54	•	•
300 x 200 x 8.0 (12.0 metres)	59.1	17	2	1.42	•	
300 x 200 x 9.0 (12.0 metres)	65.4	15	1	0.79	•	•
300 x 200 x 10.0 (12.0 metres)	72.7	14	2	1.74	•	
300 x 200 x 12.5 (12.0 metres)	89.0	11	1	1.07	•	
300 x 200 x 16.0 (12.0 metres)	111.00	9	1	1.33	•	

Size (mm) d x b x t	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Approx mass per pack – 8.0m lengths (tonnes)	Aus Tube Mills	Orrcon
350 x 250 x 6.0	54.4	18	2	1.31	•	
350 x 250 x 8.0 (12.0 metres)	71.6	14	2	1.72	•	
350 x 250 x 10.0 (12.0 metres)	88.4	11	1	1.06	•	
350 x 250 x 12.5 (12.0 metres)	109.0	9	1	1.31	•	
350 x 250 x 16.0 (12.0 metres)	136.0	7	1	1.63	•	
400 x 200 x 8.0	71.60	14	2	1.72	•	
400 x 200 x 10.0 (12.0 metres)	88.40	11	1	1.06	•	
400 x 200 x 12.5 (12.0 metres)	109.00	9	1	1.31	•	
400 x 200 x 16.0 (12.0 metres)	136.00	7	1	1.63	•	
400 x 300 x 8.0	84.2	12	1	1.01	•	
400 x 300 x 10.0 (12.0 metres)	104.0	10	1	1.25	•	
400 x 300 x 12.5 (12.0 metres)	128.0	8	1	1.54	•	
400 x 300 x 16.0 (12.0 metres)	161.0	6	1	1.93	•	

## SQUARE HOLLOW SECTIONS (SHS)

Available Grades: AS 1163 – C350L0 & AS - C350L0 (Dual Grade)

Available Finishes: Plain, Painted or Galvanised

(refer individual manufacturer's specifications)

### 6.5 METRE LENGTHS

Size (mm) d x b x t	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Approx mass per pack (tonnes)	Aus Tube Mills	Orrcon
13 x 13 x 1.8	0.57	1760	96	0.35	•	•
15 x 15 x 1.8	0.68	1468	100	0.44	•	•
20 x 20 x 1.6	0.87	1150	96	0.54	•	•
20 x 20 x 2.0	1.05	953	100	0.66	•	
25 x 25 x 1.6	1.12	890	100	0.73	•	•
25 x 25 x 2.0	1.36	733	100	0.88	•	•
25 x 25 x 2.5	1.64	610	100	1.07	•	•
25 x 25 x 3.0	1.89	529	100	1.23	•	•

### 8.0 METRE LENGTHS

Size (mm) d x b x t	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Approx mass per pack (tonnes)	Aus Tube Mills	Orrcon
30 x 30 x 1.6	1.38	725	100	1.10	•	•
30 x 30 x 2.0	1.68	595	100	1.34	•	•
30 x 30 x 2.5	2.03	493	100	1.63	•	•
30 x 30 x 3.0	2.36	424	64	1.21	•	•
35 x 35 x 1.6	1.63	613	100	1.30	•	•
35 x 35 x 2.0	1.99	503	100	1.59	•	•
35 x 35 x 2.5	2.42	413	64	1.24	•	•
35 x 35 x 3.0	2.83	353	64	1.4	•	•
40 x 40 x 1.6	1.88	533	81	1.22	•	•
40 x 40 x 2.0	2.31	434	81	1.49	•	•
40 x 40 x 2.5	2.82	355	64	1.44	•	•
40 x 40 x 3.0	3.30	303	64	1.69	•	•
40 x 40 x 4.0	4.09	244	49	1.60	•	•

Size (mm) d x b x t	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Approx mass per pack (tonnes)	Aus Tube Mills	Orrcon
50 x 50 x 1.6	2.38	420	64	1.22	•	•
50 x 50 x 2.0	2.93	341	64	1.50	•	•
50 x 50 x 2.5	3.60	278	49	1.41	•	•
50 x 50 x 3.0	4.25	236	49	1.66	•	•
50 x 50 x 4.0	5.35	187	36	1.54	•	•
50 x 50 x 5.0	6.39	156	30	1.53	•	•
50 x 50 x 6.0	7.32	137	25	1.46	•	•
65 x 65 x 1.6	3.13	319	49	1.23	•	•
65 x 65 x 2.0	3.88	258	42	1.30	•	•
65 x 65 x 2.5	4.78	209	42	1.61	•	•
65 x 65 x 3.0	5.66	177	36	1.63	•	•
65 x 65 x 4.0	7.23	138	30	1.74	•	•
65 x 65 x 5.0	8.75	114	25	1.75	•	•
65 x 65 x 6.0	10.1	99	20	1.62	•	•
75 x 75 x 2.0	4.50	222	36	1.30	•	•
75 x 75 x 2.5	5.56	180	30	1.34	•	•
75 x 75 x 3.0	6.60	152	30	1.58	•	•
75 x 75 x 3.5	7.53	133	25	1.51	•	•
75 x 75 x 4.0	8.49	118	25	1.70	•	•
75 x 75 x 5.0	10.3	97	20	1.65	•	•
75 x 75 x 6.0	12.0	83	16	1.54	•	•
89 x 89 x 2.0	5.38	186	25	1.08	•	•
89 x 89 x 3.5	9.06	110	20	1.45	•	•
89 x 89 x 5.0	12.5	80	16	1.60	•	•
89 x 89 x 6.0	14.6	68	12	1.41	•	•
90 x 90 x 2.0	5.45	183	20	0.87	•	
90 x 90 x 2.5	6.74	148	20	1.08	•	

## 8.0 & 12.0 METRE LENGTHS

Size (mm) d x b x t	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Approx mass per pack – 8.0m lengths (tonnes)	Aus Tube Mills	Orrcon
100 x 100 x 2.0	6.07	165	20	0.972	•	•
100 x 100 x 2.5	7.53	133	20	1.20	•	•
100 x 100 x 3.0	8.96	112	20	1.43	•	•
100 x 100 x 4.0	11.6	86	16	1.49	•	•
100 x 100 x 5.0	14.2	70	12	1.37	•	•
100 x 100 x 6.0	16.7	60	12	1.61	•	•
100 x 100 x 8.0	21.40	47	9	1.54	•	
100 x 100 x 9.0	23.5	43	9	1.69	•	•
100 x 100 x 10.0 (12.0 metres)	25.60	39	6	1.84	•	
125 x 125 x 4.0	14.8	68	12	1.42	•	•
125 x 125 x 5.0	18.2	55	12	1.75	•	•
125 x 125 x 6.0	21.4	47	9	1.54	•	•
125 x 125 x 8.0	27.70	36	6	1.33	•	
125 x 125 x 9.0	30.6	33	8	1.96	•	•
125 x 125 x 10.0	33.40	30	4	1.07	•	
150 x 150 x 4.0	17.90	56	9	1.29	•	•
150 x 150 x 5.0	22.1	45.3	9	1.59	•	•
150 x 150 x 6.0	26.2	38.2	6	1.26	•	•
150 x 150 x 8.0	33.90	30	6	1.63	•	
150 x 150 x 9.0	37.7	26.6	6	1.81	•	•
150 x 150 x 10.0 (12.0 metres)	41.30	24	2	0.99	•	
200 x 200 x 5.0	29.9	33	6	1.44	•	•
200 x 200 x 6.0	35.6	28	4	1.14	•	•
200 x 200 x 8.0	46.50	21	4	1.49	•	
200 x 200 x 9.0	51.8	19.3	4	1.66	•	•
200 x 200 x 10.0 (12.0 metres)	57.00	18	2	1.37	•	
200 x 200 x 12.5 (12.0 metres)	69.40	14	2	1.67	•	

Size (mm) d x b x t	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Approx mass per pack – 8.0m lengths (tonnes)	Aus Tube Mills	Orrcon
200 x 200 x 16.0 (12.0 metres)	85.50	12	1	1.03	•	
250 x 250 x 6.0	45.0	22.2	4	1.44	•	•
250 x 250 x 8.0	59.10	17	4	1.89	•	
250 x 250 x 9.0	65.9	15.2	2	1.05	•	•
250 x 250 x 10.0 (12.0 metres)	72.70	14	2	1.74	•	
250 x 250 x 12.5 (12.0 metres)	89.00	11	1	1.07	•	
250 x 250 x 16.0 (12.0 metres)	111.00	9	1	1.33	•	
300 x 300 x 6.0	53.7	19	1	0.64		•
300 x 300 x 8.0 (12.0 metres)	71.60	14	1	0.86	•	
300 x 300 x 9.0 (12.0 metres)	80.00	13	1	0.96		•
300 x 300 x 10.0 (12.0 metres)	88.40	11	1	1.06	•	
300 x 300 x 12.5 (12.0 metres)	109.00	9	1	1.31	•	
300 x 300 x 16.0 (12.0 metres)	136.00	7	1	1.66	•	
350 x 350 x 8.0	84.20	12	1	1.01	•	
350 x 350 x 10.0 (12.0 metres)	104.00	10	1	1.25	•	
350 x 350 x 12.5 (12.0 metres)	128.00	8	1	1.54	•	
350 x 350 x 16.0 (12.0 metres)	161.00	6	1	1.93	•	
400 x 400 x 6.0	73.30	14	1	0.59		•
400 x 400 x 9.0 (12.0 metres)	108.30	9	1	0.87		•
400 x 400 x 10.0 (12.0 metres)	120.00	8	1	1.44	•	
400 x 400 x 12.5 (12.0 metres)	148.00	7	1	1.77	•	
400 x 400 x 16.0 (12.0 metres)	186.00	5	1	2.23	•	

## CIRCULAR HOLLOW SECTIONS (CHS)

Available Grades: AS 1163 – C250L0

Available Finishes: Plain, Painted or Galvanised

(refer individual manufacturer's specifications)

### 6.5 METRE LENGTHS

Note: M = Medium, H = Heavy

Size (mm) d x b x t	Wall thickness (mm)	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Approx mass per pack (tonnes)	Aus Tube Mills	Orrcon
15 – 21.3	2.6M	1.20	834	217	1.69	•	
20 – 26.9	2.6M	1.56	642	127	1.29	•	•
20 – 26.9	3.2H	1.87	535	127	1.54	•	
20 – 26.9	4.0H	2.26	442	127	1.87	•	
25 – 33.7	3.2M	2.41	415	91	1.42	•	•
25 – 33.7	4.0H	2.93	341	91	1.73	•	
32 – 42.4	3.2M	3.09	323	61	1.23	•	•
32 – 42.4	4.0H	3.79	264	61	1.50	•	•
40 – 48.3	3.2M	3.56	281	61	1.42	•	•
40 – 48.3	4.0H	4.38	229	61	1.74	•	•
40 – 48.3	5.4XH	5.71	175	61	2.26	•	
50 – 60.3	3.6M	5.03	199	37	1.21	•	•
50 – 60.3	4.5H	6.19	161	37	1.49	•	
50 – 60.3	5.9H	7.31	137	37	1.76	•	•
65 – 76.1	3.6M	6.44	155	37	1.55	•	•
65 – 76.1	4.5H	7.95	126	37	1.91	•	
65 – 76.1	5.9H	10.2	97.9	37	2.45	•	•
80 – 88.9	4.0M	8.38	119	19	1.03	•	•
80 – 88.9	5.0H	10.3	96.7	19	1.27	•	•
80 – 88.9	5.9H	12.1	82.8	19	1.49	•	
90 – 101.6	4.0M	9.63	104	19	1.19	•	•
90 – 101.6	5.0H	11.9	84.0	19	1.47	•	•

Size (mm) d x b x t	Wall thickness (mm)	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Approx mass per pack (tonnes)	Aus Tube Mills	Orrcon
100 – 114.3	4.5M	12.2	82.1	19	1.51	•	•
100 – 114.3	5.4H	14.5	69.0	19	1.79	•	•
125 – 139.7	5.0M	16.6	60.2	13	1.40	•	•
125 – 139.7	5.4H	17.9	55.9	13	1.51	•	•
150 – 165.1	5.0M	19.7	50.7	10	1.28	•	•
150 – 165.1	5.4H	21.3	47.0	10	1.38	•	•

## CIRCULAR HOLLOW SECTIONS (CHS)

Available Grades: AS 1163 – C350L0

Available Finishes: Plain, Painted or Galvanised

(refer individual manufacturer's specifications)

### 6.5 METRE LENGTHS (PLAIN OR PAINTED)

Note: L = Light, XL = Extra Light

Size (mm) d x b x t	Wall thickness (mm)	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Approx mass per pack (tonnes)	Aus Tube Mills	Orrcon
20 – 26.9	2.0XL	1.23	813	127	1.02	•	•
20 – 26.9	2.3L	1.40	714	127	1.16	•	•
25 – 33.7	2.0XL	1.56	641	91	0.92	•	•
25 – 33.7	2.6L	1.99	503	91	1.18	•	•
32 – 42.4	2.0XL	1.99	503	61	0.79	•	•
32 – 42.4	2.6L	2.55	392	61	1.01	•	•
40 – 48.3	2.3XL	2.61	383	61	1.03	•	•
40 – 48.3	2.9L	3.25	308	61	1.29	•	•
50 – 60.3	2.3XL	3.29	304	37	0.79	•	•
50 – 60.3	2.9L	4.11	243	37	0.99	•	•
65 – 76.1	2.3XL	4.19	239	37	1.01	•	•
65 – 76.1	3.2L	5.75	174	37	1.38	•	•
80 – 88.9	2.6XL	5.53	181	19	0.68	•	•
80 – 88.9	3.2L	6.76	148	19	0.84	•	•
90 – 101.6	2.6XL	6.35	157	19	0.78	•	
90 – 101.6	3.2L	7.77	129	19	0.96	•	•
100 – 114.3	3.2XL	8.77	114	19	1.08	•	•
100 – 114.3	3.6L	9.83	102	19	1.21	•	•
125 – 139.7	3.0XL	10.1	99	13	0.85	•	•
125 – 139.7	3.5L	11.8	85	13	0.99	•	•
150 – 165.1	3.0XL	12.0	83	10	0.78	•	•
150 – 165.1	3.5L	13.9	72	10	0.91	•	•

## LARGE CIRCULAR HOLLOW SECTIONS (CHS)

Suitable for Pressure & Structural Applications Covering API 5LB, API 5LX42 & AS 1163 C350L0

(refer to InfraBuild or Orrcon specifications)

### 12.0 METRE LENGTHS

Nominal Bore (mm)	Diameter (mm)	Thickness (mm)	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Aus Tube Mills	Orrcon
150	168.3	4.8	19.4	51.5	1	•	•
		6.4	25.6	39.1	1	•	•
		7.1	28.2	35.4	1	•	•
		11.0	42.7	23.40	1		•
200	219.1	4.8	25.4	39.4	1	•	•
		6.4	33.6	29.8	1	•	•
		8.2	42.6	23.5	1	•	•
250	273.1	4.8	31.8	31.4	1	•	•
		6.4	42.1	23.8	1	•	•
		9.3	60.5	16.5	1	•	•
		12.7	81.6	12.3	1		•
300	323.9	4.8	37.8	26.5	1		•
		6.4	50.1	20.0	1	•	•
		9.5	73.7	13.6	1	•	•
		12.7	97.5	10.3	1	•	•
350	355.6	4.8	41.5	24.1	1		•
		6.4	55.1	18.1	1	•	•
		9.5	81.1	12.3	1	•	•
		12.7	107.4	9.3	1	•	•
400	406.4	4.8	47.5	21.0	1		•
		6.4	63.1	15.8	1	•	•
		9.5	93.0	10.8	1	•	•
		12.7	123	8.11	1	•	•

Nominal Bore (mm)	Diameter (mm)	Thickness (mm)	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Aus Tube Mills	Orrcon
450	457.0	6.4	71.1	14.1	1	•	•
		9.5	105.0	9.52	1	•	•
		12.7	139.0	7.19	1	•	•
500	508.0	6.4	79.2	12.6	1	•	•
		9.5	116.8	8.6	1	•	•
		12.7	155.1	6.4	1	•	•
600	610.0	6.4	95.3	10.5	1		•
		9.5	140.7	7.1	1		•
		12.7	187.1	5.3	1		•

Note: Minimum order quantities may apply

## LARGE CIRCULAR HOLLOW SECTIONS (CHS)

Suitable for Structural Applications

Available Grades: AS 1163 C350L0

Available Finishes: Lightly oiled coating

(refer Smorgon literature supplied by Smorgon Steel)

### 12.0 METRE LENGTHS

Diameter (mm)	Thickness (mm)	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Approx mass per pack (tonnes)	Aus Tube Mills
<b>168.3</b>	4.0	16.2	61.7	7	1.36	•
	5.0	20.1	49.8	7	1.69	•
	6.0	24.0	41.7	3	0.86	•
	8.0	31.6	31.6	3	1.14	•
	10.0	39.0	25.6	3	1.40	•
<b>219.1</b>	5.0	26.4	37.9	3	0.95	•
	6.0	31.5	31.7	3	1.13	•
	8.0	41.6	24.0	3	1.50	•
	10.0	51.6	19.4	1	0.62	•
	12.5	63.7	15.7	1	0.76	•
<b>273.1</b>	5.0	33.1	30.2	3	1.19	•
	6.0	39.5	25.3	3	1.42	•
	8.0	52.3	19.1	2	1.26	•
	10.0	64.9	15.4	1	0.78	•
	12.5	80.3	12.4	1	0.96	•
<b>323.9</b>	6.0	47.0	21.3	3	1.69	•
	8.0	62.3	16.0	1	0.75	•
	10.0	77.4	12.9	1	0.93	•
	12.5	96.0	10.4	1	1.15	•

Diameter (mm)	Thickness (mm)	Nominal mass per metre (kg)	Nominal metres per tonne	Lengths per pack	Approx mass per pack (tonnes)	Aus Tube Mills
<b>355.6</b>	8.0	68.6	14.6	1	0.82	•
	10.0	85.2	11.7	1	1.02	•
	12.5	106.0	9.45	1	1.27	•
	16.0	134.0	7.46	1	1.61	•
<b>406.4</b>	8.0	78.6	12.7	1	0.94	•
	10.0	97.8	10.2	1	1.17	•
	12.0	121.0	8.24	1	1.46	•
	16.0	154.0	6.49	1	1.85	•
<b>457.0</b>	10.0	110.0	9.07	1	1.32	•
	12.5	137.0	7.30	1	1.64	•
	16.0	174.0	5.75	1	2.09	•
<b>508.0</b>	10.0	123.0	8.14	1	1.47	•
	12.5	153.0	6.55	1	1.83	•
	16.0	194.0	5.15	1	2.33	•

Note: Minimum order quantities may apply

# BUILDING SOLUTIONS

Lysaght offers a range of tailored solutions comprising design, supply and construction abilities. These solutions deliver outstanding value and bring over 150 years of design and construction knowledge to every project.

## **LYSAGHT PERMALITE® ALUMINIUM BUILDING PRODUCTS (FOR SEVERE ENVIRONMENTS)**

PERMALITE® aluminium building products have been designed for highly aggressive, coastal or other severe environment applications.

PERMALITE® products are made from marine grade aluminium, roll formed to produce high performance cladding or extruded to produce purlins with a combination of strength and light weight. They provide exceptional durability in the toughest building environments and can be recycled at the end of their long working life.

The aluminium alloy used to produce all PERMALITE® cladding profiles, purlins and flashings was specifically developed for its resistance to corrosion in marine or industrial environments. PERMALITE® cladding is suitable for applications where corrosion protection is paramount, such as in chemical plants or industrial applications where sulphates, chlorides or other pollutants are likely to come in contact with the metal.

Information regarding PERMALITE® cladding profiles is presented in the Roofing and Walling section pages 133 - 139.

For further details on our PERMALITE® aluminium building products, visit [www.permalite.com.au](http://www.permalite.com.au) or call 1800 850 389.

## RANBUILD® SHEDS & GARAGES

RANBUILD® is a wholly owned BlueScope business and is a leader in the design and manufacture of cold-formed galvanised steel buildings using only the latest techniques and materials to produce versatile, high quality structures. Manufactured using LYSAGHT® steel building products, the extensive range of RANBUILD® structures are fully engineered to meet Australian Standards to ensure fast, low cost assembly and long term life.

RANBUILD® structures are available nationally through an extensive dealer network across Australia. For further detail or to find your local dealer, visit [www.ranbuild.com.au](http://www.ranbuild.com.au)

### Building Range and Applications

RANBUILD® buildings are suitable for many fields of Industry; Domestic, Rural, Equine and commercial applications: Examples of the various Ranbuild solutions are detailed below:

**Agriculture:** Animal housing, horse stables, poultry sheds, dog kennels, catteries, sheep shelters, fruit and vegetable packing sheds, hay and fodder storage sheds, 'Bulkstore' bulk storage sheds for fertiliser, grain, seed, meal or produce, machinery sheds, farm workshops, chemical storage buildings, pump sheds and generator sheds just to name a few.

**Industry and Commerce:** Warehousing, retail shops, bulk storage sheds, small business premises, repair and workshops, integrated industrial estates, small and large factory buildings, multi car ports and specialised buildings for the Mining industry.

**Governments and Associations:** Rural Fire Brigade and emergency services buildings. 'Schoolmaster' school shade shelters, sporting enclosures and storage sheds.

**Home and Leisure:** Single, double and multi car garages, garage and workshop combinations. Swimming pool covers, enclosures and entertainment areas. Heritage or traditional Lodge and Barn style buildings for fitting out as weekenders, bunkhouses or even a country home. Options include mezzanine floors for two story living.

**Aircraft Hangars:** Single, double and multi hangars for all sorts and size of aircraft. Simple open fronted buildings for farm use through to lock-up commercial models with the RANBUILD® renowned windlock sliding door system.

## THE ROOFING CENTRE TASMANIA

With a wealth of experience providing commercial, industrial and residential roofing solutions, The Roofing Centre Tasmania has branches in Hobart, Launceston and Devonport. It supplies LYSAGHT® steel building products to handymen, owner builders, roofers, residential and commercial builders.

For more information visit: [www.roofingcentretas.com.au](http://www.roofingcentretas.com.au)

## KITELEYS

Kiteleys is the single largest COLORBOND® domestic roof, gutter, fascia and safety-rail fixing company in NSW and serves customers across the state. Kiteleys services clients ranging from home owners to some of the leading project home builders and commercial property developers.

For more information visit: [www.kiteleys.com.au](http://www.kiteleys.com.au)

## METALFORM

Melbourne based Metalform Structures is not only one of Australia's largest purlin manufacturers, it is also a specialist and industry leader in the supply of specialist purlin sections.

The company works with engineers on major projects to provide purlin solutions beyond those available from conventional designs. Its products have been integral in projects ranging from desalination facilities, rail freight depots, shopping centres and coal mine conveyors.

For more information visit: [www.metalform.net.au](http://www.metalform.net.au)

# PRACTICAL ADVICE ON USING STEEL

This section provides practical advice on using steel building products. It has been created to give information on the usage and application of steel products, and how to handle and install them correctly.

Here you can find information on On-Site Safety for Everyone, covering protective clothing, working at heights, and manual handling

Also included is information on Service Conditions and Suitable Products, which covers selecting the appropriate coated steel building product for the location of the intended building. Here you will also find information on Atmospheric Exposure Conditions and the Avoidance of Contact Between Incompatible Metals or Metal Roofing/Gutter Solutions.

This section also covers External Fasteners, providing the recommended fastener selection and usage for the range of coated steel building products.

You can also find in this section information on Soldering, Adhesives, Sealants, Welding and painting of Steel Sheet Products.

# ON-SITE SAFETY FOR EVERYONE

Lysaght holds the safety of every employee and those visiting our sites of key importance. While this safety message relates to employees and their families both at work and in the home environment, we also recommend this to our customers and to all who use our steel products. Nothing is more important at Lysaght than the health and safety of our people

Our focus is Zero Harm. It's the way we do business at Lysaght.

## LYSAGHT SAFETY BELIEFS

- Working safely is a condition of employment
- Employee involvement is essential
- Management is accountable for safety performance
- All injuries can be prevented
- Training employees to work safely is essential
- All operating exposure can be safeguarded

## SAFETY AROUND STEEL

When working or visiting construction and building sites, or even if it is a small job around your home always "Think Safety". Review the site safety rules and familiarise yourself with the Occupational Health and Safety legislation for your state and comply with those guidelines.

## PROTECTIVE CLOTHING

Lysaght requires the following Clothing and Protective Personal equipment to be worn on its sites.

### Eye Protection

Eye protection must be worn at all times within site buildings and in all other designated areas except while inside an office, amenity, cabin or fully enclosed vehicle. Prescription glasses must have side shields fitted.

### Safety Helmets

Must be worn while inside any building or any industrial or construction work site with the exception of offices, amenities and cabins.

## Footwear

Safety footwear is required to be worn while working in all sites. Fully enclosed footwear is required to be worn by visitors at all times whilst on site, in the yard and on green walkways.

## Clothing

Employees and Contractors working in the plant are to wear prescribed industrial high visibility clothing. Clothing must fully cover the legs and arms.

Employees coming to and from work that need to enter the manufacturing area for any reason must wear enclosed footwear, long trousers or slacks and sleeved shirt or top. High visibility vests must be worn by visitors in work areas.

## Gloves & Armguards

Gloves and Armguards must be worn at all times when handling product - this will include activities such as coil and sheet handling including samples and small pieces, strapping and the removal of strapping, and loading of finished products.

Employees should be encouraged to wear armguards whilst walking in areas with limited space and in the vicinity of sheet metal and coil products.

## Hearing Protection

Hearing protection must be worn in sign-posted areas.

## Sun Protection

Suitable protection against personal sun damage is required at all times. Sunscreens containing semi-conducting metal oxides such as titanium dioxide (TiO<sub>2</sub>) and zinc oxide (ZnO) can accelerate the degradation of organic materials, including paint systems. Such sunscreens should be prevented from making contact with COLORBOND® steel.

## Special Protective Equipment

Site Management, in consultation with the Safety Professional and OH&S Committee, shall determine any special protective equipment requirements to suit site processes and ensure compliance to the PPE Policy.

## WORKING AT HEIGHTS

First you should try to bring the job to ground level so that there is no risk of falling.

### IF YOU CAN'T!

Put up a solid barrier or handrail so you can't fall.

### IF YOU CAN'T!

Use a platform to work from such as a scaffold or an elevated work platform (EWP).

### IF YOU CAN'T!

Use a fall RESTRAINT system such as a purposely designed fixed length lanyard for the job that will stop you reaching the edge (note: some restraint systems may have energy absorbers fitted).

### IF YOU CAN'T!

Use a fall ARREST system such as harness with personal lanyard or a retractable lanyard with an energy absorber that will arrest you should you fall, and you must have a fall rescue plan and be understood by all.

**IF YOU CAN'T! - DON'T DO THE JOB! - GO SEE YOUR SUPERVISOR!**

## MANUAL HANDLING

This not only applies to the building construction site. Be it at home or in the office we often encounter manual handling issues. So consider the following and the affect they will have before lifting.

### 1. What am I about to do?

- Lift, carry or lower?

### 2. What are the hazards?

- People around you?
- Heavy Load?
- Awkward Posture?
- Repetitive Action?

### 3. What can I do to make the job safe?

- Split the load?
- Use a trolley or crane?
- Avoid reaching and twisting?
- Get some Help?

### 4. How do I plan to lift?

Check what I am about to move and where to. Remove obstacles.  
Look out for sharp edges and unstable loads.

### 5. Is my posture correct?

Check, breathe deeply, body weight evenly placed, knees not locked, back straight, shoulders relaxed, avoid jerking moves.

### 6. Now prepare to lift

Stand close to the object, grasp the object firmly, Lift with your legs not your back and keep the load close to your body.

# SERVICE CONDITIONS AND SUITABLE PRODUCTS

(Information under this heading is derived in part from Appendix C to AS/NZ 2728:2007. Acknowledgement and thanks to Standards Australia).

In the selection of an appropriate coated steel building product, it is important to assess the atmospheric conditions expected in the location of the intended building. This includes an assessment of both macro and micro-environmental conditions.

On-site factors require additional consideration because a mildly corrosive atmosphere can be converted into an aggressive environment by rain, dew or humid conditions, and can thus affect the choice of a particular category of painted metallic coated product.

Typical on-site factors or types or microclimates which may cause a breakdown of protective coatings include:

- Industry Pollution
- Contamination from agricultural fertilisers or insecticides
- Damp locations not dried out by sunlight
- Exposure to sea breezes
- Alkaline or acidic fallout (e.g. fossil fuel combustion)
- Hot or cold surfaces
- Abrasion or impact
- Organic matter (leaves, etc)
- Unwashed Areas\*

Prevailing winds which can transport contamination from one location to another also require consideration.

High levels of ultra-violet light and humidity have adverse effects on the performance of organic coatings and thus reduce their durability. Because of the effects of high humidity, the designer of a building should take special care to ensure that the effects of condensation are minimised.

It should also be borne in mind that bending or roll-forming operations will cause stressing and may cause cracking of paint films. In moderate exposure conditions, cracking does not adversely affect the expected life of a product. However, in severe environments products designed for such environments should be specified with more generous bend radii in order to ensure the required service life is achieved.

\*Area Unwashed by Rain - Particles of dust, salt and other grime settle on building cladding but are usually washed away by rain. However, some areas such as upper wall or upper garage door regions, under eaves, soffits, exterior ceilings, etc, remain unwashed because they are protected by overhangs (leaves, lintels). ZINCALUME® steel and COLORBOND® steel in such areas should be regularly maintained by washing with a fresh water and mild detergent solution followed by rinsing with fresh water to remove grime which could otherwise generate early corrosion. In hard-to-reach areas a hosing would be considered as a minimum requirement.

# ATMOSPHERIC EXPOSURE CONDITIONS – STEEL CLADDING

## PERFORMANCE OF STEEL ROOFING AND WALLING

### General applications

The performance of steel roofing and walling can be maximised by choosing a material and design appropriate to the relevant environment.

### Environmental factors

1. Atmospheric exposure conditions.
2. Unusually harsh service conditions due to the nature of the activity in a building, eg, intensive animal farming.

### Atmospheric Exposure Conditions

In a country the size of Australia, with its wide variety of climatic conditions ranging from the tropical north to the alpine regions, and from the heavy surf characteristics of much of the coastline to the desert regions of the interior, it is clearly not possible in a brief general description to cover all possibilities in detail.

The following environmental descriptions and table are therefore intended to serve as a guide only. Consult with your roofing supplier or Lysaght representative for the best advice on the most suitable choice of COLORBOND® steel and ZINCALUME® steel product.

In general, atmospheric exposure conditions can be categorised by five main groups; very severe marine, severe marine, marine, moderate and benign, as shown in the table across.

## GUIDE TO SATISFACTORY SERVICE LIFE OF COLORBOND® STEEL, PERMALITE® ALUMINIUM CLADDING AND ZINCALUME® STEEL IN SALT MARINE ENVIRONMENTS

Marine environment severity	Distance from breaking surf	Distance from calm marine	Recommended roofing product
Very Severe Marine (Immediate vicinity to active surf)	0m – 100m	N/A	COLORBOND® Stainless steel PERMALITE® aluminium cladding
Severe Marine (Close to surf)	101m – 200	0m – 100m	COLORBOND® Ultra steel
Marine (Reasonably close to surf)	201m – 400m	101m – 200m	COLORBOND® steel
Moderate (Some distance from surf, close to calm water)	401m – 1000m	201m – 1000m	COLORBOND® steel COLORBOND® Metallic steel ZINCALUME® steel
Benign (Outer urban, semi-rural & rural areas, well removed from shoreline)	1001m +	1001m +	COLORBOND® steel COLORBOND® Metallic steel ZINCALUME® steel

Corrosive Element = Salt laden, moist air

NOTE: Absolute performance is subject to local conditions (e.g. prevailing winds) and presence of unwashed areas

Distance is measured to the high water/tide mark

The above table applies to salt marine influences only. For installations subject to severe or heavy industrial conditions, it is essential to consult your local Lysaght representative for advice on appropriate product selection.

Definitions and examples of surf, exposed and calm marine are outlined in BlueScope Technical Bulletin TB-35 "Australian Marine Classifications". It is essential to consult BlueScope or Steel Direct for advice on the correct product to use for very severe and severe conditions as well as placements in industrial environments that could be corrosive.

Fastener performance is also important to ensure the cladding system offers satisfactory performance. Specific information of fastener performance is included on page 316 onwards. (Further details are available in BlueScope Technical Bulletin 16; Fasteners for Roofing and Walling Product - Selection Guide).

## UNUSUALLY HARSH SERVICE CONDITIONS

There are many activities carried out in sheds and industrial buildings that are quite severe in their effects on steel cladding products.

The micro-environment inside sheds for intensive animal farming provides an example of this. The products recommended by BlueScope for best performance under these conditions are profiles rollformed from a heavy coating mass, zinc-coated base i.e. ZINCFORM® steel G300 or G550 (depending on profile), with a Z450 or Z600 coating class.

ZINCALUME® steel is not suitable for use in intensive animal farming environments.

Any proposed structure for industrial activity involving acids, chemicals, heat and moisture, fossil fuel combustion etc, or any site immediately adjacent to such activity, should be referred to BlueScope for specific recommendations on suitable product. This should include seeking advice on the design of purlins with downturned lips to avoid the build up of contaminants.

Note: This information is an abridged version of BlueScope Technical Bulletin CTB - 22.

## **AVOIDANCE OF CONTACT BETWEEN INCOMPATIBLE METALS OR METAL ROOFING / GUTTER SITUATIONS**

This information is not intended to cover all contingencies where metals incompatibility can cause problems. The subject matter is selective in that it relates to metal roofing/gutter situations, and as such is also pertinent for steel rainwater tanks.

Data provided is based on a relatively small section of AS/NZS 2179:1994 published by Standards Australia. All trades and professions associated with this subject should read and observe the practices and recommendations contained in this useful publication.

Drainage systems should be designed so that direct contact between two or more incompatible metals or alloys does not occur. Drainage from copper or copper alloy roofs, pipes, etc, must not be discharged onto or into aluminium alloy, zinc, zinc-coated or zinc/aluminium alloy-coated steel gutters, downpipes and the like.

The following tables are a guide only. Please refer to your fastener or accessory supplier for further detail.

## COMPATIBILITY OF DIRECT CONTACT BETWEEN METALS OR ALLOYS

Roof drainage system components and any cladding material	Accessories or fasteners or upper surface			
	ZINCALUME® steel	GALVANISED (zinc coated) steel	Zinc	COLORBOND® steel COLORBOND® ULTRA steel COLORBOND® METALLIC steel
ZINCALUME®	YES	YES	YES	YES
GALVANISED	YES	YES	YES	YES
ZINC	YES	YES	YES	YES
COLORBOND® (Standard, Matt, Ultra, Metallic)	YES	YES	YES	YES
COLORBOND® STAINLESS STEEL	NO	NO	NO	NO
STAINLESS STEEL	NO	NO	NO	NO
ALUMINIUM ALLOYS	YES	YES	YES	YES
COPPER AND COPPER ALLOYS*	NO	NO	NO	NO
LEAD	NO	NO	NO	NO

\*Monel – copper/nickel alloy

## ACCEPTABILITY OF DRAINAGE FROM AN UPPER SURFACE TO A LOWER METAL SURFACE

Lower roof drainage system material	Upper cladding or roof drainage system material				
	ZINCALUME® steel	GALVANISED (zinc coated) steel	Zinc	COLORBOND® steel COLORBOND® ULTRA steel COLORBOND® METALLIC steel	COLORBOND® STAINLESS steel
<b>ZINCALUME®</b>	YES	YES	YES	YES	YES
<b>GALVANISED</b>	NO	YES	YES	NO	NO
<b>ZINC</b>	NO	YES	YES	NO	NO
<b>COLORBOND® (Standard, Matt, Ultra, Metallic)</b>	YES	YES	YES	YES	YES
<b>COLORBOND® STAINLESS STEEL</b>	YES	YES	YES	YES	YES
<b>STAINLESS STEEL</b>	YES	YES	YES	YES	YES
<b>ALUMINIUM ALLOYS</b>	YES	YES	YES	YES	YES
<b>COPPER AND COPPER ALLOYS*</b>	YES	YES	YES	YES	YES
<b>LEAD</b>	YES	YES	YES	YES	YES

\*Monel – copper/nickel alloy

## ACCEPTABILITY OF DRAINAGE FROM AN UPPER SURFACE TO A LOWER METAL SURFACE

Lower roof drainage system material	Upper cladding or roof drainage system material				
	Stainless steel	Aluminium alloys	Copper and copper alloys	Lead	Glazed roof tiles & plastic
<b>ZINCALUME®</b>	YES	YES	NO	NO	YES
<b>GALVANISED</b>	NO	NO	NO	YES	NO
<b>ZINC</b>	NO	NO	NO	YES	NO
<b>COLORBOND® (Standard, Matt, Ultra, Metallic)</b>	YES	YES	NO		YES
<b>COLORBOND® STAINLESS STEEL</b>	YES	YES	YES	YES	YES
<b>STAINLESS STEEL</b>	YES	YES	YES	YES	YES
<b>ALUMINIUM ALLOYS</b>	YES	YES			YES
<b>COPPER AND COPPER ALLOYS*</b>	YES	YES	YES	YES	YES
<b>LEAD</b>	YES	YES	YES	YES	YES

\*Monel – copper/nickel alloy

# HANDLING AND SITE NOTES

## INSTALLATION INSTRUCTION

Installation instructions for each LYSAGHT® roofing and walling product are provided online or in individual product literature titled “Using LYSAGHT® Roofing and Walling” available from [www.lysaght.com](http://www.lysaght.com)

## SAFETY ON SITE

It is common sense to work safely, protecting yourself and workmates from accidents on site. Safety includes the practices you use; as well as personal protection of eyes from harm, skin from sunburn\* and hearing from noise.

\*Note: Some sunscreens contain titanium oxides. These have been shown to break down some paint compounds and these sunscreen should be avoided when working with LYSAGHT® pre-painted steel products.

Occupational health and safety laws enforce safe working conditions in most locations. Laws in every state require you to have fall protection which includes safety mesh, personal harnesses and perimeter guard rails. Lysaght recommends that you are fully aware of all local codes of safe practice and you adhere strictly to all laws that apply in your state.

## CARE AND STORAGE PRIOR TO INSTALLATION

LYSAGHT® roofing and walling products are normally delivered to the building site in strapped bundles.

If not required for immediate use, sheets or bundles should be neatly stacked clear of the ground and, if left in the open, protected from rain and moisture with tarpaulins or similar covers. On no account should sheeting in any surface finish be allowed to get wet while still bundled or nested in stacks. Rain or condensation is easily drawn between the surfaces of nested sheets by capillary action, or driven in by wind action. This trapped moisture cannot evaporate normally and can cause deterioration of the coating, which may lead to a reduced life expectancy or poor appearance.

If packs become wet, the sheets should be separated without delay and the surface moisture removed with a clean cloth. The sheets should then be stacked so that air circulation completes the drying process.

Wet storage stain can occur from condensation alone - even in dry weather. All efforts should be taken to keep the product dry prior to installation.

## HANDLING ON SITE

On large building projects, handling time can be reduced by lifting sheet bundles by crane direct from the delivery truck onto the roof frame. For long length sheets, the use of a spreader bar and fabric slings is recommended for this operation. For small to medium size projects, without mechanical handling facilities, sheets can be unloaded by hand and passed up to the roof one at a time.

To assist in handling and protecting 'COLORBOND® steel' accessories (Gutter, Fascia, Flashings and Cappings, Downpipe, etc), BlueScope Lysaght supplies the particular products with a protective film.

If a protective film is present on any steel building product, it is essential that the film be stripped away as soon as possible after installation. Failure to do this can result in problems with stripping.

To preserve the surface finish, and for personal safety, clean, dry gloves should be worn when handling sheets. Do not slide sheets over rough surfaces or over each other and do not drag tools or equipment over sheets. Protecting the finish will ensure optimum performance.

## CUTTING SHEETS ON SITE

For cutting thin metal on site, we recommend a circular saw with a metal cutting blade because it produces fewer damaging hot metal particles (swarf) and a less resultant burr than a carborundum disc.

Cut metals over ground and not over other materials.

Sweep all metallic swarf and other debris from roof areas and gutters at the end of each day and at the completion of installation. Failure to do so can lead to surface staining when the metal particles rust.

Ensure adequate safety procedures are followed when cutting steel.

## WALKING ON ROOF SHEETING

It is important that you walk on steel roofing carefully to avoid damage to either the roofing or yourself.

Generally, keep your weight evenly distributed over the soles of both feet to avoid concentrating your weight on either heels or toes. Always wear smooth, soft soled shoes, avoid ribbed soles that pick up and hold small stones, swarf and other objects.

When walking parallel to the ribs:

- For ribbed roofing profiles (eg. SPANDEK® and CUSTOM ORB®) walk on at least two ribs or corrugations at a time
- For pan-type roofing profiles (KLIP-LOK® 406, KLIP-LOK® 700, TRIMDEK®) walk in the pans

When you walk across the ribs, walk over or close to the roofing supports (usually over fastener locations).

Be careful when moving between supports. Do not walk in the pan immediately adjacent to flashings or translucent sheeting. Walk at least one pan away.

Always take particular care when walking on wet or newly laid sheets – particularly on steep pitched roofs.

If there will be heavy foot traffic on a roof, provide a temporary walkway or working platform with consideration of hand rails to minimise damage.

## **GALVANIC OR ELECTRO-CHEMICAL ACTION**

These terms refer to the corrosion set off when dissimilar metals are in contact with one another in the presence of moisture. This process can have either a positive or negative effect on corrosion protection. In the case of zinc and steel, galvanic action leads to the protection of the steel by the sacrificial corrosion of the zinc. However, conditions can arise where zinc can be severely corroded by reason of its contact with dissimilar metals. In particular, contact with copper or brass, in the presence of moisture, will lead to the rapid removal of zinc from galvanized or ZINCALUME® steel, and likewise the corrosion of the underlying steel.

**DO NOT** use lead head nails or any lead as flashings, washers etc, in contact with ZINCALUME® steel or COLORBOND® steel.

See Incompatible Metals for Metal Roofing/Gutter Situations section on page 307 for more information.

## **CLEANING UP**

Swarf (metal scraps and/or abrasive particles resulting from cutting and drilling) left on the surfaces of LYSAGHT® metallic coated and pre-painted steel building products will cause rust stains which can lead to reduced life of the materials.

To avoid potential issues:

- Sweep or hose all metallic swarf and other debris from roof areas and gutters at the end of each day and at the completion of the installation. Failure to do so can lead to blockages of water flow or surface staining (such as when metal particles rust).
- If swarf has become stuck to the finish it can be removed. Take care not to also remove the paint or metallic coating.
- For critical applications inspect the job two weeks after completion, when rain or condensation will have caused any remaining swarf to rust and thus highlight affected areas.

## WARN OTHER CONTRACTORS

Many stains arising from swarf do so, not from the work of roof installers but from other contractors working on the job. Similarly, problems can arise from contact with incompatible materials like copper piping or chemically treated timber. Acid cleaning of bricks can also be a problem. Remember to warn others of the correct way to walk on the particular roofing profile installed. Architects and builders should be aware of this and warn other contractors accordingly.

## STRIPPABLE COATINGS

To provide temporary protection during production, handling and transport, some products made from COLORBOND® steel are coated with a removable plastic film. This coating peels off easily when new, but has a relatively short life, especially in direct sunlight. If you don't remove this coating at the time of installation, it can be very hard to remove at a later time.

On removal of the plastic film please dispose in an environmentally responsible manner.

# EXTERNAL FASTENERS

When you select fasteners, you should consider the design life of the structure, because the fasteners and the cladding material should have similar life expectancies.

## Fastener change to metric sizing

The Australian fastener industry is moving to a change in fastener description that will bring it into line with international markets. This is an on-going process as product requirements and design changes.

Traditionally self drilling fasteners have been described in gauge (outside thread diameter), by tpi (threads per inch) and by length (mm). The new changes will convert to metric sizing (eg #12 is approx. M5.5)

## MATERIALS FOR SCREWS

Screws are available in a variety of materials, finishes and colours to match COLORBOND® prepainted steel, and design. You should use screws to AS 3566:2002 Class 3 (or better). Additional information on fastener finishes is in BlueScope Technical Bulletin TB-16.

Product	Appropriate screw materials
For most external applications not closer than 400 metres from the ocean or severe marine influence: <ul style="list-style-type: none"> <li>COLORBOND® steel</li> <li>COLORBOND® Metallic steel</li> <li>ZINCALUME® AZ150 steel</li> </ul>	AS 3566 Class 3
For severe exposure conditions: <ul style="list-style-type: none"> <li>COLORBOND® steel (200 to 400 metres from marine environments)</li> <li>COLORBOND® Ultra steel (100 to 200 metres from marine environments)</li> </ul>	AS 3566 Class 4 Where the colour match of fasteners is an overriding consideration, powder coated/painted fasteners may be used
For very severe exposure conditions: <ul style="list-style-type: none"> <li>COLORBOND® Stainless steel</li> </ul>	Stainless steel

Stainless steel fasteners are only recommended for use with COLORBOND® Stainless steel.

## IDENTIFICATION OF SCREWS

The format of the number code is:

12	-	14	x	50
M6	-	11	x	50
Screw gauge (thread outside diameter)		Thread pitch (threads per inch)		Overall length of the screw measured from under the head to the tip of the drill point (mm)
M refers to metric size				

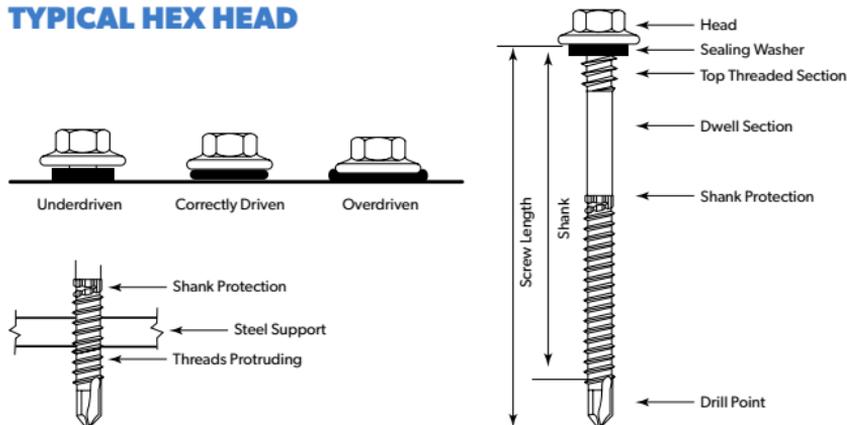
Fasteners must have a coating system to meet AS 3566 Class 3 or AS 3566 Class 4.

Ripple Teks®, AutoTeks®, Teks® and RoofZips® are registered trademarks of ITW Buildex and are recommended for specific applications. Other equivalent quality fasteners which comply to the above standards are also recommended for use with Lysaght roofing and walling products.

Where a screw penetrates roof sheeting (for fixing or stitching), a sealing washer is recommended. The sealing washer is to be an EPDM nonconductive rubber.

Where a screw penetrates the rib of the sheeting (as for roofing), the 'top thread section' feature is recommended to maximise resistance to water penetration.

## TYPICAL HEX HEAD



## Typical types of screws

HEAD		SHANK	DRILL POINT
<b>Hexagon head with integrated metal washer</b> 	Hex. head with EPDM seal	<b>Top Tread Section</b> Extrudes sheeting towards the seal to maximise resistance to water penetration. Grips the sheeting for a secure connection. Stops sheeting from moving when walked on.	Self drilling for metal RoofZip® Point 
<b>Hexagon head with integrated metal washer</b> 	Hex. head with no seal	<b>Dwell Section</b> Prevents the sheeting from riding up during fixing and minimises distortion of the profile.	Self drilling for timber Drill Point. Type 17 
<b>Wafer Head</b> 	Wafer head with no seal	<b>Shank Protection</b> Enlarges the hole in the sheeting to minimise damage to the protective coating on the screw.	Self drilling for metal Drill Point. Standard Metal  Self drilling for metal Extended Drill Point 
<b>Special Self-sealing Head</b> 	RippleZips® screw head with self-sealing head		Self drilling for metal RippleZip® Point 

## Fastener length with insulation, boards and packers

Where insulation (blankets or boards), foam packers or any other packer/board where the cladding screw penetrates through to the support is installed under cladding, you may need to increase the length of screws depending on the density and thickness of the insulation, board or packer.

When the screw is properly tightened:

- Into metal: there should be at least three threads protruding past the support you are fixing to – where rib fixing is done then the ‘shank protection’ must not reach the support.
- Into timber: the screw must penetrate the timber by the same amount that the recommended screw would do if there were no insulation, i.e. same embedment.
- For deep insulation, board or packer the availability of a suitable screw, with all the recommended features and minimum specifications will need to be investigated. It may be necessary to increase the screw gauge accordingly or seek advice from the screw manufacturer. Site trial of screw fixing may need to be conducted to determine the suitability of the selected screw.

## Fixing to steel thicker than 3mm

Use appropriate self-drilling screws with an extended drill point; or pre-drill hole and seek advice from the screw manufacturer on the appropriate screw specifications.

## FASTENER SELECTION

The recommended fasteners and minimum specifications for a cladding are detailed in individual Lysaght Cladding brochures. In areas prone to cyclones special consideration is taken in the selection, design and installation of the complete roof structure. Full details of these considerations are outlined in our Cyclonic Area Design Manual.

Visit [www.lysaght.com](http://www.lysaght.com) for more information.

# ADHESIVES FOR JOINING STEEL SHEET PRODUCTS

In the manufacture of products from steel sheet, adhesives are playing an increasingly important role as the benefits of adhesive joining become more widely known and accepted, and as new adhesives are introduced. The progression from simple natural rubbers to adhesives and resins has seen the achievement of new dimensions in strength, flexibility and resistance to environmental conditions.

## REASONS FOR USING ADHESIVES

Adhesive bonding is often a preferred method for joining and sealing steel sheet. It is particularly beneficial for bonding prepainted sheet.

Subject to a uniform surface condition, the performance of modern adhesives is both reliable and predictable, and joints of moderate strength can be produced. But as with any fastening method, there are limitations as well as advantages.

Advantages include:

- Uniform stress distribution
- Vibration dampening
- Seals as well as bonds
- Joins other materials to steel
- Joins thin steel sheets
- High joint security when combined with mechanical or integral fastening
- Smooth contoured outer surface
- Reduces corrosion caused by galvanic cells

Limitations include:

- Difficulty in the correct choice of adhesive from the large range available, although this gives more flexibility of choice to suit specific requirements
- Need for careful surface preparation for some types
- Relatively long curing times for some adhesives
- Non-destructive inspection of joint is difficult
- Jigs and fixtures may be needed

## Joint Design

To take full advantage of adhesives, joint design in steel sheet must be considered early in the development of the manufactured product. The two main aspects of study are joint bonding and service environment.

Joint loading must be known, including direction and type, i.e. whether the loading is in compression, tension, shear or whether a cleavage or peel loading predominates.

## Application

Adhesives are used both for joining steel sheet surfaces together and for affixing attachments.

Service environment must be known and the appropriate adhesive chosen to withstand all likely temperature, moisture or corrosive conditions. In many instances an adhesive can have the dual roll of supporting the design load and acting as a sealant.

Adhesives may be combined with mechanical fastening or welding systems to give a highly desirable combination of strength combined with the advantage of load distribution over a wide area.

Common methods for applying adhesives include brush, spatula, rolled cartridge extrusion, pneumatic and electric hand guns and, for automated assembly lines, multi-nozzle applicators. Adhesives are often in tape form, with some double sided tapes in varying thicknesses offering high strength under many service conditions.

The complexity of the variations possible with the use of adhesives makes it mandatory for adhesive suppliers to be consulted in the design stage regarding both the product being made and the method of manufacture.

## TYPES AND SELECTION

The variety of adhesives available to a manufacturer is rapidly increasing so it is important to understand the characteristics. The properties of an adhesive can be altered by a change in formulation from a basic type to suit many different requirements, and by mixing the basic types themselves to give a combination of desirable characteristics.

The basic types of adhesives can be broadly categorised into three main groups: thermoplastic, thermoset, elastomeric.

### Thermoplastic adhesives

Thermoplastic adhesives soften when heated. The hot melt group needs heat for application whereas reactive acrylics, anaerobic and cyanoacrylates set at room temperature.

**Hot melt adhesives** - soften in the general working range of 170-200°C. Available as tapes, films, powders, rods, pellets and blocks, they are applied by equipment such as hand-held or automated self-heating guns. At temperature, the adhesive flows onto the surfaces to be joined, giving adhesion and strength as cooling and hardening occurs. No chemical change takes place as the adhesive sets and so it will soften again if reheated.

In general terms, hot melt adhesives are less expensive than other adhesive types and have:

- Good flexibility
- Tolerance to surface condition (less surface preparation)
- High impact resistance
- Low creep strength

Differences in the formulation of hot melt adhesives means there is a wide range of strength properties.

**Reactive acrylics** - are two-pack adhesives and have the advantage of a simple no-mix application with each part applied to one of the faces to be joined, a rapid bond at ambient temperature, good mechanical properties, and a lesser need for surface preparation.

**Anaerobic adhesives** - set when starved of oxygen, such as between closely matching metal surfaces. They are stored in low density polyethylene containers permeable to oxygen to prevent setting before use. Anaerobics are often used to secure tightly fitting joints such as threaded fasteners, gaskets, keyways and splines.

**Cyanoacrylates** - polymerise or harden at room temperature when pressed into a thin film between two tightly fitting surfaces. The hardening is initiated by the presence of a very thin film of moisture always present on surfaces at room temperature.

Both anaerobics and cyanoacrylates produce a high strength bond in tension or shear but are very low in cleavage or peel loadings.

### **Thermoset adhesives**

Thermoset adhesives, for example, the well known epoxy group, undergo chemical change during hardening at room temperature for the two-pack, or elevated temperature for single-pack types. They will not soften when reheated. Characteristics are:

- High strength bonds (often called structural adhesives).
- High creep strength.
- Low impact resistance.
- Less flexible bond than thermoplastic bond.

### **Elastomeric adhesives**

Elastomeric adhesives are the synthetic rubber-based group and usually set with the evaporation of a solvent. They can also be formulated as contact types which produce instant adhesion when adhesive coated surfaces are brought together.

## SURFACE PREPARATION

The object of surface preparation is to remove a sufficient degree of contamination from a surface at a processing cost, compatible with the bond strength required from most adhesives, not only for the initial bond strength but also for the durability of the bond when exposed to normal environmental conditions.

BlueScope organic finished pre-painted steel sheets usually require only a solvent wipe. Uncoated and metal coated steels invariably require more cleaning to remove any oil and dirt contamination and oxide layers from the surface, the degree of removal depending on the adhesive to be used.

Mechanical cleaning, abrasive blasting and chemical etching can also be used for surface preparation of adhesive joints. Because of the many possible differences in both surfaces and adhesives, the adhesive manufacturers' directions should be followed explicitly.

Any calculations for bond areas to give the required joint strength must make allowances for variations in surface treatment likely to be encountered in normal production conditions.

## SPECIAL NOTE ON SOLDERING ZINCALUME® STEEL

Although it is possible to solder ZINCALUME® steel, the process is impractical in the field and is not recommended.

As indicated, alloy solder in a joint is primarily a low mechanical strength sealer capable only of holding joint members in place. Where any significant strength is required the joint needs to be mechanically fastened (screwed, rivetted) or integrally formed (seamed) prior to sealing. For situations where soldering would formerly have been considered, suitable polymeric sealants are available for use in conjunction with mechanical or other fastening systems. The ZINCALUME® steel coating is a zinc/aluminium/magnesium alloy. Essentially due to the aluminium content special solder alloys, fluxes, techniques and high soldering temperatures are required for soldering ZINCALUME® steel.

To ensure that the most up-to-date information on soldering ZINCALUME® steel is obtained, advice should be sought from BlueScope.

# SEALANTS FOR ZINCALUME® STEEL & COLORBOND® STEEL

The sealant industry in Australia produces a wide variety of building sealants which together embrace a multitude of end use applications and an even greater range of specific conditions.

BlueScope considers that NEUTRAL CURE silicone rubber sealants form the most suitable class of sealants for the applications in which its products will be exposed.

Neutral cure silicone rubber sealants meet the necessary requirements of:

- Providing good adhesion to the clean surface of BlueScope's exterior finished products.
- Not requiring a primer except in extreme service conditions. Resisting extremes of both heat and cold while retaining good flexibility.
- Providing very high resistance to the damaging effects of ultra-violet rays (in sunlight) hence achieving long life compatible with the performance of BlueScope's exterior finished products.

Any other generic type of sealant considered should possess similar properties to neutral cure silicone rubber if long term performance is required.

## WELDING

There is a wealth of welding and joining information available for those manufacturing or fabricating steel products. The Welding Technology Institute of Australia (WTIA) is a non-profit organisation whose mission is "to assist in making Australian industry locally and globally competitive in welding related activities".

Among the services provided to industry are concise technical publications, known as Technical Notes, covering a variety of specific welding applications. Additionally, videos are available covering a wide variety of welding topics.

Listed is an abbreviated list of Technical Notes and Videos available. For further information, call the WTIA on 1800 620 820 or (02) 8748 0100, visit [www.wtia.com.au](http://www.wtia.com.au) or email [info@weldaustalia.com.au](mailto:info@weldaustalia.com.au)

<b>Codes</b>	<b>Titles</b>
<b>TN01</b>	The Weldability of Steels (2006)
<b>TN02</b>	Successful Welding of Aluminium (2006)
<b>TN03</b>	Care & Conditioning of Arc Welding Consumables (2006)
<b>TN04</b>	The Industry Guide to Hardfacing for the Control of Wear (2006)
<b>TN05</b>	Flame Cutting of Steels (1994)
<b>TN06</b>	Control of Lamellar Tearing (1985)
<b>TN07</b>	Health & Safety in Welding (2004)
<b>TN08</b>	Economic Design of Weldments (1979)
<b>TN09</b>	Welding Rates in Arc Welding Processes: Part 1 MMAW (1979)
<b>TN10</b>	Fracture Mechanics (2002)
<b>TN11</b>	Commentary AS/NZS 1554 Structural Steel Welding (2004)
<b>TN12</b>	Minimising Corrosion in Welded Steel Structures (1996)
<b>TN13</b>	Stainless Steels for Corrosive Environments (2000)
<b>TN14</b>	Design and Construction of Welded Steel Bins (1984)
<b>TN15</b>	Welding and Fabrication of Quenched and Tempered Steel (1996)
<b>TN16</b>	Welding Stainless Steels (1985)
<b>TN17</b>	Automation in Arc Welding (1986)
<b>TN18</b>	Welding of Castings (1987)
<b>TN19</b>	Cost Effective Quality Management for Welding (1995)
<b>TN20</b>	Repair of Steel Pipelines (2004)
<b>TN21</b>	Submerged Arc Welding (1999)
<b>TN22</b>	Welding Electrical Safety (2003)
<b>TN23</b>	Environmental Improvement Guidelines (2002)

## **BASIC TRAINING MANUALS (WTIA)**

- Manual Metal Arc Welding
- Aluminium Welders Training Manual

Also refer to BlueScope Technical Bulletin TB-21 "Resistance Spot Welding of BlueScope Metallic-Coated Steel Sheet (2004)".

# PAINTING OF ZINC-COATED & ZINCALUME® STEEL SHEET

The painting of ZINCALUME® steel or galvanised steel for either decoration or added protection can be easily and effectively carried out, providing certain basic requirements are observed. Ordinary painting techniques and readily available appropriate paints should be used, but care must be taken in the choice of paint to ensure its suitability for the application in the field; or in the factory.

Painting in the field requires air drying paints. The table opposite summarises the general approach to the field painting of BlueScope Lysaght sheet products.

Painting in the factory, normally on a line designed specifically for the purpose and using elaborate cleaning and pretreatment, usually requires specialist paints systems.

Selection of paint for factory use is dictated by the final use and exposure conditions, and should be chosen in consultation with a reputable paint manufacturer. Interior exposure tends to be less severe than exterior, but many corrosive interior conditions are encountered, e.g. in washing machine cabinets.

Selection of paint for field use should take into account the severity of the environment in which the paint will be exposed, e.g. rural, coastal, industrial or special conditions.

## SECTION 1 - FIELD PAINTING

For satisfactory priming, the surface to be painted must be clean and dry. Dirt should be removed by washing with water containing a little kitchen detergent, and any loose corrosion product removed by the use of a soft nylon bristle brush. Brushing should remove as little of the existing metallic coating as possible.

## GENERAL APPROACH TO THE FIELD PAINTING OF ZINC-COATED OR ZINCALUME® STEEL

Cleaning	Priming and Finishing
1. Remove dirt by washing with water.	1. Select paint system with due regard to environmental requirements.
2. Wipe off greasy deposits with paint thinners.	2. Follow the paint manufacturer's instructions explicitly.
3. Remove any corrosion product by wire brushing, taking care not to unnecessarily remove any of the metal coating.	3. Do not mix different proprietary brands of primer and finisher.
	4. Apply two finishing coats in addition to the primer. Principal exception is zinc-dust/zinc-oxide coatings applied to galvanized steel with two coats in total is usually sufficient.
	5. Finishing coats may be applied directly to ZINCANNEAL® steel without priming, but when the two pack type etch primer is used, the overall protection given by the paint system is very much improved.
	6. Care should be taken to provide adequate ventilation as some volatile compounds may be toxic.
	7. Where possible, contact with the skin should be avoided.

Weathering, formerly considered to improve long term paint adhesion, has since been found to give inconsistent results and is no longer recommended. One exception to this is for water-based acrylic-type paint, where two weeks weathering makes painting easier by improving the wettability of the surface. The choice of paint, as stated earlier, depends principally on the environmental conditions.

Use of the recommended brands should produce a satisfactory result provided care is taken to follow the manufacturers mixing and application instructions. The mixing of different brands of priming and finishing coats should be avoided.

A minimum of two finishing coats in addition to the priming coat is advised. Spray painting can be used providing an experienced applicator is employed and the paint is suitable for this method of application.

At all times it is important to avoid excessive paint build up, as may occur in the valleys of formed roofing panels.

## SECTION 2 – FACTORY PAINTING

The range of metallic coated products produced by BlueScope can all be successfully factory painted. From powder coating to the application of water based acrylics, with the right advice exceptional finishes can be achieved.

Usually, pretreatment is applied to the article after forming and immediately before painting, but the practice of prepainting before forming is increasing. This latter procedure requires special attention to the type and efficiency of the pretreatment system used and also to the selection of appropriate finish coats. Should forming occur after painting, it is often more economical to use prepainted sheet or strip, such as COLORBOND® steel.

A wide variety of basic paint types are available for factory finishing, but it is important to select the most appropriate paint for the particular application. Usually this involves consultation with a reputable supplier in the field, and it is advisable that the supplier's recommendations and directions for the paint systems be incorporated into an integrated process and paint technique. As with 'field' painting, any doubts or queries should be referred to the supplier.

The technique of post-forming painted strip requires special, flexible paint systems and this technique should only be considered in close consultation with a paint manufacturer experienced in this particular field.

### **COLORBOND® STEEL**

In most instances, it is possible - and desirable - to avoid either field or factory painting. COLORBOND® prepainted steel is available in a wide range of roofing and cladding profiles or as coil or sheet for fabrication.

## OVERPAINTING AND RESTORATION OF COLORBOND® STEEL

COLORBOND® prepainted steel for exterior applications is zinc/aluminium alloy-coated or zinc coated steel sheet that is painted on one of BlueScope's continuous strip coating lines. The paint system used is specially formulated for the intended purpose and is oven-cured during the production process.

Several different but related circumstances are encountered in the maintenance of COLORBOND® steel surfaces:

Restoration	The repair of COLORBOND® steel surfaces.
Overpainting	The complete overpainting of the surface, as in the case of normal maintenance after years of service, or where a change of colour is desired.
Accessory Painting or Match Painting	The application of colour-matched paint of unpainted small accessory items to match the COLORBOND® steel colour being used on the building. Such small accessories may include gutter corners, down pipes, fastener heads, windows, pergolas, fascias, and gutter brackets.
Minor Scratches and Blemishes	If the scratches cannot be seen from the road and/or they are less than 2mm in width they should be left alone.
Galling	Generally only superficial damage caused by surfaces rubbing together as a result of vibration and interwrap movement during transport.

Detailed recommendations for overpainting and/or restoring COLORBOND® steel are documented in BlueScope Steel Technical Bulletin TB-2.

## MAINTENANCE

Factors that most affect the long life of a roof (or wall) are original design, the environment of the installation, and the maintenance of the installation. Maintenance is probably the biggest factor.

Maintenance includes:

- Regular inspection for problems before they become major corrosion sites;
- Regular washing down, especially near coastal or industrial influences;
- Removal of leaves and other debris from gutters, downpipes, leaf-guards, slots, holes and other overflow devices;
- Keep walls free of soil, concrete and debris near the ground;
- Don't overspray pesticide.

## Maintenance of COLORBOND® pre-painted steel

The paint system on COLORBOND® steel sheet is very durable. Simple maintenance of the finish enhances its life and maintains attractiveness for longer periods.

Where the paint finish is naturally washed by rainwater (roofs, for example) there is usually no additional maintenance needed. However areas to be washed include soffits, wall cladding under eaves, garage doors, and the underside of eave gutters.

Washing should be done at least every six months and more frequently in coastal areas where sea spray is prevalent, and in areas where high levels of industrial fallout occur. Avoid accumulation of salty deposits or industrial dirt.

Establish a regular routine for washing COLORBOND® prepainted steel products. Often garage doors can be washed with clean water at the same time as your car is being washed. Guttering and eaves can be hosed down when windows are being cleaned. Walls can be hosed down (if water restrictions permit) while watering the garden.

Where regular maintenance doesn't remove all the dirt, wash the surface with a mild solution of pure soap or nonabrasive non-ionic kitchen detergent in warm water. Use a sponge, soft cloth or soft bristle nylon brush; be gentle to prevent shiny spots. Thoroughly rinse off the detergent with clean water.

Never use abrasive or solvent cleaners (like turps, petrol, kerosene and paint thinners) on COLORBOND® steel surfaces.

# USEFUL RURAL INFORMATION

## DETERMINING THE QUANTITY OF HAY IN A STACK

Formulae for the exact calculation of the capacity of a haystack are rather complicated for general use. These formulae are used because of the fact that a haystack is irregular in shape and dimensions. However, since the volume of hay per tonne varies greatly with the age of the hay and its degree of settling, formulae which are not so accurate, but are sufficient for practical purposes, are given below. These will enable the farmer to obtain a reasonable estimate of the amount of fodder available in both rectangular and circular stacks.

## CUBIC CONTENTS OF A RECTANGULAR STACK

To determine the volume of a rectangular stack:

- (a) Multiply length at base in metres by breadth at base in metres.
- (b) Multiply together length and breadth at eaves in metres.
- (c) Add length at base and length at eaves in metres together and multiply this figure by the sum of the breadth at the base and the breadth at the eaves in metres. Add (a), (b) and (c) together and multiply by the height in metres of the eaves above ground level. Divide this product by six, and the result is the volume of the body of the stack in cubic metres.

For the top portion:

- (d) Multiply together the length and breadth in metres at the eaves.
- (e) Multiply the breadth in metres at the eaves by the sum of the length at the eaves and length along the ridge in metres.

Add (d) and (e) together, multiply by the height of the ridge above the eaves in metres and divide by six. This gives the volume of the portion above the eaves which when added to the volume of the body gives the total volume of the stack.

**Example:** Consider a rectangular stack the dimensions of which are: 12m by 6m at base; 15m by 7m at the eaves; 9m long at the ridge; eaves 3m above the ground; ridge 3m vertically above the eaves.

### Cubic Contents of a Regular Stack

Volume of base or body	Volume of portion above eaves
(a) $12 \times 6 = 72$	(d) $15 \times 7 = 105$
(b) $15 \times 7 = 105$	(e) $7 \times (15 + 9) = 7 \times 24 = 168$
(c) $(12 + 15) \times (6 + 7) = 27 \times 13 = 351$	(d) + (e) = 273
(a) + (b) + (c) = 528	$\frac{273 \times 3}{6} = 136.5$ cubic metres
$\frac{528 \times 3}{6} = 264$ cubic metres	
	Total volume = 400.5 cubic metres

## CUBIC CONTENTS OF A CIRCULAR STACK

To determine the volume of a circular stack:

- Measure the circumference at both the base and eaves in metres.
- Add these together and multiply this figure by itself (ie square it).
- Multiply the circumference at the base by the circumference at the eaves and deduct this from the result of (b).
- Multiply the result of (c) by the height in metres of the eaves above the base and divide the result by thirty-eight. The figure obtained is the volume of the body of the stack in cubic metres.

For the top conical portion of the stack, square the circumference in metres at the eaves and multiply the height in metres of the top or peak above the eaves. Divide by thirty eight and the result obtained is the volume in cubic metres of the top portion. By adding the volume of the base and top together, the total content of the stack is obtained.

### Cubic Contents of a Circular Stack

Volume of body of stack	Volume of conical top
$= \frac{[(18 + 21) \times (18 + 21) - (18 \times 21)] \times 3}{38}$	$= \frac{21 \times 21 \times 2}{38}$
$= \frac{(1521 - 378) \times 3}{38}$	$= \frac{882}{38}$
$= 1143 \times \frac{3}{38} = 90.2 \text{ cubic metres}$	$= 23 \text{ cubic metres}$
Total volume = 113.2 metres	

## APPROXIMATE CONTENT OF HAYSTACK

After a paddock has been cut, the farmer will usually know, either from experience or from rough guides such as the amount of twine used, about how much hay is to be stacked.

The size of the haystack built should be in accordance with the expected yield. Stacks are usually about as high above the eaves as below when built in correct proportions, and the following table gives an idea of the content of various sized stacks.

### Mass per stack of hay

Average width (m)	Average length (m)	Height to eaves (m)	Height of ridge (m)	Mass per stack (tonnes)
3	6	2.5	1	1.5
3	6	3	1.5	2
4	8.5	3	3	4
5	9	3.5	3	6
6	15	4	3	15

### Approximate number of cubic metres per tonne of hay

Period	Oats		Wheat		Lucerne (m) <sup>3</sup>
	Sheaf (m) <sup>3</sup>	Loose (m) <sup>3</sup>	Sheaf (m) <sup>3</sup>	Loose (m) <sup>3</sup>	
FRESHLY STACKED	10	11	11	14	11 - 13
ONE MONTH AFTER STACKING	8.5	10	10	11	10 - 11
ONE YEAR AFTER STACKING	8.5	9	9	10	8.5 - 10

## STOCK BREEDING TABLE

Date of Service	Expected Date of Parturition					
	Mares (340 days)*	Cows (283 days)*	Ewes (150 days)*	Does (147 days)*	Sows (116 days)*	Bitches (63 days*)
<b>1 JAN</b>	7 Dec	11 Oct	31 May	28 May	27 Apr	5 Mar
<b>8 "</b>	14 "	18 "	7 "	4 June	4 May	12 "
<b>15 "</b>	21 "	25 "	14 "	11 "	11 "	19 "
<b>22 "</b>	28 "	1 Nov	21 "	18 "	18 "	26 "
<b>29 "</b>	4 Jan	8 "	28 "	25 "	25 "	2 Apr
<b>5 FEB</b>	11 "	15 "	5 July	2 July	1 June	9 "
<b>12 "</b>	18 "	22 "	12 "	9 "	8 "	16 "
<b>19 "</b>	25 "	29 "	19 "	16 "	15 "	23 "
<b>26 "</b>	1 Feb	6 Dec	26 "	23 "	22 "	30 "
<b>5 MAR</b>	8 "	13 "	2 Aug	30 "	29 "	7 May
<b>12 "</b>	15 "	20 "	9 "	6 Aug	6 July	14 "
<b>19 "</b>	22 "	27 "	16 "	13 "	13 "	21 "
<b>26 "</b>	1 Mar	3 Jan	23 "	20 "	20 "	28 "
<b>2 APR</b>	8 "	10 "	30 "	27 "	27 "	4 June
<b>9 "</b>	15 "	17 "	6 Sep	3 Sep	3 Aug	11 "
<b>16 "</b>	22 "	24 "	13 "	10 "	10 "	18 "
<b>23 "</b>	29 "	31 "	20 "	17 "	17 "	25 "
<b>30 "</b>	5 Apr	7 Feb	27 "	24 "	24 "	2 July
<b>7 MAY</b>	12 "	14 "	4 Oct	1 Oct	31 "	9 "
<b>14 "</b>	19 "	21 "	11 "	8 "	7 Sep	16 "
<b>21 "</b>	26 "	28 "	18 "	15 "	14 "	23 "
<b>28 "</b>	3 May	7 Mar	25 "	22 "	21 "	30 "
<b>4 JUNE</b>	10 "	14 "	1 Nov	29 "	28 "	6 Aug
<b>11 JUNE</b>	17 May	21 March	8 Nov	8 Nov	5 Oct	13 Aug
<b>18 "</b>	24 "	28 "	15 "	15 "	12 "	20 "
<b>25 "</b>	31 "	4 Apr	22 "	22 "	19 "	27 "
<b>2 JULY</b>	7 June	11 "	29 "	29 "	26 "	3 Sep
<b>9 "</b>	14 "	18 "	6 Dec	6 Dec	2 Nov	10 "

Date of Service	Expected Date of Parturition					
	Mares (340 days)*	Cows (283 days)*	Ewes (150 days)*	Does (147 days)*	Sows (116 days)*	Bitches (63 days*)
16 "	21 "	25 "	13 "	13 "	9 "	17 "
23 "	28 "	2 May	20 "	20 "	16 "	24 "
30 "	5 July	9 "	27 "	27 "	23 "	1 Oct
6 AUG	12 "	16 "	3 Jan	3 Jan	30 "	8 "
13 "	19 "	23 "	10 "	10 "	7 Dec	15 "
20 "	26 "	30 "	17 "	17 "	14 "	22 "
27 "	2 Aug	6 June	24 "	24 "	21 "	29 "
3 SEP	9 "	13 "	31 "	31 "	28 "	5 Nov
10 "	16 "	20 "	7 Feb	7 Feb	4 Jan	12 "
17 "	23 "	27 "	14 "	14 "	11 "	19 "
24 "	30 "	4 July	21 "	21 "	18 "	26 "
1 OCT	6 Sep	11 "	28 "	28 "	25 "	3 Dec
8 "	13 "	18 "	7 Mar	7 Mar	1 Feb	10 "
15 "	20 "	25 "	14 "	14 "	8 "	17 "
22 "	27 "	1 Aug	21 "	21 "	15 "	24 "
29 "	4 Oct	8 "	28 "	28 "	22 "	31 "
5 NOV	11 "	15 "	4 Apr	4 Apr	1 Mar	7 Jan
12 "	18 "	22 "	11 "	11 "	8 "	14 "
19 "	25 "	29 "	18 "	18 "	15 "	21 "
26 "	1 Nov	5 Sep	25 "	25 "	22 "	28 "
3 DEC	8 "	12 "	2 May	2 May	29 "	4 Feb
10 "	15 "	19 "	9 "	9 "	5 Apr	11 "
17 "	22 "	26 "	16 "	16 "	12 "	18 "
24 "	29 "	3 Oct	23 "	23 "	19 "	25 "
31 "	6 Dec	10 "	30 "	30 "	26 "	4 Mar

\*Average length of gestation period may be subject to slight variation in individual cases.

## CAPACITY OF TANKS – CALCULATIONS

**Square or Rectangular Section** - All dimensions in metres:

Length x breadth x depth = capacity in kilolitres.

**Circular Section** - Capacity in kilolitres given by either of the following rules:

- Exact formula capacity =  $\frac{\pi D^2 h}{4}$
- Approximate formula capacity =  $\frac{8C^2 h}{100}$
- Approximate formula capacity =  $\frac{4D^2 h}{5}$

Where capacity is in kilolitres and:

C = circumference in metres

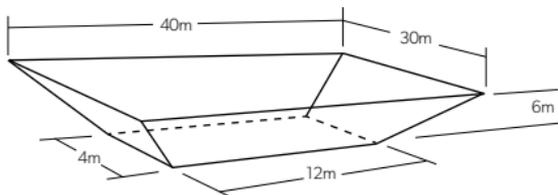
D = diameter in metres

h = height in metres

**Example:** Capacity of a tank with a diameter 2m and height 2m

$$\text{Approximate capacity} = \frac{4D^2 h}{5} = \frac{4 \times 2^2 \times 2}{5} = 6.4 \text{ kilolitres}$$

## HOW TO MEASURE DAMS OR TANKS



In order to calculate the amount of excavation required or the capacity of a dam or tank, as illustrated, the following formula should be used.

(a) Length at bottom multiplied by width at bottom  
 $= 12 \times 4 = 48$

(b) Length at top multiplied by width at top  
 $= 40 \times 30 = 1200$

(c) Sum of the lengths multiplied by sum of the widths  
 $= 52 \times 34 = 1768$

(a) + (b) + (c) = 3016

(a) + (b) + (c) multiplied by the depth and divided by six  
 $= \frac{3016 \times 6}{6} = 3016\text{m}^3$

1 cubic metre is equal to 1 kilolitre.

# AVERAGE DISTRICT RAINFALL THROUGHOUT AUSTRALIA

State or Territory	Map No.	District	Annual fall (mm)
NSW	46	Western Far North West	234.4
	47	Western Lower Darling	257
	48	Western Upper Darling	368
	49	Western SW Plains	349
	50	Central Western Plains South	483.2
	51	Central Western Plains North	479
	52	North-west Plains West	529.3
	53	North-west Plains East	613.7
	54	North-west Slopes North	702.4
	55	North-west Slopes South	674.6
	56	Northern Tablelands Western	832.9
	57	Northern Tablelands Eastern	991.2
	58	North Coast Upper	1269.1
	59	North Coast Lower	1324.8
	60	Manning	1132.3
	61	Hunter	838.3
	62	Central Tablelands North	672
	63	Central Tablelands South	807.6
	64	Central Western Slopes North	614.1
	65	Central Western Slopes South	609.6
	66	Metropolitan East	1111.9
	67	Metropolitan West	960.4
	68	Illawarra	1089.6
	69	South Coast	898.2
	70	Southern Tablelands, Goulburn, Monaro	705.9
71	Southern Tablelands, Snowy Mountains	717.8	
72	South-west Slopes South	881.1	
73	South- west Slopes North	632.5	
74	Riverina East	468.3	
75	Riverina West	380.5	

State or Territory	Map No.	District	Annual fall (mm)
<b>VIC</b>	76	Mallee North	334.9
	77	Mallee South	372.1
	78	North Wimmera	413.8
	79	South Wimmera	549.7
	80	Lower North	418.8
	81	Upper North	536.7
	82	Low North – east	900.8
	83	Upper North –east	985.7
	84	East Gippsland	825.6
	85	West Gippsland	851.7
	86	East Central	956.6
	87	West Central	629.1
	88	North Central	749.9
	89	Western Plains	626.8
90	West Coast	782.3	
<b>TAS</b>	91	Northern	1144.2
	92	East Coast	773.3
	93	Midlands	616.4
	94	South-east	749.6
	95	Derwent Valley	910.2
	96	Central Plateau	1117.2
	97	West Coast Mountain Region	1567.3
	98	King Island	897.5
	99	Flinders Island	741.3
<b>NT</b>	14GA	Darwin-Daly	1183
	14BC	Arnhem	1110.5
	14DE	Roper-Mcarthur	721.1
	14F	Victoria	568.8
	15A	Barkly	430.7
	15B	Alice Springs	277.3

State or Territory	Map No.	District	Annual fall (mm)
SA	16	North-west	184.5
	17	Far North	159.6
	18	Western Agricultural	278.7
	19	Upper North	299
	20	North-east	232.2
	21	Lower North	404.6
	22A	Yorke Peninsula	413.7
	22B	Kangaroo Island	563.8
	23A	Adelaide Plains	488.8
	23B	County Light	481.6
	23C	Mount Lofty Ranges	641.6
	24A	Upper Murray Valley	271.5
	24B	Lower Murray Valley	394.8
	25A	Murray Mallee & Upper Southeast	322.3
	25B	Upper Southeast	446.3
	26	Lower Southeast	620.8
WA	1	North Kimberley	900.6
	2	East Kimberley	571.4
	3	West Kimberley	568.2
	4	De Grey	333.5
	5	Fortescue	307.7
	6	West Gascoyne	234.7
	7	East Gascoyne	235.3
	7A	Murchison	236.7
	8	North Coast	380
	9	Central Coast	697.5
	9A	South Coast	766.9
	10	Central North	349.6
	10A	Central South	423.1
11	Eucla	243.2	
12	South-east	251.7	
13	North-east	294.7	

State or Territory	Map No.	District	Annual fall (mm)
QLD	27	Peninsula North	1331.4
	28	Peninsula South	1080
	29	Carpentaria Lower	670.5
	30	Carpentaria Uppper	641.1
	31	North Coast, Barron	1453.3
	32	North Coast, Herbert	1453
	33	Central Coast East	1014.6
	34	Central Coast West	647.5
	35	Central Highlands	620.9
	36	Central Lowlands	489.6
	37	Upper West	357
	38	Lower West	232.1
	39	South Coast, Port Curtis	806.1
	40	South Coast, Moreton	980.8
	41	Darling Downs East	663
	42	Darling Downs West	602.7
	43	Maranoa	576.1
44	Warrego	434.6	
45	Far South West	248.9	

Information Courtesy Bureau of Meteorology – 2008  
Please refer to map over page for "Map No." references.

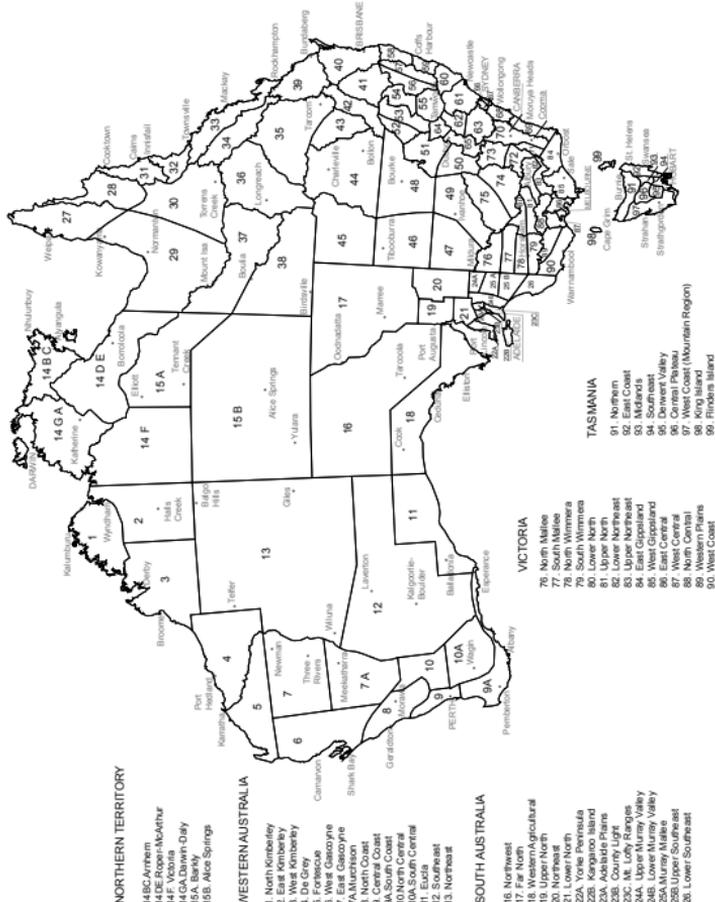
# AUSTRALIAN RAINFALL DISTRICTS

## QUEENSLAND

- 27. North Peninsula
- 28. South Peninsula
- 29. Lower Capriensis
- 30. Barron North Coast
- 31. Herbert North Coast
- 32. Mackay North Coast
- 33. Mackay Central Coast
- 34. Mackay South Coast
- 35. Central Highlands
- 36. Central Lowlands
- 37. Upper Western
- 38. Lower Western
- 39. Port Curtis
- 40. Monsoon
- 41. Upper Darling Downs
- 42. West Darling Downs
- 43. Maranoa
- 44. Warrago
- 45. Far Southwest

## NEW SOUTH WALES

- 46. Western (Far Northwest)
- 47. Western (Lower Darling)
- 48. Western (Upper Darling)
- 49. Western Plains (S)
- 50. Central Western Plains (S)
- 51. Central Western Plains (N)
- 52. Northwest Plains (W)
- 53. Northwest Plains (N)
- 54. Northwest Slopes (N)
- 55. Northwest Slopes (S)
- 56. Northern Highlands (W)
- 57. Northern Highlands (E)
- 58. Upper North Coast
- 59. Lower North Coast
- 60. Hunter
- 61. Murray
- 62. Central Tablelands (N)
- 63. Central Tablelands (S)
- 64. Central Western Slopes (N)
- 65. Central Western Slopes (S)
- 66. Metropolitan (E)
- 67. Metropolitan (W)
- 68. Southern
- 69. Southern Tablelands
- 70. Goulburn/Monaro
- 71. Snowy Mountains (Snowy Mountains)
- 72. Southwest Slopes (S)
- 73. Southwest Slopes (N)
- 74. Riverina (W)
- 75. Riverina (W)



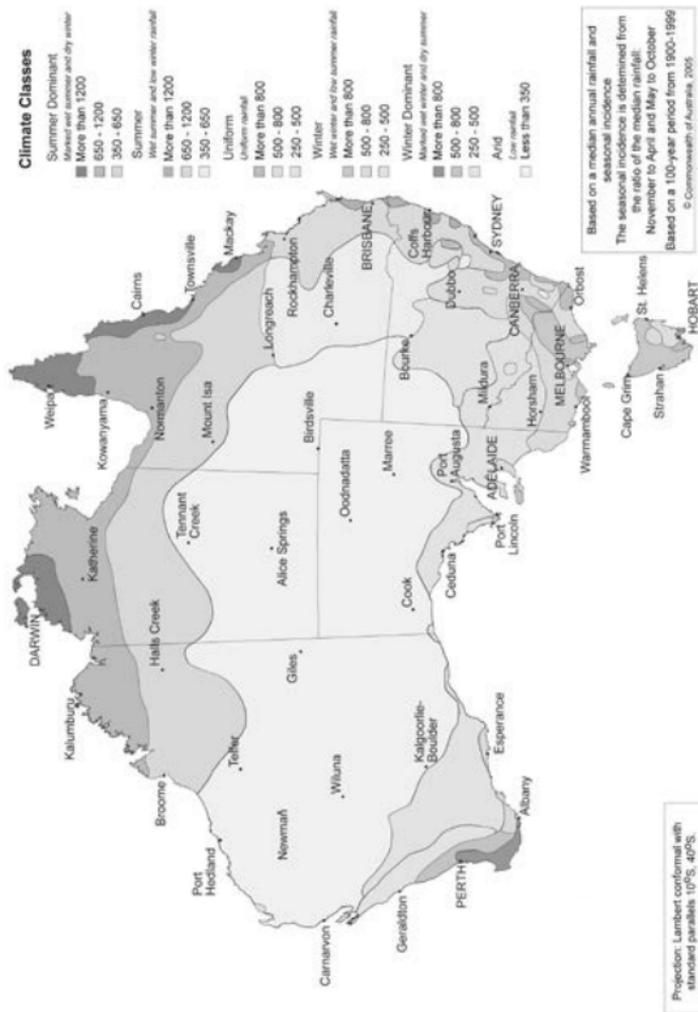
More information available at:  
[www.bom.gov.au/climate/cdo/about/rain-districts.shtml](http://www.bom.gov.au/climate/cdo/about/rain-districts.shtml)

## AREA COASTLINE TROPICAL AND TEMPERATE ZONES

State or Territory	Estimated Area		Length of coastline (km)	Percentage of total area in	
	Total (km) <sup>2</sup>	Percentage of total area		Tropical zone	Temperate zone
<b>NEW SOUTH WALES</b>	800650	10.41	2000		100
<b>VICTORIA</b>	227400	2.96	1900		100
<b>QUEENSLAND</b>	1730650	22.50	7000	54	46
<b>SOUTH AUSTRALIA</b>	983500	12.79	3800		100
<b>WESTERN AUSTRALIA</b>	2529900	32.89	12900	37	63
<b>TASMANIA</b>	68400	0.89	2800		100
<b>NORTHERN TERRITORY</b>	1349100	17.54	5400	81	19
<b>AUSTRALIAN CAPITAL TERRITORY (A)</b>	2400	0.03	50		100
<b>AUSTRALIA TOTAL</b>	7692000	100	35850	39	61

(a) includes Jervis Bay Territory  
Source: Geoscience Australia

# AUSTRALIAN MEDIAN RAINFALL ANNUAL



## AUSTRALIAN REGIONAL RAINFALL CLASSIFICATION



# MAJOR DAMS AND RESERVOIRS IN AUSTRALIA

(H/E = hydro-electricity, FC = flood control and/or mitigation, WS = water supply, Gigalitres = 1000 megalitres)

State or Territory	Name (Year of Completion)	Location and nearest town	Gross capacity gigalitres	Height of wall (m)	Purpose
NSW	Eucumbene (1985)	Eucumbene River Cooma	4,798	116	Part of Snowy Mountains H/E Scheme
	Hume (1936, 1961)	Murray River, near Albury	3,038	51	Irrigation, water supply, H/E
	Warragamba (1960)	Warragamba River	2,057	142	Water supply Sydney, H/E
	Menindee Lakes (1960)	Darling River, near Menindee	1,794	76	Irrigation
	Burrendong (1967)	Macquarie River near Wellington	1,677	76	Irrigation, FC
	Blowering (1968)	Tumut	1,628	112	H/E, irrigation
	Copeton (1976)	Gwydir River, Inverell	1,364	113	Irrigation
	Wyangala (1936, 1971)	Lachlan River, Cowra	1,220	85	Irrigation, stock, etc
	Burrinjuck (1927, 1956)	Murrumbidgee River, Yass	1,026	79	Irrigation, H/E
	Talbingo (1971)	Tumut River, Tumut	921	162	H/E
	Jindabyne (1967)	Snowy River, Cooma	688	72	H/E
	Lake Victoria (1928)	Murray River, near SA border	680		Conserves supply for SA
	Keepit (1960)	Namoi River, Tamworth	423	55	Conservation, irrigation H/E
	Split Creek (1988)	Manilla River, Namoi Valley, Tamworth	372	66	Irrigation
	Windamere (1984)	Cudgong River, near Mudgee	368	69	Irrigation
	Glennies Creek (1983)	Hunter Valley, near Singleton	284	65	Irrigation, industrial, mining, water supply
	Glenbawn (1958, 1987)	Hunter River, near Scone	759	100	Conservation, irrigation, FC
	Tantangara (1960)	Murrumbidgee River, Cooma	254	45	H/E
	Avon (1927)	Avon River, Mittagong	214	72	Water supply for Sydney
	Grahamstown (1969)	Grahamstown, near Newcastle	153	12	Industrial, mining, water supply
Lake Brewster (1952)	Lachlan River, near Hillston	150		Irrigation	

State or Territory	Name (Year of Completion)	Location and nearest town	Gross capacity gigitalitres	Height of wall (m)	Purpose
NSW	Liddell (1968)	Gardiner Creek, near Muswellbrook	148	43	Cooling water for thermal electricity generation, WS
	Tallowa (1976)	Shoalhaven River, near Nowra	115	43	WS for Sydney, H/E
	Googong (1979)	Queanbeyan River	125	62	Canberra region
VIC	Dartmouth (1979)	Mitta Mitta River	4000	180	Irrigation, water supply, H/E
	Eildon (1927, 1955)	Upper Goulburn River, Alexandra	3390	79	Irrigation, H/E
	Thomson (1984)	Thomson River, near Moe	1175	164	Irrigation, water supply
	Waranga (1910)	Near Rushworth (Swamp)	411	12	Irrigation
	Mokoan (1971)	Winton Swamp, near Benalla	365	10	Irrigation, water supply
	Rocklands (1953)	Glenelg River, Hamilton	348	28	Domestic and stock water supply
	Eppalock (1964)	Campaspe River, Bendigo	312	45	Irrigation, water supply
	Cardinia (1973)	Cardinia Creek, near Emerald	289	86	Water supply for Melbourne
	Upper Yarra (1957)	Warburton	207	89	Water supply for Melbourne
	Blue Rock (1984)	Tanjil River, near Moe	200	75	Industrial, mining, WS
	Glenmaggie (1927, 1958)	Macalister River, Sale	190	37	Irrigation
	Cairn Curren (1956)	Loddon River, near Newstead	148	44	Irrigation
	Yarrawonga (1939)	Murray River	117	22	Irrigation
	Toolondo (1952, 1960)	Natural depression, near Horsham	107		Domestic and stock water supply
	Winneke (1980)	Sugarloaf Creek	100	89	Water supply
WA	Lake Argyle (Ord) (1972)	Ord River, near Wyndham	5797	99	Irrigation, FC, H/E
	South Dandalup (1973)	Pinjarra	208	43	Water supply for Perth
	Wellington (1933, 1944, 1960)	Collie	185	37	Water supply, irrigation, H/E
	Serpentine (1961)	Perth	185	55	Water supply for Perth
	Harding (1985)	Harding River, Pilbara	114	42	Water supply, industrial, mining

State or Territory	Name (Year of Completion)	Location and nearest town	Gross capacity gigitalres	Height of wall (m)	Purpose
QLD	Burdekin (1987)	Burdekin River, near Townsville	1860	55	Irrigation, water supply
	Fairbairn (1972)	Nogoa River, Central Qld, Emerald	1440	49	Irrigation, industrial
	Wivenhoe, (1986)	Brisbane River, near Ipswich	1150	59	H/E, FC, water supply
	Somerset (1959)	Stanley River	893	50	WS for Brisbane, H/E
	Fred Haigh (1974)	Kolan River, near Gin Gin	586	52	Irrigation
	Proserpine Dam (1989)	Proserpine River, near Bowen, QLD	500	51	Water supply, irrigation
	Ross River (1974)	Near Townsville	417	35	FC, water supply
	Tinaroo Falls (1958)	Barron River, Mareeba	407	47	Irrigation, H/E
	Awoonga High Dam (1985)	Boyne River, near Gladstone	250	45	Industrial, mining, water supply
	Glenlyon (1976)	Pike Creek, near Stanthorpe	261	62	Irrigation
	Boondooma (1983)	Boyne River, near Proston	212	64	Irrigation, water supply
	North Pine (1975)	North Pine, near Brisbane	205	44	Water supply
	Wuruma (1968)	Nogo River, near Eidsvold	194	46	Irrigation
	Koombooloomba (1961)	Tully River, Innisfail	212	52	H/E, irrigation
	Callide Dam (St. II) (1986)	Callide Creek, near Biloela	127	35	Irrigation, water supply, industrial, mining
	Julius (1977)	Leichhardt River, near Mt Isa	127	35	Irrigation, water supply, industrial, mining
	Bjerkle Petersen (1988)	Barker Creek, near Murgon, Qld	125	43	Irrigation
	Leslie Dam (St. II) (1985)	Sandy Creek, near Warwick	108	34	Water supply, irrigation
	Lake Moondarra (1957)	Leichhardt River, near Mt Isa	107	27	Water supply, mining, industrial
	Eungella (1969)	Broken River Collinsville	131	49	Water supply, irrigation, industrial, mining
Beardmore (1972)	Balonne River	101	15	Water supply, irrigation	

State or Territory	Name (Year of Completion)	Location and nearest town	Gross capacity gigitalitres	Height of wall (m)	Purpose
TAS	Lakes Gordon and Pedder (1974)	Gordon	11316	140	H/E
	Scotts Peak (1973)	South west (Queenstown)	2960	43	H/E
	Serpentine (1971)	Strathgordon	2937	38	H/E
	Edgar (1993)	Strathgordon	2937	17	H/E
	Miena (1967)	Great Lake, Launceston	3356	28	Storage for H/E
	Lake St Clair (1938)	Central Plateau	Est 2000	3	Natural storage for H/E
	Crotty Dam (1990)	King River, near Queenstown, Tas	1091	83	H/E
	Mackintosh (1981)	Mackintosh River, near Queenstown	949	75	H/E
	Tullibardine (1981)	Tullibardine River near Queenstown	25		H/E
	Lake Echo (1956)	Queenstown	725	19	H/E
	Lower Pieman (1985)	Pieman River, near Queenstown	641	122	H/E
	Lake King William (Clark) (1949, 1966)	Derwent River, Queenstown	541	67	H/E
	Arthur's Lake (1965)	Source of Lake River, near Great Lake, Launceston	511	17	H/E
	Devils Gate (1969)	Forth River, near Devonport	180	84	H/E
	Rowallan (1967)	Mersey River	131	43	H/E
	Bastyan (1983)	Pieman River, near Queenstown	124	75	H/E
Cethana (1971)	Forth River, near Devonport	109	110	H/E	
NT	Darwin River (1972)	Darwin River	259	31	Water supply for Darwin

Note: This information was compiled from the "Register of Dams in Australia", which lists some 260 dams completed between 1857 and 1988. Of these some 132 have a wall height above 40 metres which places them in a significant category. However, due to space restrictions we have listed only those with a reservoir gross capacity above 100,000 10(3) M(3) (100 gigitalitres). We acknowledge the assistance from the "Australian National Committee on Large Dams".

# AERIAL AGRICULTURE

Aircraft are widely used in Australia for top dressing and seeding, for spraying and dusting of crops and pastures, and for pest and vermin extermination.

Aircraft are permitted to take off from, or land at, any place that is suitable for use as an aerodrome with safety being the paramount consideration. This means that landing areas may be determined by the operator, providing they meet the minimum requirements specified by the Civil Aviation Safety Authority (CASA).

Paragraph 92(1) "Use of Aerodromes" of the Civil Aviation Regulations (CAR) states:

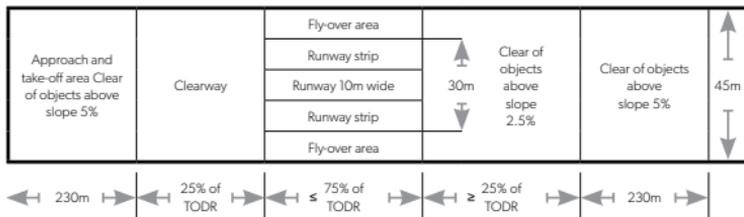
A person must not land an aircraft on, or engage in conduct that causes an aircraft to take off from, a place that does not satisfy one or more of the following requirements:

- (a) the place is an aerodrome established under the Air Navigation Regulations;
- (b) the use of the place as an aerodrome is authorised by a certificate granted, or registration, under Part 139 of CASR;
- (c) the place is an aerodrome for which an arrangement under section 20 of the Act is in force and the use of the aerodrome by aircraft engaged in civil air navigation is authorised by CASA under that section;
- (d) the place (not being a place referred to in paragraph (a), (b) or (c) is suitable for use as an aerodrome for the purposes of the landing and taking-off of aircraft;

and, having regard to all the circumstances of the proposed landing or take-off (including the prevailing weather conditions), the aircraft can land at, or take-off from, the place in safety.

Use of landing areas other than aerodromes is not recommended for aircraft with a MTOW (Maximum Take Off Weight) greater than 5700 kg.

## DIMENSIONS – AGRICULTURE DAY OPERATIONS ONLY



(TODR – Take Off Distance Required)

## RECOMMENDED MINIMUM PHYSICAL CHARACTERISTICS OF LANDING AREAS

- Runway width** - for other than agricultural operations, a minimum width of 15 metres is recommended, although aeroplanes with a MTOW below 2000 kg can be operated safely on runways as narrow as 10 metres provided there is no or only light cross-wind. For agricultural operations, a 10 metre wide runway is the recommended minimum.
- Runway Length** - for agricultural day operations, the minimum runway length is the greater of 75% of the take-off distance specified in the aeroplane's flight manual or approved performance chart for the prevailing conditions with the balance as clearway or the landing distance so specified.
- Longitudinal Slope** - for agricultural operations, the slope should not exceed 12.5% for day and 2% for night operations: where the overall slope exceeds 2% the runway should only be used for one-way operations - downhill for take-off and uphill for landing.
- Transverse Slope** - for agricultural day operations, the transverse slope should not be more than 3% over the runway and 5% over the runway strip.

A pilot should not use a landing area or have an aeroplane engine running unless the aeroplane is clear of all persons, animals, vehicles or other obstructions.

A pilot should not use a landing area without taking all reasonable steps to ensure the physical characteristics and dimensions are satisfactory. For aerial

work and charter operations the operator should provide evidence to the pilot on the suitability of a landing area prior to its use.

Runway lengths calculated for take-offs and landings should be increased by 50% for agricultural operations on one-way runways at night.

**Geographic Location** - a landing area should not be located:

- (a) within the area or in such close proximity as to create a hazard to aircraft conducting a published instrument approach, excluding the holding pattern; or
- (b) within any area where the density of aircraft movements makes it undesirable; or
- (c) where take-off or landing involving flight over a populated area creates an unnecessary hazard.

Except in an emergency, the consent of the owner/occupier is required before a landing area may be used.

If the proposed landing area is located near a city, town or populous area or any other area where noise or other environmental considerations make aeroplane operations undesirable, the use of such a landing area may be affected by the provisions of Commonwealth or State environmental legislation. It is the responsibility of the pilot and/or operator to conform with these requirements.

A method of determining the surface wind at a landing area is desirable. A windsock is the preferred method.

The surface of a landing area should be assessed to determine its effect on aeroplane control and performance. For example, soft surfaces or the presence of long grass (over 150mm) will increase take-off distances while moisture, loose gravel or any material that reduces braking effectiveness will increase landing distances.

## SURFACE TESTING OF A LANDING AREA

- **Rough Surfaces** - the presence of holes, cracks and ruts will degrade aeroplane performance and handling and increase the possibility of structural damage. The smoothness of the runway can be tested by driving a stiffly sprung vehicle along the runway at a speed of at least 75kph. If this is accomplished without discomfort to the occupants, the surface can be considered satisfactory.
- **Soft, Wet Surfaces** - a test vehicle as indicated in the table below should be driven in a zig-zag pattern at a speed not exceeding 15kph along the full length and width of the runway. Particular attention should be paid to suspect areas with possibly three passes over these areas. If tyre imprints exceed the depth of 25mm the surface is not suitable for aircraft operations represented by the test vehicle. Experience may prove that for a certain type of aircraft (e.g. an aircraft with small wheels or high tyre pressure) operations are unsafe with a lesser imprint. Testing with a crowbar should also be done in several places along the runway to ensure that a dry surface crust does not conceal a wet base.

User Aircraft Weight	Suggested Vehicle to be used for test
1. MTOW not exceeding 2000kg	Fully laden utility, 4WD, station sedan
2. MTOW 2001kg to 3400kg	Fully laden 1.5 tonne truck or lightly laden 3 tonne truck
3. MTOW 3401kg to 5700kg	Fully laden 3 tonne truck

Attention should also be given to the remainder of the strip as this area is provided for run-off in the event of an abnormal take-off or landing

Note: We reiterate these excerpts cover Agriculture Day Operations only and acknowledge the assistance of the Civil Aviation Safety Authority Australia.

Responsibility for aviation in Australia is shared between the Civil Aviation Safety Authority and Air Services Australia. Civil Aviation Regulations and other information relevant to aircraft operation can be viewed on the CASA web site, [www.casa.gov.au](http://www.casa.gov.au). Air Services Australia manages air space and provides air navigation and rescue services. More information at [www.airservicesaustralia.com](http://www.airservicesaustralia.com).

It is recommended the latest detail is obtained from the CASA prior to runway design and installation.

# SUSTAINABILITY

Sustainability is about maintaining the quality of the natural environment while providing for human needs. In terms of how BlueScope operates, this means minimising any negative effects the business has on the environment and society, whilst ensuring viability in the long-term. This 'triple bottom line' can be thought of as people, planet and product.

Sustainability is one of the major issues of our world today. As governments, businesses and communities the world over try to solve social, economic and environmental challenges, trying to achieve sustainability will affect our lives on a day-to-day basis.

Sustainability is becoming increasingly important to BlueScope and its customers. BlueScope takes sustainability very seriously and is continuing to look for ways to reduce its environmental footprint and develop products that can be used to help create a sustainable built environment.

## LIFE CYCLE OF STEEL

One of the best ways to evaluate the environmental sustainability of any good or service is to use a life cycle approach. This means that impacts or effects are assessed over the entire life of the product, from cradle-to-grave – accounting for impacts associated with raw material extraction; product manufacture; product use; disposal or recovery at the end-of-life; and any transport.

## RAW MATERIALS IN STEEL

BlueScope uses virgin materials, including iron ore, coke, fluxes and scrap steel, to produce their range of steel products. Scrap is an important ingredient as it maintains the thermal balance of the steelmaking vessel. It also makes steel one of the few materials in the world to have guaranteed recycled content.

## WATER USE

Water is an important component in the steelmaking process. Predominantly due to the implementation of a major water-recycling programme in late 2006, only 2% of the water required for processes at Port Kembla Steelworks comes from portable municipal supply.

## MANUFACTURING – EFFICIENT PRODUCTION

BlueScope has made a commitment to continually improve the company's environmental footprint and minimising waste is a key to being sustainable. For example, slag that is generated in the steelmaking process is an important raw material input to the concrete industry as a cement substitute.

Additionally, BlueScope is developing new ways to reduce the amount of steel needed to perform specific functions, called dematerialisation. For example, residential roofing that was once 0.55mm thick is today made from high strength COLORBOND® steel which is 0.42mm thick, a 24% reduction without any loss in performance.

## STEEL AND TRANSPORT

Steel products are lightweight compared to many other materials used for the same purpose. Therefore, the advantages of using steel may start before materials even reach the construction or manufacturing site.

1kg of steel would likely clad approximately nine times the area that 1kg of roof tiles could (see table below). This means that more flat steel can be transported in each load than many other materials that can be used for the same purpose.

### The unit mass (kg/m<sup>2</sup>) of different roofing materials

ROOFING MATERIAL	UNIT MASS (kg/m <sup>2</sup> )
Concrete roof tiles	44
Fibre cement roofing @ 6mm	19
Fibre cement sheet roofing @ 7mm (commercial/industrial)	14
Hardwood roofing @ 10mm	8.5
Steel roofing @ 0.5mm (residential)	4.9
Steel roofing @ 0.53mm (commercial/industrial)	5.6
Synthetic rubber membrane roofing @ 1.5mm	1.84
Terracotta roof tiles	49

Source: Lawson, B. (1996) Building Materials Energy and the Environment: Towards Ecological Sustainability. The Royal Australian Institute of Architects, ACT, Australia.

## USE OF STEEL

### Design for Climate

It is now widely accepted that the changes to the composition of the Earth's atmosphere due to human activities, such as deforestation, industrialisation and urbanisation has affected, and will continue to affect many aspects of local, regional and global climate. For each of the elements of Australia's harsh climate, BlueScope products offer a way to avoid or mitigate some of the impacts now, and in the future.

Temperature range, rainfall frequency and intensity, storm severity, cyclonic activity and bushfire frequency and intensity are all predicted to change across Australia over the coming decades. Steel products can be used in new construction and retrofit projects to help mitigate these expected changes. For instance, roofing and cladding manufactured from COLORBOND® steel with Thermatech® solar reflectance technology reduces the amount of solar radiation (and consequently heat) absorbed into buildings and independent testing has found steel products to be more resistant to fire than other materials used for the same purpose.

### Design for Sustainability

The sustainability advantages of including steel products in sustainable designs are manifested at every stage of a development's life – from construction, to use, to eventual decommissioning.

## Potential key advantages of incorporating steel products over the life cycle of a development

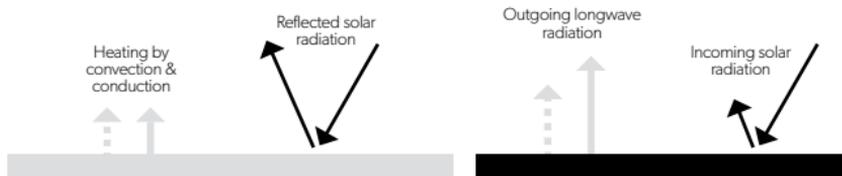
Building Life Cycle	Attribute	Properties of Steel	Key Advantage	
<b>TRANSPORTATION</b>		Lightweight	Potentially reduced transport costs due to decreased number of loads and/or reduced fuel consumption.	
<b>CONSTRUCTION</b>	Waste	Prefabricated and pre-cut components	Less waste on-site; waste produced off-site can be recovered and reused.	
	On-site safety		Safer building sites.	
	Construction time and cost	Lightweight	Easier to assemble; reduced construction time; may reduce construction costs.  Reduced need for heavy lifting equipment; may reduce construction time and cost.	
<b>FOUNDATIONS</b>	On-site disturbance		Option to use pillar (suspended floor) construction; leads to less damage to site and potentially reduced landscaping costs.	
	Off-site disturbance		Less disruption of nearby built and natural environments e.g. noise, traffic, sedimentation.	
	Materials use	High strength		Material efficiency – fewer resources required; cost effective.
		High strength – weight ratio		Potential reuse of existing structures.
		Dematerialisation		Innovation has allowed reduction in thickness and increased manufacturing efficiency.

Building Life Cycle	Attribute	Properties of Steel	Key Advantage
USE	Adaptability	High strength – weight ratio	Large internal volumes are more easily redefined. Ability to reduce the overall mass of a building
	Ventilation		One-room-thick designs; good cross-ventilation; improved indoor air quality (IAQ); good light penetration; passive solar heating and passive cooling.
	Thermal comfort and energy consumption	Design flexibility	Flexibility in design and aesthetics of decking and eaves to suit the climate zone.
		Low thermal mass	Roof retains low levels of heat from solar radiation compared to high thermal mass materials then enables reverse mass and lightweight construction.
		Solar absorptance	Light colours reflect energy; dark colours absorb energy. Low solar absorptance can help meet legislative requirements; helps reduce the intensity of urban heat islands (UHIs).
		Prefabrication	Tight envelopes minimise air leakage.
Durability			
END-OF-LIFE	Reuse	Long lifespan	Designs for disassembly and reuse.
	Recycling	100% recyclable	Reduces waste to landfill.

## Cool Roofs

Cool roofs help maintain thermal comfort and minimise energy demand in buildings as well as reduce the intensity of Urban Heat Islands. Cool roofs have high solar reflectivity, and preferably, high thermal emittance.

High solar reflectivity means that less energy is absorbed into the roof initially. This reduces the heat that can move from the roof to the atmosphere by convection and conduction – the surface temperature of a cool roof can be up to 39°C less than a dark coloured roof.



**Cool roofs** - limit heating due to high reflectance and maximise heat loss via re-radiation due to high thermal emittance.

**Hot dark roofs** - heat the atmosphere (and the home) due to high absorption of solar radiation.

BlueScope produces a range of roofing products with high solar reflectance that can be integrated into designs to improve thermal comfort. The solar reflectance of COLORBOND® steel for roofing has been improved due to the addition of Thermatech® solar reflectance technology to all 20 standard COLORBOND® steel colours at no additional cost to consumers.

The Building Code of Australia (BCA) and New South Wales BASIX classify roof colour based on solar absorptance – the inverse of reflectance – expressed as a ratio between 0 and 1. Solar absorptance values are based on as-new / unweathered product. A value of 0 indicates that a roof absorbs none of the incoming solar radiation, whereas a value of 1 would mean that a roof absorbs 100% of the incoming radiation.

Three classes have been established by the building codes, and by choosing colours in the lightest two categories, designs may qualify for an insulation concession in warm climates under deemed-to-satisfy provisions. For most Australian climates, the use of these products may also improve the energy performance of a modelled design – when modelling tools are used to demonstrate compliance.

### BCA 2010 Roofing Solar Absorptance

Product	Very Light Solar Absorptance <0.4	Light Solar Absorptance <0.6
<b>STANDARD COLORBOND® STEEL</b>	Classic Cream™	Paperbark®
	Surfmist®	Evening Haze®
		Shale Grey™
		Dune®
		Cove®
		Windspray®
		Pale Eucalypt®
<b>COLORBOND® METALLIC STEEL</b>	Galactic®	Rhea®
	Cosmic®	
<b>COLORBOND® COOLMAX® STEEL</b>	Whitehaven®	

## BASIX residential Roofing Solar Absorptance [NSW Class 1, 2, 4 & 10 Buildings]

Product	Very Light Solar Absorptance <0.4	Light Solar Absorptance <0.6
<b>STANDARD COLORBOND® STEEL</b>	Classic Cream™	Paperbark®
	Surfmist®	Evening Haze®
		Shale Grey™
		Dune®
		Cove®
		Windspray®
		Pale Eucalypt®
<b>COLORBOND® METALLIC STEEL</b>	Galactic®	Rhea®
	Cosmic®	
<b>COLORBOND® COOLMAX® STEEL</b>	Whitehaven®	
<b>METALLIC COATED STEEL</b>	ZINCALUME® steel	

## HEALTHY INDOOR SPACES

Pre-painted steel products manufactured by BlueScope are classified as low VOC (Volatile organic compounds) emitting, resulting in better indoor air quality, protecting the health of building occupants.

## MEETING GREEN STAR™ REQUIREMENTS

Launched in 2002, and endorsed by the World Green Building Council, the Green Building Council of Australia (GBCA) is a national, not-for-profit organisation that aims to develop a sustainable property industry in Australia by encouraging the adoption of green building practices. To this end, the GBCA developed Green Star™ as a national rating scheme to evaluate the environmental design and achievements of buildings. The high strength of BlueScope's steel products can help accrue Green Star points. The steel credit (Mat-6) focuses on encouraging environmentally responsible production, design and fabrication methods that result in the efficient use of steel as a building material.

There are nine categories that make up each Green Star™ tool. Once all credits in each category are claimed and verified, a percentage score is calculated, and Green Star™ environmental weighting factors applied. Weighting factors vary according to State and Territory, to reflect the diversity of environmental concerns across Australia. The result is a weighted score out of 100. There are three levels of achievement:

- 4 Star Green Star™ Certified Rating (score 45-59) signifying Best Practice;
- 5 Star Green Star™ Certified Rating (score 60-74) signifying Australian Excellence; and
- 6 Star Green Star™ Certified Rating (score 75-100) signifying World Leadership.

Green Star™ certification is a formal process certified by the GBCA, although any developer can use the Green Star™ tools as a guide to track and improve the environmental performance of their project.

In Office v3 the materials that make up the building envelope account for 21 of the 141 points available across the nine categories. Of the 21 points in the Materials category, steel accounts for a maximum of two points.

The Steel credit (Mat-6) focuses on encouraging environmentally responsible production, design and fabrication methods that result in efficient use of steel as a building material set out below and is sourced from a responsible steel maker (defined as steelmakers with ISO 14001 certification and worldsteel Climate Action Program membership). BlueScope is a responsible steelmaker; therefore, BlueScope products meet the mandatory requirements of the credit.

## RECYCLABILITY

Recyclability refers to how effectively and efficiently a product or material can be recycled into a new product. Steel is theoretically 100% recyclable; if recovered at the end of each use phase, the life cycle of steel is potentially endless. Recycling prevents the waste of potentially useful materials; reduces consumption of raw materials and energy; and reduces pollution. Scrap steel is an important component in all steel products, which means that steel is one of the only materials in the world to have guaranteed recycled content.

For further information visit [www.bluescope.com/sustainability](http://www.bluescope.com/sustainability) or call 1800 800 789.

# REDUCING OUR ECOLOGICAL FOOTPRINT

Our ecological footprint is the measure of the impact our lifestyle has on the environment. It estimates the amount of land or space that is required to provide the resources needed to support our standard of living. The size of our house, the amount of energy we use, the kind of transport we use, the amount of waste we produce, and even the kinds of food we eat, all affect the size of our footprint. The average Australian footprint is around seven hectares per person, which is one of the highest in the world and compares to just 0.5 of a hectare in a poor country like Bangladesh, or 1.2 hectares in China. If everyone in the world had an ecological footprint as big as ours, we would need at least four more planet Earths to accommodate them.

Fortunately there are many things we can do to reduce the size of our ecological footprint and ease the stress on Earth's fragile eco-systems.

Australians dump about 10 million tonnes of waste each year of which more than half is made up of food scraps or garden waste. Instead of dumping these scraps they can be made into compost for your garden to add vitality to the soil, especially if you grow your own vegetables. Compost can be used as a potting mix for raising seeds, as a fertiliser for container plants, vegetables, ornamental shrubs or trees, and as a top dressing for lawns.

## HOW TO MAKE COMPOST

Choose a composting system that suits you - an open heap, an enclosure, or a bin with lots of air holes (available at most garden shops) and select a sunny, well-drained location. Start with a 10-15 cm layer of twigs, sticks and dry leaves and lay this as a base which will provide drainage and aeration.

You can then add a range of organic materials including kitchen scraps and some manures. Keep a sealed bucket in the kitchen for food scraps including coffee grounds, tea bags, fruit and vegetable peelings and other scraps such as eggshells and fish bones. Keep grass clippings, raked leaves, etc. in piles so you can add them in layers together with weeds (but no oxalis, onion or nutgrass bulbs) and garden prunings. Add the organic materials in layers no more than 10 cm deep, alternating between nitrogen rich (food scraps, manure etc.) and nitrogen poor (twigs, dry leaves etc.). Shredded newspaper and pizza boxes can also be added. Dog and cat faeces are a source of parasites and should not go into the compost.

Ensure that each layer is as slightly wet and occasionally add a thin (3-5 cm) layer of soil to keep microbe levels up. Also add a sprinkling of lime, dolomite or wood ash after layers of manure and food and cover the heap with a hessian sack. When the heap is full you can start a second heap, leaving the first to break down; or remove the enclosure from the heap and relocate it next to the original heap. Start the new heap by forking the top uncomposted material into the enclosure. The finished compost at the bottom of the original heap is ready to use.

## HOW TO MAKE A WORM FARM

Worm farms are another great way of turning kitchen waste into useful fertiliser, especially for people who live in units or houses with a small yard. Worms can eat the equivalent of their body weight in food scraps a day producing castings that are a rich soil conditioner or plant food. You can use small containers (such as a styrofoam box) with drainage or buy a commercially produced worm farm from a garden shop or nursery. Put the container in a shaded position that will not get too hot or too cold. Worms prefer temperatures between 20 and 25°C. Place a few sheets of moistened newspaper on the base of the tray and add a layer of bedding - a mixture of shredded newspaper and either composted horse or cow manure, worm castings or coco peat to a depth of 10-15cm. Add soil for grit, then add water so that the mixture is as wet as a lightly squeezed sponge. You will need from 1000 to 2000 worms, which can be purchased from some garden nurseries or through relevant websites.

There is no need to bury them - they will quickly move away from the light. Cover with a damp hessian sack or newspaper and leave for a week. This allows the worms to adapt to their new home. Begin adding small amounts of food scraps in shallow troughs. Only add more food scraps when the worms have worked through the existing scraps. After a number of months, you will be able to increase the amount of food. Worms will also eat shredded egg cartons, cardboard and paper. Add small sprinklings of lime if a lot of acidic materials (fruit peelings, etc.) are used. Shredding food scraps will speed up the worm system.

When the entire container has been converted to castings (vermicast or worm manure) empty the contents onto a table and leave it for a few minutes to allow the worms to burrow away from the surface. Scrape away the castings, layer by layer until you are left with a ball of worms, ready to use again. The castings can then be added to potting mix or used as plant food.

## OTHER WAYS TO REDUCE WASTE

1. Reduce, reuse and recycle whenever possible.
2. Don't use plastic shopping bags. Keep re-useable calico bags in the car for when you shop. And put fruit and vegetables straight into the supermarket trolley rather than in individual plastic bags. Decline a plastic bag if you are only buying one or two items that you can easily carry.
3. Buy in bulk.
4. Only buy items in recyclable packaging, including cardboard, glass or steel cans and decline over-packaged goods.
5. Put a "No Junk Mail Please" notice on your mail box.
6. Reuse milk cartons and cans to plant and grow seedlings.
7. Reuse newspaper and cardboard (old pizza boxes are ideal) for weed control by laying them beneath a layer of mulch in the garden.
8. Rather than sending old or unwanted goods to the tip, have a garage sale. One person's junk is another's treasure.
9. If you are renovating, ask your builder to resell or reuse items.
10. Take your own mug to work rather than use disposable cups for tea or coffee.

## WATER CONSERVATION

Ours is the driest inhabited continent, yet Australians are among the highest users of water. A simple thing like rinsing dishes under a running tap can use six litres of water a minute, which is as much water as people in some poorer countries use in a day. Plug the sink and use the cold water from the hot tap as rinse water while you are waiting for the hot water to come through. Other things you can do to conserve water, are:

1. Take shorter showers. Three minutes under the shower should be long enough.
2. Turn off the tap while cleaning your teeth or shaving.
3. Put a bucket under the shower while you are waiting for the water to get hot and use it for watering your pot plants.
4. Fit water saving valves to your taps.
5. Don't put the washing machine on until you have a full load.
6. Fit a water saving device to your toilet cistern or put a brick in the cistern to reduce the volume of water.
7. Fit a AAA rated shower head.
8. When you buy a new washing machine or dishwasher, make sure it has a 5 star rating
9. Use 'grey' water from your washing machine to water your garden. You can install a manually operated water diverter under the laundry tub.
10. Water the garden only in the early morning or late afternoon. In the heat of the day water will evaporate rapidly.
11. Water longer, but less frequently. Plants will become tougher and their roots will grow deeper into the soil.
12. Install a rainwater tank or ask BlueScope Water about a rainwater harvesting system or a grey water recycling system.

## ENERGY CONSERVATION

Reducing the amount of energy you use will help reduce greenhouse gas emissions, the cause of global warming, as well as saving you money. Small changes in the way we use energy can make a big difference.

1. Turn off lights when not in use.
2. Use energy-efficient fluorescent light globes.
3. Install a solar hot water system.
4. When buying new appliances, check their energy rating. Further information available at [www.energyrating.gov.au](http://www.energyrating.gov.au)
5. Insulate walls and ceilings and seal gaps around external windows and doors to reduce heat loss or gain.
6. Shade north facing external walls with deciduous trees, pergolas or window shades.
7. Use public transport, cycle or walk to work. Try to have at least one 'car free' day each week.
8. Have your car serviced regularly.
9. Use the washing machine on a cold water cycle and use the drier only as a last resort.
10. Turn off computers, stereos, television or video players at the wall rather than leaving them on stand-by.

# HERITAGE CONSERVATION

## GIVING THE PAST A FUTURE

Throughout Australia 'the things we want to keep' have been evaluated. The memorable features of the built environment - whether they be a slab homestead, a shearing shed, a High Victorian town hall, a cast iron bridge, an Edwardian foundry, or a 1920s department store - can be important for a variety of reasons. These may derive from aesthetic, historic, cultural, social, spiritual or scientific/technical significance - and this should be clearly evident in a tangible way.

Such places enrich our lives, providing a sense of connection with the Australia's history and identity. They are often part of a broader context, elements in familiar and highly regarded townscapes and landscapes.

All levels of government have formally identified the heritage significance of the built environment and listed key examples. Before any work is commenced to a recognised heritage item, one must, through due process, establish what must be kept and what can be altered.

## REGULAR MAINTENANCE

Many older structures were built to last, and have robust stone footings, solid brick walls, hardwood framing, cedar window sashes, and roofs of slate or galvanised iron. Such elements can often survive for hundreds of years with simple maintenance. Typical problems include rising and descending damp. Rising damp can be addressed by improved ground drainage and sub-floor ventilation and, on occasion, the introduction of an impervious damp-proof course. Descending damp (typically rain) reveals the importance of keeping the roof and the stormwater system in good working order, as well as ensuring that the protective coatings (such as paint) on exposed surfaces are kept in good condition. One must check regularly for termite activity.

## A MARRIAGE OF THE NEW AND THE OLD

Every building requires significant re-investment every 20 to 30 years. While a building's heritage significance is a given, the usefulness of the building and the likely return on capital are other important considerations. When retention cannot be justified, the quality elements - fine joinery, hardwood posts, hand-made bricks, etc. - should be recycled.

The mid-twentieth century solution of converting historic buildings into museums is rarely plausible today. It is essential that we find new uses and new roles for many of our important older buildings to survive. Adaptive re-use, out of necessity, involves some acceptable modification of the existing entity and perhaps sympathetic extensions, to breathe new life into the place. While the replacement of a 'missing tooth' will doubtless replicate historic detail, more substantial works should use a contemporary vocabulary, as 'repro' often looks wrong in the end product. A spirit of adventure, allied with real design skills, and an appreciation of the original building are required to achieve a successful result, ideally valued in its own right 25 years hence.

The sensible re-use of existing buildings often represents best sustainable practice.

## WHERE TO GET ASSISTANCE

- State heritage agency
- A registered architect with relevant experience

It is important that advisors have:

- A good understanding of heritage issues,
- Design qualifications,
- Construction experience.

An understanding of the philosophies behind current heritage conservation practice can be gained by studying the Australia ICOMOS Burra Charter, in particular its illustrated version. The Australian Heritage Directory is another useful resource, available on the internet ([www.environment.gov.au/heritage/organisations](http://www.environment.gov.au/heritage/organisations)).

The Federal Government and a number of the States offer modest financial assistance to owners of heritage properties from time to time. Rate and land tax relief may also be available. Your State heritage agency will have the details.

# STEEL ROAD SAFETY BARRIERS

“W” Beam Guardfence (Armco Barrier), Thrie Beam and Wire Rope Safety Barriers are systems manufactured from high strength steel and are hot dip galvanised to meet the design life requirements of modern road design specifications.

All safety barrier systems must pass internationally recognised crash testing procedure before being approved for use on Australian roads. An incorrectly designed or located safety barrier can often be a roadside hazard. The choice of an appropriate barrier and its location should be carefully considered using risk analysis techniques developed by the appropriate road authority.

Roadside Safety Barriers are defined as rigid and non-rigid types. These steel and wire rope barriers are non-rigid and by definition require a clear zone between the barrier and the obstacle to allow the barrier adequate room to deflect when impacted. Interfaces with other barrier types should be carefully considered and designed with a gradual transition in height and horizontal stiffness.

Erection practices that do not comply with the appropriate drawings and specifications should not be permitted.

## CORRUGATED STEEL PIPE

Pre-engineered and easy to design for any given situation, the pipes are custom produced in diameters ranging from 300mm to 3600mm and in lengths up to 12 metres, making them the ideal solution in a wide variety of applications, such as:

- Road and rail crossings
- Pedestrian, vehicular and livestock underpasses
- Irrigation pipes, dam level overflows and erosion protection
- Urban stormwater detention and retention systems
- Conveyor tunnels, access tunnels and air overcast
- Under-floor escape tunnels and service ducts
- Vertical shafts, chimney stacks and aerial conduits

Many factors make galvanised steel pipe the cost effective alternative:

- The high strength-to-weight ratio
- The low initial material cost
- Custom fabricated tee and angle junctions
- Light weight long lengths, allowing easy handling by minimal skilled labour, contributing to a lower installed cost.

AS 1762 details the necessary requirements for culvert installation.

## MULTI-PLATE CORRUGATED STRUCTURES

Constructed from hot dip galvanised structural plate, Multi-Plate is available in a range of shapes and sizes from circular pipes and arches up to 8.5 metres in diameter, to elliptical bridge structures spanning 15.0 metres.

The ability to design and manufacture structures to almost any shape and size makes Multi-Plate the ideal solution for a wide range of applications, including:

- Grade separation for road and rail through underpasses for vehicles, pedestrians and fauna
- Mining portals and load-out tunnels
- Conveyor and access tunnels
- Fire escape and service tunnels

**Note:** A number of companies in Australia utilise BlueScope to manufacture a range of "Road Hardware". Call BlueScope Steel Direct for contact details.

# CONCRETE

The Cement Concrete & Aggregates Australia (CCAA) is a national, non-profit organisation sponsored by the cement industry. Publications and information on the making and uses of concrete are available from the Regional Office of the Association in each State. The organisation's website can be located at [www.concrete.net.au](http://www.concrete.net.au).

## SPECIFYING CONCRETE QUALITY

Concrete should be specified so that it will possess both adequate strength and durability (i.e. resistance to environmental agents and wear). The quality of concrete is dependent on the quality of materials used, the standard of workmanship in placing, and the care with which the concrete is compacted, finished and cured.

Required quality (strength and curing period) is specified in AS 3600 "Concrete Structures". This depends on exposure classification and for external members should be determined by a qualified specialist. Appropriate compressive strengths and curing periods for some common cases and cover to reinforcement, are shown in the following table.

Member	Strength (grade MPa)	Curing period days	Cover (mm)
Residential slab-on-ground floors, footings in non-aggressive soils, footpaths, and residential driveways	20	3	20*
Industrial floors (internal) subject to light traffic only or medium traffic	25	3	20*
	32	7	20*
External members within 1km of coast or 1 to 50km of coast	40	7	45
	32	7	30
Elements in aggressive environments, e.g. marine conditions	Obtain specialist advice		

\*Where cover is measured to face against soil, increase the dimension shown by – 10mm if concrete surface protected by damp-roof membrane, or 20mm otherwise.

# CONCRETE SUPPLY AND MANUFACTURE

## PRE-MIXED CONCRETE

The easiest way to obtain good quality concrete is to purchase it from a pre-mixed concrete supplier. Pre-mixed concrete is generally specified as "normal-class". The purchaser has to nominate:

- The appropriate strength grade (one of N20, N25, N32, N40 or N50)
- Appropriate slump (one of 20 to 110 in 10mm increments) usually 80mm
- Appropriate maximum nominal size of aggregate (one of 10, 14, or 20mm) usually 20mm
- Method of placement (e.g. direct from truck, by pump)
- Whether or not project assessment is required to be carried out by the supplier (not usual for small projects)

If required the purchaser may also nominate:

- An early strength requirement for early stripping of formwork and air-entrainment for freeze-thaw resistance. However, these would normally be specified only where required by special conditions.

## SITE MIXED CONCRETE

This should not normally be used for structural projects. Suggested mixes for some applications are shown in the following table.

Use	Nominal proportions by volume cement	Materials required for one cubic metre of cement			Max added water per bag cement (litres)
		Cement bags	Sand (m) <sup>3</sup>	Coarse aggregate (m) <sup>3</sup>	
Mass footings, light duty driveways and paths	2:5:8	8	0.5*	1	20
Fence posts, floors and wearing surfaces	2:3:6	10.5	0.5*	1	20

\*When ordering sand, allow 15-20% extra to the above figure for losses & bulking of sand.

## MATERIALS

**Cement** - Type GP (General purpose portland) and Type GB (General purpose blended) can be used. Other types are available but are used for special applications. Masonry cement should not be used to make concrete. Cement is available in multi-layer paper bags:

1 bag = 40kg

25 bags = 1 tonne

**Sand** - Must be clean and free from clay, earth, humus, salt or other deleterious material. A coarse, well-graded (i.e. from coarse to fine) sand is preferable.

**Coarse aggregate** - May be river gravel or crushed stone. Material should be clean, hard, impervious and free from organic matter. For most work a well-graded material 10 to 20mm is suitable.

**Water** - Water should be clean and fresh. Generally mains water is satisfactory but bore water should be checked.

## STORAGE OF MATERIALS

- Cement must be kept dry, Stack off the ground and away from exterior walls. Cover so as to allow only limited air circulation but preventing condensation. Use on first in/first out basis.
- Aggregates should be stored on firm, hard surfaces and kept separate from each other.

## MIXING

Concrete should be mixed in power-operated or hand mixer. Mixers should not be overfilled and should revolve at speeds recommended by the maker. A minimum mixing time of two minutes after the addition of the last ingredients should be allowed.

Proportions should be controlled by mass or volume batching. When volume batching, proportions should be measured in boxes or buckets. Do not use shovelfuls as shovelfuls of cement, sand and coarse aggregate are not equal. Ingredients should be added to the mixer in the following order:

- (a) Half to two-thirds of the water,
- (b) Coarse aggregate,
- (c) Sand,
- (d) Cement,
- (e) Final water sparingly added until desired workability is reached.

Higher strengths and better durability are achieved by using as little water as possible.

## CONCRETE CONSTRUCTION

### Formwork

The quality and rigidity of the formwork is reflected in the trueness of line and the surface finish exposed after the formwork is stripped. Some of the points to watch are:

- Formwork should be well braced, and rigid enough to remain true to line and level during the concreting operations.
- Joints between boards and at corners should be sealed to prevent loss of cement paste from the concrete, (causes honeycombing).
- Formwork should be treated with a form-release agent to prevent concrete adhering to the form.
- Formwork should not be removed until the concrete has gained sufficient strength to carry the imposed loads. This will be longer in cold than in warm weather and will be affected by cement type.

### Reinforcement

Concrete is strong in compression but needs the addition of steel reinforcing bars to carry the tensile forces resulting from: the dead load of the member, the application of external loads, or from the shrinkage of the concrete as it dries out.

Determination of the amount and position of the reinforcement requires specialist knowledge, we suggest you visit the InfraBuild website at [www.infrabuild.com](http://www.infrabuild.com) and use the reinforcement area calculator.

Once determined, the steel reinforcement must be accurately placed and firmly supported and tied to prevent displacement during the concreting operations. Tie wires used to bind the reinforcement in place should be trimmed off and bent back away from the concrete surface.

For slabs in slab-on-ground floors, driveways and paths, the reinforcement is used to control the cracking of the concrete surface. It should be located in the top third of the slab but with appropriate cover to protect it against corrosion.

## Placing

Concrete should be poured as soon as possible after arriving at the site.

The concrete should be deposited in the forms as close as possible to its final location. Avoid flowing it along the forms, as this can lead to segregation. The concrete should be spread by shovel and worked thoroughly into place, ramming with shovel or rod. Concrete should be compacted preferably by mechanical vibrators. Immersion vibrators should be used only for sections over 200mm deep and beam/screed vibrators for slabs. On small jobs where these are not available, use tamping with rods and screed boards.

## Finishing of horizontal surfaces

Many surface finishes and textures are possible. The type of surface finish should be chosen with regard to its use.

## Curing

The action of retaining water in the concrete so that it can react chemically with the cement to bond the aggregates together is known as curing. This process enables concrete to reach its potential strength, ensures the surface is as hard as possible and minimises the tendency for cracking.

Curing is most simply done by covering or encasing the member immediately after finishing with a plastic sheet secured to seal the surface from the atmosphere. This should be kept in place for three to seven days.

Alternatively, the surface of the concrete should be kept continuously wet for three to seven days.

## SLAB-ON-GROUND-FLOORS

### Site considerations

Residential slab-on-ground floors are suitable for use on flat sites or on sites with moderate slopes (up to 1 in 5) by using cut-and-fill techniques. For more steeply sloping sites, split level or suspended floors formed with BONDEK® structural decking should be considered.

Foundation material should be checked. Stable materials (e.g. rock, sand, sandy clay) pose no constraints but expansive soils (e.g. heavy plastic clays) and soils with low bearing capacity (e.g. soft alluvial clays, peaty soils) may cause problems for all footing systems and should be investigated by a specialist consultant. Properly designed slabs are suited for use on expansive soils and those with low bearing capacity, and are covered in AS 2870.

It is important to check the site drainage and the position of water courses during heavy rain. Low-lying sites should be avoided or built up to avoid flooding. Dish drains and sloped paving should be used to keep surface runoff away from a slab-on-ground floor and foundation under it.

### **Construction considerations**

The construction area should be cleared of all vegetable matter and the associated layer of topsoil.

In a cut-and-fill situation, any fill should be well compacted in shallow layers using hand-operated vibrating rollers or mechanical tampers. To prevent water vapour rising through the slab, a polyethylene sheet vapour barrier should be laid immediately under the slab and any beams or thickenings.

The sheet should be purpose-made concrete underlay polyethylene of minimum thickness 0.2mm. Penetrations should be sealed with pressure sensitive tape. Joints should be lapped 200mm.

- Design of the slab and reinforcement details must conform to local building regulations and should follow AS 2870 "Residential Slabs and Footings - constructions". In most areas it is desirable to minimise the risk of termites gaining entry to the building by following the recommendations of AS 3660.1.
- Slab-on-ground construction should follow the preceding recommendations for concrete construction in general.

### **Landscaping**

Large trees should not be planted close to any building. Where gardens are adjacent to the walls they should be kept well below the damp-proof course or the floor level. The ground in a one metre wide strip out from the walls should fall at least 25mm away from the walls.

## STANDARD REINFORCING BARS

Bar Size (mm)	Bar Type (TC/MA*)	Mass per metre (kg/m)	Cross-sectional area (mm <sup>2</sup> )	Minimum hole dia** for clearance (mm)
10	MA	0.617	78.5	12
12	TC & MA	0.888	113	15
16	TC & MA	1.58	201	20
20	TC	2.47	314	25
24	TC	3.55	452	29
28	TC	4.83	616	34
32	TC	6.31	804	39
36	TC	7.99	1020	44
40	TC	9.86	1260	49

\* TC = TEMPCORE, MA = MICROALLOYED

\*\* This is the diameter of hole that will allow a bar of nominal size shown to pass through assuming the bar is at maximum size tolerance. Smaller hole sizes may be possible depending on the dimensions of the actual bar. Tolerance on mass per metre is +/- 4.5% for all sizes. 2.5% is added to cover rolling margin and associated costs.

## DEFORMED STEEL REINFORCING BARS FOR CONCRETE

All details for Steel Reinforcing Bars for Concrete are contained in AS 1302.

## REINFORCING FABRIC FOR CONCRETE

Reinforcing fabric is manufactured in accordance with AS 1304 from hard-drawn steel wire conforming with AS 1303. Standard sheets are cut flush at the sides and have equal overhangs at the ends.

## RIBBED REINFORCING MESH (GRADE 500)

Product Code	Mesh Specification				Approx. Mass of 2.4m x 6m sheets		Nominal cross-sectional area	
	Longitudinal Wires		Cross Wires		Area kg/m <sup>2</sup>	sheet kg	Longitudinal mm <sup>2</sup> /m	Cross Wires mm <sup>2</sup> /m
	No x size (mm)	@ pitch (mm)	No x size (mm)	@ pitch (mm)				
<b>RECTANGULAR MESHES</b>								
<b>RF1218</b>	25 x 11.90	100	30 x 7.60	200	10.5	157	1112	227
<b>RF1118</b>	25 x 10.70	100	30 x 7.60	200	8.8	130	899	227
<b>RF1018</b>	25 x 9.50	100	30 x 7.60	200	7.3	109	709	227
<b>RF918</b>	25 x 8.60	100	30 x 7.60	200	6.3	93	581	227
<b>RF818</b>	25 x 7.60	100	30 x 7.60	200	5.3	79	454	227
<b>RF718</b>	25 x 6.75	100	30 x 7.60	200	4.6	67	358	227
<b>SQUARE MESHES (WITH EDGE LAPPING WIRES)</b>								
<b>SL102</b>	10 x 9.60	200	30 x 9.50	200	5.6	80	354	354
	+4 x 6.75	100						
<b>SL92</b>	10 x 8.60	200	30 x 8.60	200	4.6	66	290	290
	+4 x 6.00	100						
<b>SL82</b>	10 x 7.60	200	30 x 7.60	200	3.6	52	227	227
	+4 x 5.37	100						
<b>SL72</b>	10 x 6.75	200	30 x 6.75	200	2.8	41	179	179
	+4 x 4.77	100						
<b>SL62</b>	10 x 6.00	200	30 x 6.00	200	2.2	33	141	141
	+4 x 4.24	100						
<b>SL52</b>	10 x 4.77	200	30 x 4.77	200	1.4	20	89	89
	+4 x 4.00	100						
<b>SL63 (WA)</b>	10 x 6.00	200	30 x 6.00	200	1.5	21	94	94
	+4 x 4.00	100						
<b>SL53 (WA)</b>	10 x 4.75	200	30 x 4.75	200	1.0	14	60	60
	+4 x 4.00	100						

Product Code	Mesh Specification				Approx. Mass of 2.4m x 6m sheets		Nominal cross-sectional area	
	Longitudinal Wires		Cross Wires		Area kg/m <sup>2</sup>	sheet kg	Longitudinal mm <sup>2</sup> /m	Cross Wires mm <sup>2</sup> /m
	No x size (mm)	@ pitch (mm)	No x size (mm)	@ pitch (mm)				
<b>SQUARE MESHES</b>								
<b>SL81</b>	25 x 7.60	100	60 x 7.60	100	7.1	105	454	454
<b>TRENCH MESHES (STRIP WIDTHS 200MM, 300MM, 400MM)</b>								
<b>L12TM</b>	3, 4 or 5 x 11.90	100	4.77	300				
<b>L11TM</b>	3, 4 or 5 x 10.70	100	4.77	300				
<b>L8TM</b>	3, 4 or 5 x 10.70	100	4.77	300				

# MASONRY – BRICKWORK AND BLOCKWORK

Masonry walls are commonly built using clay bricks, calcium silicate bricks or concrete bricks and blocks. In addition to the more routine uses, masonry walls offer properties such as high sound absorption coefficients, high sound transmission loss, and good thermal insulation and fire resistance.

Information is available from the Clay Brick and Paver Institute (most States) and the Concrete Masonry Association of Australia (most States).

## DESIGN

The design of masonry structures is regulated by Australian Codes and Standards and Building Regulations of State Governments. As with any other structure, design should be entrusted to a competent person experienced in such work and in the requirements of the applicable Codes, Standards and Regulations.

Points requiring special attention in design include the provision of control joints and other movement and crack control measures, the design of lintels over wall openings, and proper lateral support of loadbearing elements.

## SPECIFICATION FOR BUILDING WALLS

### Modular planning

To achieve economy in construction, walls should be dimensioned to suit brick or block sizes.

### Dimensions

Manufacturing dimension of bricks and blocks are 10mm less than nominal dimensions to allow for a standard 10mm mortar joint.

### Laying

All manufacturers recommend that bricks and blocks should be laid as dry as possible. They should never be wetted to control suction prior to application of mortar. Keep units as dry as possible on the site. At the stoppage of work, the tops of the walls should be covered to prevent moisture entering cores.

All joints are to be fully bedded except in the special situation where blockwork is face-shell bedded to prevent entry of water.

## Support of walls during construction

All walls must be braced during construction against lateral loads, especially wind loads, to ensure that adverse or unsafe conditions do not arise in the wall.

The height of unbraced free-standing walls should be limited during construction to the heights specified in the appropriate State Building Regulations.

## Damp-proof courses

Damp-proof courses should be provided in accordance with recognised practice.

## External finish

If single-leaf clay or concrete block external walls are to be constructed they should be coated with an approved waterproofing film such as acrylic paint and protected by wide eaves overhangs.

## Mortar mix

Mortar for brickwork and blockwork is made up from a mixture of cement, lime and sand, with sufficient water to provide a workable consistency. Material proportions are varied to suit the job, the most commonly used being:

1. Cement : 1 lime : 6 sand

Where higher strength or impermeability is required, mortars richer in cement can be used. Lime-rich mortars should only be used where strength is not important.

If cement other than portland cement is used, the mix proportions will need to be varied. For example, if a blended cement is used the common mix should be:

2. Blended cement: 1 lime: 5 sand

For calcium silicate bricks and concrete masonry, the manufacturers recommend the use of a particular mortar consisting of one part cement to five parts sand with the addition of Calsil Mortarbond to provide workability and water retention.

**Quantities**

To lay 2000 standard size bricks use, approximately one cubic metre of mortar. To make the quantity requires six bags cement, six bags lime and one cubic metre of sand for the 1:1:6 mix.

**WALL TIES**

Normal cavity walls are tied with wall ties spaced 600mm apart, both vertically and horizontally. Some situations, however, do require special tying. For information refer to the appropriate SAA Code.

# BRICKWORK DIMENSIONS FOR MODULAR BRICKS

Modular brick dimensions are in even 100mm increments, therefore all dimensions can be extrapolated from the following table:

## MODULAR BRICK

Size: 290 x 90 x 90mm

No. of bricks	Wall length (mm)	Opening size (mm)	Height (mm)
1	290	310	100
1 1/3	390	410	200
1 2/3	490	510	300
2	590	610	400

Note: Wall panels are 10mm shorter and openings 10mm longer than figures below.

## BLOCKWORK DIMENSIONS

Blocks, like modular bricks, are in dimensions which follow a simple arithmetic progression; therefore all dimensions required can be extrapolated from the following table:

No. of bricks	Length (mm) (based on 400mm lengths)				Height (mm) (based on 200mm high units)	
	Full blocks	+ Fractional blocks			No. of courses	Height (mm)
		1/4	1/2	3/4		
1	400	500	600	700	1	200
2	800	900	1000	1100	2	400
3	1200	1300	1400	1500	3	600

## BRICKWORK DIMENSIONS

Metric Standard Brick: 230 x 110 x 76mm

Joints: 10mm Vertical Gauge: 7 course = 600mm

No. of bricks	Wall length (mm)	Opening size (mm)	Height (mm)
1	230	250	86
1.5	350	370	
2	470	490	172
2.5	590	610	
3	710	730	257
3.5	830	850	
4	950	970	343
4.5	1070	1090	
5	1190	1210	429
5.5	1310	1330	
6	1430	1450	514
6.5	1550	1570	
7	1670	1690	600
7.5	1790	1810	
8	1910	1930	686
8.5	2030	2050	
9	2150	2170	772
9.5	2270	2290	
10	2390	2410	857
10.5	2510	2530	
11	2630	2650	943
11.5	2750	2770	
12	2870	2890	1029
12.5	2990	3010	
13	3110	3130	1114
13.5	3230	3250	
14	3350	3370	1200
14.5	3470	3490	
15	3590	3610	1286
15.5	3710	3730	

No. of bricks	Wall length (mm)	Opening size (mm)	Height (mm)
16	3830	3850	1372
16.5	3950	3970	
17	4070	4090	1457
17.5	4190	4210	
18	4310	4330	1543
18.5	4430	4450	
19	4550	4570	1629
19.5	4670	4690	
20	4790	4810	1714
20.5	4910	4930	
21	5030	5050	1800
21.5	5150	5170	
22	5270	5290	1886
22.5	5390	5410	
23	5510	5530	1972
26	6230		2229
26.5	6350		
27	6470		2314
27.5	6590		
28	6710		2400
28.5	6830		
29	6950		2486
29.5	7070		
30	7190		2572
30.5	7310		
31	7430		2657
31.5	7550		
32	7670		2743
32.5	7790		
33	7910		2829
33.5	8030		

No. of bricks	Wall length (mm)	Opening size (mm)	Height (mm)
34	8150		2914
35	8390		3000
35.5	8510		
36	8630		3086
36.5	8750		
37	8870		3172
37.5	8990		
38	9110		3257
38.5	9230		
39	9350		3343
39.5	9470		
40	9590		3429
40.5	9710		
41	9830		3514
41.5	9950		
42	10070		3600
42.5	10190		
43	10310		3686
43.5	10430		
44	10550		3772
44.5	10670		
45	10790		3857
45.5	10910		
46	11030		3943
46.5	11150		
47	11270		4029
47.5	11390		
48	11510		4114

## FUNDAMENTAL UNITS

**Ampere** is the unit in which electric current flow is measured.

**Ohm** is the unit in which resistance to the flow to of an electric current is measured.

**Volt** is the unit of electric pressure. A pressure of 1 volt is required to force a current of 1 ampere through a resistance of 1 ohm.

**Watt** is the unit of power or rate of doing work.

watts = volts x amperes

**Kilowatt hour** - For commercial purposes electrical energy is charged in units of 1000 watt hours, and is called the kilowatt hour.

$\text{kW.h} = \frac{\text{volts} \times \text{amperes} \times \text{hours}}{1000}$  or  $\frac{\text{watts} \times \text{hours}}{1000}$

Example: To find the cost of burning five 60 -watt lamps for ten hours, assuming the cost per unit to be seven cents:

Cost =  $\frac{60 \times 5 \times 10 \times 7c}{1000}$

The normal voltage for household appliances is 240; for 3-phases motors, etc., it is 415.

## SAFETY PRECAUTIONS

One of the main advantages of electricity is that there is nothing complicated about its use. It is a good servant, but this does not mean you can abuse it.

Fortunately, fatal electrical accidents have been few compared with fatal accidents from other causes. But a few is still too many and these can be avoided by the observance of simple safety precautions.

## FLEXIBLE CORD CORE COLOURS

In the past, the requirements concerning the identification of the conductors of flexible cords have provided that the colour green shall be used to identify the earthing conductor and that current - carrying conductors shall not be green. A new system of Australian colour coding of flexible conductor cords conforms to overseas practice. The earthing conductor is coloured green/yellow.

The colours of the cores of the old and new flexible cords are:

Old cords	New cords
Red	Brown
Black	Blue
Green or green/yellow	Green/yellow

In three-pin plugs and cord extension sockets, the green/yellow earthing core must be connected to the earth terminal (or the green core in old cords). The earth terminal is marked E, EARTH and in modern plugs is also marked with a green colour. No other conductor may be connected to this terminal.

## ELECTRICAL INSTALLATION

It is illegal for any person other than a licensed electrician or a person in the employment of and under the supervision of a licensed electrician to carry out any electrical wiring work, including the installation, repair or replacement of power points, dimmers, light fittings, etc.

- **DO NOT** interfere with the fixed wiring in your home. If you do, you not only break the law, you run the risk of serious accident.
- **DO** have your installation checked by a licensed electrician if signs of wear and tear appear. Your local electricity supply authority will also inspect the installation if you suspect it is faulty.
- **DO** inspect the main earth wire connection regularly. The earth wire should be connected to a rod driven directly into the ground and also to the water pipe system, except that in older installations it might be connected to the water pipe system only. Remember that an effective main earthing system is essential for personal safety.

- **DO** arrange to have electrical repairs carried out by an electrical contractor as a matter of urgency if the earth wire or its connection is found to be damaged or disconnected.
- **DO** arrange for an electrical contractor to modify the main earthing system, if it is not connected to a driven rod, prior to any work being carried out on the water pipe system involving the use of non-metallic pipes or fittings.

## **FLEXIBLE CORDS**

Flexible cords can cause electrical fatalities.

- **DO** consider replacing old or damaged cord extension sockets with new shrouded types that help prevent accidental contact with the plug pins.
- **DO** make sure that all flexible cords are correctly connected. If in even the slightest doubt, consult an electrician. Incorrect connection of the earthing core in flexible cords has accounted for almost half of the domestic fatalities associated with flexible cords.
- **DO** treat extension cords with respect. As they are often subjected to rough treatment and are used in awkward work situations, they should be inspected regularly.

Either buy ready-made extension cords or have them made up by an electrician. The do-it-yourself approach might have fatal consequences.

- **DO** read and follow the instructions carefully when using a flexible cord wound on a reeling or coiling device. If used coiled up it may overheat and melt the insulation.
- **DO NOT** dismantle, repair, or attempt to adjust contacts on cord fittings while the cord is switched on or plugged in. There is a golden rule which says switch off the electricity then pull the plug out.
- **DO NOT** join cords by twisting and taping. Makeshift joints are dangerous. If it is necessary to join two lengths of cord a correctly attached three-pin plug and shrouded cord extension socket should be used.

- **DO NOT** use cords which are frayed, badly worn, or perished or which have chipped, cracked or broken fittings. Replace them now, later may be too late.
- **DO** make sure that any cord you use is suitable in type and size for the job it has to do.

**NEVER** assemble extension cords from two-core cables. Even if intended for use with a double insulated appliance, it is certain that the extension cord will be used inadvertently to supply single insulated equipment which must be earthed by a three-core cord for safety.

### **EQUIPMENT REQUIRED TO BE EARTHED**

All equipment that is not double insulated is required to be earthed. All equipment that is double insulated is required to be marked with the symbol (☐) or with the words DOUBLE INSULATED.

- **DO** make sure that all electrical appliances and other equipment that is not double insulated are fitted with three-core supply flexible cord and three-pin plug.

### **OVERSEAS TYPE PLUGS**

Two-pin parallel pin overseas type plugs are not suitable for connection to electricity supply in Australia, because they have a small resistance between pins and the edge of the plug body, and are considered to be dangerous.

- **DO** replace overseas type plugs with Australian approved plugs.
- **DO NOT** bend or twist pins of two-pin overseas type plugs to fit Australian power points.

## PORTABLE APPLIANCES IN EARTHED SITUATIONS

Portable appliances commonly used in earthed situations include electric tools and welders, washing, polishing and ironing machines, mixers, blenders, kettles, toasters, irons, room heaters and any other appliances used in the kitchen, bathroom or laundry, or out-of-doors.

- **DO** use a portable safety switch to guarantee against serious electric shock.
- **DO** find out from a licensed electrician whether the power point to which you normally connect these appliances is effectively earthed.
- **DO** make sure the flexible cord is properly connected.
- **DO NOT** under any circumstances connect the appliance to a two-pin power point or a lampholder.
- **DO NOT** use portable electric tools outdoors while barefooted. Bare feet, minimum clothing and wet skin lower body resistance, thus increasing the amount of shock current if an accident should occur.

The growing use of light metal ladders around the home gives cause for some further safety reminders. Remember when working from metal ladders that you are in metallic contact with the ground or wall (i.e. earthed). Therefore even simple operations such as changing a lamp should be performed with care. Also keep well clear of overhead wires when moving metal ladders.

## OUTSIDE THE HOME

- **DO** take immediate action should you see overhead wires which have sagged or fallen. Keep well clear. Stand guard to warn others of the danger. Send somebody to inform the police or the electricity supply authority. Make sure somebody remains on guard until the supply authority's repair people arrive. In particular, remember that both ends of a broken wire may be alive and need to be guarded.
- **DO** take extreme care when climbing on a roof, ladder, tree, etc., near overhead electrical wires. Touching these wires may mean death. Be careful when painting or carrying out repairs near electric wires.

- **DO** take extreme care when operating mobile cranes, tip trucks or tall agricultural machinery, or when upending long pipes, boatmasts or erecting aerials or lengths of guttering in the vicinity of overhead power lines.

## MAINTENANCE

- **DO NOT** expect that electrical equipment you use every day will last forever.
- **DO** arrange for your electrical equipment to be regularly checked by the manufacturer or a qualified electrician.
- **DO NOT** use any electrical equipment if there is any doubt about its safe condition.
- **DO NOT** dismantle or attempt to repair or adjust internal parts of any electrical equipment or flexible cord while it is plugged into a power outlet. Disregard of this rule can prove fatal. Each year someone makes the fatal mistake of disregarding this rule.
- **DO** ensure that all repairs of electrical equipment are carried out by a qualified electrician.

## DANGER SIGNALS

- **DO** act immediately if the following danger signals appear. Call your electricity supply authority or a licensed electrical person without delay.
- An electric shock, however slight, is a warning that something is wrong with the installation or appliance. If you do not have it fixed the next shock may be fatal.
- When a fuse blows or circuit breaker trips repeatedly there is a fault somewhere... in the permanent wiring, an appliance, or the flexible cord.
- Sparking, spluttering or overheating at the fittings of a flexible cord or at the power point show that the cord connections or the power point are faulty. These symptoms are frequently accompanied by a crackling noise in the radio and interference lines on a TV screen.

# LIQUEFIED PETROLEUM GAS (LPG)

When used properly and handled with appropriate care, LP gas is a safe, clean, efficient and convenient source of energy. It is used for domestic, leisure, commercial, industrial, and agricultural applications and as an automotive fuel.

Information about LP gas and appliances and equipment is available from the Australian Liquefied Petroleum Gas Association (ALPGA), 30 George Street, Redfern, NSW 2016 or at [www.lpgaaustralia.com.au](http://www.lpgaaustralia.com.au).

Liquefied Petroleum Gas (LP gas) is composed predominantly of the following hydrocarbons or a mixture of all or any of them: propane, butane or propylene. The main supply sources of LP gas are extractions from natural gas or a by-product from oil refineries.

When compressed moderately at normal temperature it becomes a liquid. When gas is withdrawn, the pressure drops and the liquid reverts to a gas. This means it can be stored and transported as a liquid and burnt as gas. As the expansion ratio of gas from liquid is 270:1, LP gas has a significant advantage in that a large quantity of liquid may be transported in a small space.

LP gas is odourised with a distinctive smell (like rotting cabbage) to assist in the detection of leaks.

Cylinders and tanks are never filled to capacity; and ullage (vapour space) of approx. 15% of the container volume is necessary for the expansion of the liquid gas under possible temperature increases. The vapour pressure is dependent on the ambient temperature; for instance, commercial propane exerts a pressure at 15 degrees Celsius of approximately 760 kPa. As gas is drawn from a container, the pressure in the vapour space is reduced and more liquid boils off and will continue to do so until the cylinder is empty or the withdrawal is discontinued. This re-establishes an equilibrium condition with the LP gas exerting a vapour pressure related to its temperature.

Tanks and cylinders are fitted with a relief device. It is important that the containers always be stored or transported in a vertical position so that the relief valve connects to the gas space, not to the liquid space in the vessel.

Various standards and codes for the safe and efficient use of LP gas are published by Standards Australia and the ALPGA. State governments also

have regulations controlling LP gas matters, either gazetting the codes of the SAA or ALPGA or including the requirements for these codes in their respective LP gas regulations. If in doubt on the requirements of any Standard or Code, contact ALPGA.

All LP gas cylinders must be stamped to indicate they have been checked at a test station. Reinspection and restamping at a test station must be carried out every ten years. 3T05 stamped on a cylinder means it was tested March 2005 and by March 2015 it must be retested and restamped. It is illegal to fill a cylinder outside of the ten-year period since its last test.

Adequate ventilation with gas burning appliances is essential, particularly in caravans and marine craft where the free volume is limited.

All installation and repair work shall must be carried out and checked by an authorised or licensed LP gas installer to the requirements of Gas Installations Code AG601.

### **SOME ADDITIONAL SAFETY HINTS**

- All appliances and equipment must be maintained in a serviceable condition and the overall installation must be checked regularly for leaks with a detergent or soap solution, not with a naked flame.
- All appliances should meet LP gas industry approval requirements.
- The uses of unflued water heaters or space heaters in caravans and marine craft is prohibited.
- Cylinder valves shall be kept closed when the installation is not in use. This is of particular importance during the refuelling of caravans and marine craft. Never use any gas appliance including refrigerator in a moving vehicle.
- In the event of accidental gas leaks or fire, close cylinder valve(s) until hazard is removed.
- Close valves and fit gas tight sealing plug to all spare cylinders whether full or empty.
- Valves on caravan cylinders must be closed during transit.

## GAS HAND CUTTING NOZZLES

### Standard Nozzle

Plate thickness (mm)	Nozzle size	Oxygen (kPa)	Acet & LP Gas (kPa)	Speed Acet & LP Gas (mm/min)
6	8	200	100	450
12	12	200	100	380
20	12	250	100	340
25	15	220	100	320
40	15	350	100	270
50	15	400	100	240
75	15	450	100	180
100	20	400	100	150
125	20	450	100	150
150	20	520	100	130

## MASS DENSITIES OF MATERIALS

Mass densities shown in this selective list may vary, depending on material composition. Where calculations need to be precise, exact density factors should be obtained from manufacturers or other appropriate sources.

Material	Kind	kg/m <sup>3</sup>
Aluminium, rolled		2710
Bitumen, prepared		1362
Bolts and nuts, bags		1201
Brass, cast		8330
Bricks (common burnt clay)	Stacked	1602-1920
	Brickwork	1920
Cement	Bags	1281
	Slurry	1442
Coal	Loose lumps	897
	Slurry	993
Coke		481-561
Concrete, reinforced	2 per cent steel	2420
Copper, drawn or sheet		8938

<b>Material</b>	<b>Kind</b>	<b>kg/m<sup>3</sup></b>
Cyprus wood		593
Douglas fir		529
Earth	Dry, loose	1280
	Moist, loose	1440-1600
Galvanized steel, sheet, bundles		897
Glass, plate		2787
Grain	Wheat	770
	Barley	625
	Oats	416
	Rye	721
Gypsum, plaster		737
Ice		913
Iron, cast		7208
Lead, cast or rolled		1325
Lime, hydrate, gables		513
Lime mortar	Dry	1650
	Wet	1748
Magnesite		3044
Mapie	Canadian	737
	English	689
Nails, wire, bags		1201
Paper	Printing reels	897
	Writing	961
Petrol		689-769
Pine	Kauri, QLD	481
	New Zealand	609
	Oregon	529
Pipes	Cast iron; stacked	961-1281
	Earthenware, loose	320
	Wrought iron, 9.5mm stacked	3204
Plywood		481-641
Pulp, wood	Dry	561

Material	Kind	kg/m <sup>3</sup>
Rubber	Processed sheet	1121
	Sponge	48-160
Sand	Saturated	1922
	Undisturbed dry	1682
Sawdust		208
Screws, iron, packs		1602
Slag wool		224-288
Snow	Fresh	96
	Wet compact	320
Steel, low carbon		7850
Straw, compressed bales		304
Sulphate of ammonia, bags		641
Tyres, rubber		176-256
Waste paper		352
Water	Fresh	1001
	Salt	1009-1201
Wire	Iron, coils	1185
	Rod, coils	801
	Rope, coils	1442
Wool	Compressed bales	769
	Uncompressed	208
Zinc	Cast	6804
	Rolled	7192

# GEOMETRY AND MENSURATION

<b>CIRCLE</b>	Circumference = diameter $\times 22/7$ (or 3.1416)
	Area = diameter <sup>2</sup> $\times 0.7854$
	Area of sector of circle = length of arc $\times$ half radius
	Area of segment of circle = area of sector, less area of triangle
	Side of square of area equal to circle = 0.862 diameter of circle
	Diameter of circle equal in area to square = 1.1284 side of square
<b>SPHERE</b>	Surface area = 3.1416 $\times$ diameter <sup>2</sup>
	Volume = 0.5236 diameter <sup>3</sup>
<b>AREAS GENERALLY</b>	Square, rectangle, rhombus or rhomboid = base $\times$ height
	Triangle = half base $\times$ perpendicular height
	Trapezoid = half sum of two parallel sides $\times$ height
	Area of any figure of four or more unequal sides is found by dividing it into triangles, finding areas of each, and adding together
	Regular polygon (inscribed circle) = half radius of circle $\times$ length of one side $\times$ number of sides
	Parabola = base $\times$ height $\times 2/3$
	Ellipse = long axis $\times$ short axis $\times 0.7854$
<b>CUBES</b>	a = length of one side, volume = a <sup>3</sup> , surface area = 6a <sup>2</sup>
<b>RECTANGULAR PRISM</b>	Volume = area of base $\times$ half height = bl $\times$ h
	Total surface area = 2 (bl + lh + bh)
<b>REGULAR PRISM</b>	Volume = $1/2 n \times r \times a \times h$ , where n = number of sides, r = radius of inscribed circle, a = length of side
<b>CYLINDER (RIGHT CIRCULAR)</b>	Volume = 0.7854 $\times$ diameter <sup>2</sup> $\times$ height
	Lateral surface area = 3.1416 $\times$ diameter $\times$ height
	Total surface area = 3.1416 (diameter $\times$ height) + 1.5708 diameter <sup>2</sup>
<b>ANY PRISM OR CYLINDER</b>	Volume = h $\times$ area of base
	Lateral surface area = length of cylinder $\times$ perimeter of normal section
<b>REGULAR PYRAMID OR CONE</b>	Volume = $1/3$ (area of base $\times$ height)
	Lateral surface area of regular figure $1/3 =$ (perimeter of base $\times$ slant height)
<b>ANY PYRAMID OR CONE</b>	Volume = $1/3$ (area of base $\times$ distance from vertex to plane of base)
<b>FRUSTUM OF ANY PYRAMID OR CONE</b>	Volume = $h/3 (A_1 + A_2 + \sqrt{A_1 A_2})$ , where A <sub>1</sub> and A <sub>2</sub> are the areas of bases made by parallel planes.

## AREAS AND CIRCUMFERENCES OF CIRCLES

Diameter	Area	Circumference
1	0.7854	3.1416
2	3.1416	6.2832
3	7.6086	9.4248
4	12.566	12.566
5	19.635	15.708
6	28.274	18.850
7	38.485	21.991
8	50.266	25.133
9	63.617	28.274
10	78.540	31.416
11	95.003	34.558
12	113.10	37.699
13	132.73	40.841
14	153.94	43.982
15	176.72	47.124
16	201.06	50.266
17	226.98	53.407
18	254.47	56.549
19	283.53	56.690
20	314.66	62.832
21	346.36	65.974
22	380.13	69.115
23	415.48	72.257
24	452.39	75.398
25	490.88	78.540
26	530.93	81.682
27	572.56	84.823
28	615.75	87.965
29	660.52	91.106

<b>Diameter</b>	<b>Area</b>	<b>Circumference</b>
31	764.77	97.390
32	804.25	100.53
33	855.30	103.67
34	907.92	106.81
35	962.12	109.96
36	1017.9	113.10
37	1075.2	116.24
38	1134.1	119.38
39	119.46	122.52
40	1256.6	125.66
41	1320.3	128.81
42	1385.4	131.95
43	1452.2	135.09
44	1520.5	138.23
45	1590.4	141.37
46	1661.9	144.51
47	1734.9	147.66
48	1809.6	150.80
49	1885.7	153.94
50	1963.5	157.08
51	2042.8	160.22
52	2123.7	163.36
53	2206.2	166.50
54	2290.2	169.65
55	2375.8	172.79
56	2463.0	175.93
57	2551.8	179.07
58	2642.1	182.21
59	2734.0	185.35
60	2827.4	188.50
61	2922.5	191.64

<b>Diameter</b>	<b>Area</b>	<b>Circumference</b>
62	3019.1	194.78
63	3117.3	197.92
64	3217.0	201.06
65	3318.3	204.20
66	3421.2	207.35
67	3525.7	210.49
68	3631.7	213.63
69	3739.3	216.77
70	3848.5	219.91
71	3959.2	223.05
72	4071.5	226.20
73	4185.4	229.34
74	4300.9	235.48
75	4417.9	235.62
76	4536.5	238.76
77	4656.6	241.90
78	4778.4	245.04
79	4901.7	248.19
81	5153.0	254.47
82	5281.0	257.61
83	5410.6	260.75
84	5541.8	263.89
85	5674.8	267.04
86	5808.8	270.18
87	5944.7	273.32
88	6082.1	276.46
89	6221.2	279.60
90	6361.7	282.74
91	6503.9	285.89
92	6647.6	289.03
93	6792.9	292.17

<b>Diameter</b>	<b>Area</b>	<b>Circumference</b>
94	6939.8	285.31
95	7088.2	298.45
96	7238.2	301.59
97	7389.8	304.74
98	7543.0	307.88
99	7697.7	311.02
100	7854.0	314.16

**SQUARES, CUBES, SQUARE ROOTS & CUBE ROOTS**

<b>n</b>	<b>n<sup>2</sup></b>	<b>n<sup>3</sup></b>	<b>√n</b>	<b>∛n</b>
1	1	1	1.000	1.000
2	4	8	1.414	1.260
3	9	27	1.732	1.442
4	16	64	2.000	1.587
5	25	125	2.236	1.710
6	36	216	2.449	1.817
7	49	343	2.646	1.913
8	64	512	2.828	2.000
9	81	729	3.000	2.080
10	100	1 000	3.162	2.154
11	121	1 331	3.317	2.224
12	144	1 728	3.464	2.289
13	169	2 197	3.606	2.351
14	196	2 744	3.742	2.410
15	225	3 375	3.873	2.466
16	256	4 096	4.000	2.520
17	289	4 913	4.123	2.571
18	324	5 832	4.243	2.621
19	361	6 859	4.359	2.668
20	400	8 000	4.472	2.714
21	441	9.261	4.583	2.759
22	484	10 648	4.690	2.802
23	529	12 167	4.796	2.844
24	576	13 824	4.899	2.884
25	625	15 625	5.000	2.924
26	676	17 576	5.099	2.962
27	729	19 683	5.196	3.000
28	784	21 952	5.292	3.3037
29	841	24 389	5.385	3.072
30	900	27 000	5.477	3.107

<b>n</b>	<b>n<sup>2</sup></b>	<b>n<sup>3</sup></b>	<b>√n</b>	<b>3/n</b>
31	961	29 791	5.568	3.141
32	1 024	32 768	5.657	3.175
33	1 089	35 937	5.745	3.208
34	1 156	39 304	5.831	3.240
35	1 225	42 875	5.916	3.271
36	1 296	46 656	6.000	3.302
37	1 369	50 653	6.083	3.332
38	1 444	54 872	6.164	3.362
39	1 521	59 319	6.245	3.391
40	1 600	64 000	6.325	3.420
41	1 681	68 921	6.403	3.448
42	1 764	74 088	6.481	3.476
43	1 849	79 507	6.557	3.503
44	1 936	85 184	6.633	3.5320
45	2 025	91 125	6.708	3.557
46	2 116	97 336	6.782	3.583
47	2 209	103 823	6.856	3.609
48	2 304	110 592	6.928	3.634
49	2 401	117 649	7.000	3.659
50	2 500	125 000	7.071	3.864
51	2 601	132 651	7.141	3.708
52	2 704	140 608	7.211	3.733
53	2 809	148 877	7.280	3.756
54	2 916	157 464	7.348	3.780
55	3 025	166 375	7.416	3.803
56	3 136	175 616	7.483	3.826
57	3 249	185 193	7.550	3.849
58	3 364	195 112	7.616	3.871
59	3 481	205 379	7.681	3.893
60	3 600	216 000	7.746	3.915
61	3 721	226 981	7.810	3.936

<b>n</b>	<b>n<sup>2</sup></b>	<b>n<sup>3</sup></b>	<b>√n</b>	<b>3√n</b>
62	3 844	238 328	7.874	3.958
63	3 969	250 047	7.937	3.979
64	4 096	262 144	8.000	4.000
65	4 225	274 625	8.062	4.021
66	4 356	287 496	8.124	4.041
67	4 489	300 373	8.185	4.062
68	4 624	314 432	8.246	4.082
69	4 761	328 509	8.307	4.102
70	4 900	343 000	8.367	4.121
71	5 041	357 911	8.426	4.141
72	5 184	373 248	8.485	4.160
73	5 329	389 017	8.544	4.179
74	5 476	405 224	8.602	4.198
75	5 625	421 875	8.660	4.217
76	5 776	438 976	8.718	4.236
77	5 929	456 533	8.775	4.254
78	6 084	474 552	8.832	4.273
79	6 241	493 039	8.888	4.291
80	6 400	512 000	8.944	4.309

## TRIGONOMETRIC RATIOS

Angle		Chord	Sine	Cosine	Tangent	Co-Tangent	Secant
Degrees	Radians						
<b>0</b>	<b>0.0000</b>	<b>0.000</b>	<b>0.0000</b>	<b>1.0000</b>	<b>0.0000</b>	$\infty$	<b>1.0000</b>
1	0.0175	0.017	0.0175	0.9998	0.0175	57.2900	1.0002
2	0.0349	0.035	0.0349	0.9994	0.0349	28.6363	1.0006
3	0.0524	0.052	0.0523	0.9986	0.0524	19.0811	1.0014
4	0.0698	0.070	0.0698	0.9976	0.0699	14.3007	1.0024
5	0.0873	0.087	0.0872	0.9962	0.0875	11.4301	1.0038
6	0.1047	0.105	0.1045	0.9945	0.1051	9.5144	1.0055
7	0.1222	0.122	0.1219	0.9925	0.1228	8.1443	1.0075
8	0.1396	0.140	0.1392	0.9903	0.1405	7.1154	1.0098
9	0.1571	0.157	0.1564	0.9877	0.1584	6.3138	1.0125
10	0.1745	0.174	0.1736	0.9848	0.1763	5.6713	1.0154
11	0.1920	0.192	0.1908	0.9816	0.1944	5.1446	1.0187
12	0.2094	0.209	0.2079	0.9781	0.2126	4.7046	1.0223
13	0.2269	0.226	0.2250	0.9744	0.2309	4.3315	1.0263
14	0.2443	0.244	0.2419	0.9703	0.2493	4.0108	1.0306
15	0.2618	0.261	0.2588	0.9659	0.2679	3.7321	1.0353
16	0.2793	0.278	0.2756	0.9613	0.2867	3.4874	1.0403
17	0.2967	0.296	0.2924	0.9563	0.3057	3.2709	1.0457
18	0.3142	0.313	0.3090	0.9511	0.3249	3.0777	1.0515
19	0.3316	0.330	0.3256	0.9455	0.3443	2.9042	1.0576
20	0.3491	0.347	0.3420	0.9397	0.3640	2.7475	1.0642
21	0.3665	0.364	0.3584	0.9336	0.3839	2.6051	1.0711
22	0.3840	0.382	0.3746	0.9272	0.4040	2.4751	1.0785
23	0.4014	0.399	0.3907	0.9205	0.4245	2.3559	1.0864
24	0.4189	0.416	0.4067	0.9135	0.4452	2.2460	1.0946
25	0.4363	0.433	0.4226	0.9063	0.4663	2.1445	1.1034
26	0.4538	0.450	0.4384	0.8988	0.4877	2.0503	1.1126
27	0.4712	0.467	0.4540	0.8910	0.5095	1.9626	1.1223
28	0.4887	0.484	0.4695	0.8829	0.5317	1.8807	1.1326
29	0.5061	0.501	0.4848	0.8746	0.5543	1.8040	1.1434
30	0.5236	0.518	0.5000	0.8660	0.5774	1.7321	1.1547

Angle		Chord	Sine	Cosine	Tangent	Co-Tangent	Secant
Degrees	Radians						
31	0.5411	0.534	0.5150	0.8572	0.6009	1.6643	1.1666
32	0.5585	0.551	0.5299	0.8480	0.6249	1.6003	1.1792
33	0.5760	0.568	0.5446	0.8387	0.6494	1.5399	1.1924
34	0.5934	0.585	0.5592	0.8290	0.6745	1.4826	1.2062
35	0.6109	0.601	0.5736	0.8192	0.7002	1.4281	1.2208
36	0.6283	0.618	0.5878	0.8090	0.7265	1.3764	1.2361
37	0.6458	0.635	0.6018	0.7986	0.7536	1.3270	1.2521
38	0.6632	0.651	0.6157	0.7880	0.7813	1.2799	1.2690
39	0.6807	0.668	0.6293	0.7771	0.8098	1.2349	1.2868
40	0.6981	0.684	0.6428	0.7660	0.8391	1.1918	1.3054
41	0.7156	0.700	0.6561	0.7547	0.8693	1.1504	1.3250
42	0.7330	0.717	0.6691	0.7431	0.9004	1.1106	1.3456
43	0.7505	0.733	0.6820	0.7314	0.9325	1.0724	1.3673
44	0.7679	0.749	0.6947	0.7193	0.9657	1.0355	1.3902
45	0.7854	0.765	0.7071	0.7071	1.0000	1.0000	1.4142
46	0.8029	0.781	0.7193	0.6947	1.0355	0.9657	1.4396
47	0.8203	0.797	0.7314	0.6820	1.0724	0.9325	1.4663
48	0.8378	0.813	0.7431	0.6691	1.1106	0.9004	1.4945
49	0.8552	0.829	0.7547	0.6561	1.1504	0.8693	1.5243
50	0.8727	0.845	0.7660	0.6428	1.1918	0.8391	1.5557
51	0.8901	0.861	0.7771	0.6293	1.2349	0.8098	1.5890
52	0.9076	0.877	0.7880	0.6157	1.2799	0.7813	1.6243
53	0.9250	0.892	0.7986	0.6018	1.3270	0.7536	1.6616
54	0.9425	0.908	0.8090	0.5878	1.3764	0.7265	1.7013
55	0.9599	0.923	0.8192	0.5736	1.4281	0.7002	1.7434
56	0.9774	0.939	0.8290	0.5592	1.4826	0.6745	1.7883
57	0.9948	0.954	0.8387	0.5446	1.5399	0.6494	1.8361
58	1.0123	0.970	0.8480	0.5299	1.6003	0.6249	1.8871
59	1.0297	0.985	0.8572	0.5150	1.6643	0.6009	1.9416
60	1.0472	1.000	0.8660	0.5000	1.7321	0.5774	2.0000
61	1.0647	1.015	0.8746	0.4848	1.8040	0.5543	2.0627
62	1.0821	1.030	0.8829	0.4695	1.8807	0.5317	2.1301

Angle		Chord	Sine	Cosine	Tangent	Co-Tangent	Secent
Degrees	Radians						
63	1.0996	1.045	0.8910	0.4540	1.9626	0.5095	2.2027
64	1.1170	1.060	0.8988	0.4384	2.0503	0.4877	2.2812
65	1.1345	1.075	0.9063	0.4226	2.1445	0.4663	2.3662
66	1.1519	1.089	0.9135	0.4067	2.2460	0.4452	2.4586
67	1.1694	1.104	0.9205	0.3907	2.3559	0.4245	2.5593
68	1.1868	1.118	0.9272	0.3746	2.4751	0.4040	2.6695
69	1.2043	1.133	0.9336	0.3584	2.6051	0.3839	2.7904
70	1.2217	1.147	0.9397	0.3420	2.7475	0.3640	2.9238
71	1.2392	1.161	0.9455	0.3256	2.9042	0.3443	3.0716
72	1.2566	1.176	0.9511	0.3090	3.0777	0.3249	3.2361
73	1.2741	1.190	0.9563	0.2924	3.2709	0.3057	3.4203
74	1.2915	1.204	0.9613	0.2756	3.4874	0.2867	3.6280
75	1.3090	1.218	0.9659	0.2588	3.7321	0.2679	3.8637
76	1.3265	1.231	0.9703	0.2419	4.0108	0.2493	4.1336
77	1.3439	1.245	0.9744	0.2250	4.3315	0.2309	4.4454
78	1.3614	1.259	0.9781	0.2079	4.7046	0.2126	4.8097
79	1.3788	1.272	0.9816	0.1908	5.1446	0.1944	5.2408
80	1.3963	1.286	0.9848	0.1736	5.6713	0.1763	5.7588
81	1.4137	1.299	0.9877	0.1564	6.3138	0.1584	6.3925
82	1.4312	1.312	0.9903	0.1392	7.1154	0.1405	7.1853
83	1.4486	1.325	0.9925	0.1219	8.1443	0.1228	8.2055
84	1.4661	1.338	0.9945	0.1045	9.5144	0.1051	9.5668
85	1.4835	1.351	0.9962	0.0872	11.4301	0.0875	11.4737
86	1.5010	1.364	0.9976	0.0698	14.3007	0.0699	14.3356
87	1.5184	1.377	0.9986	0.0523	19.0811	0.0524	19.1073
88	1.5359	1.389	0.9994	0.0349	28.6363	0.0349	28.6537
89	1.5533	1.402	0.9998	0.0175	57.2900	0.0175	57.2987
90	1.5708	1.414	1.0000	0.0000		0.0000	

## CONVERSION FACTORS

To convert from	Convert to	Multiply by
acre	hectare	0.404686
acre foot	cubic metre	1 233.48
atmosphere	millibar	1 013.25
atmosphere	pascal	101325
barrel	litre	159.113
barrel (US)	litre	158.987
barrel, dry (US)	cubic metre	0.115627
British thermal unit	joule	1 055.06
British thermal unit	kilowatt. hour	0.000 293
British thermal unit	megajoule	0.001055
Btu per cubic foot	kilojoule per cubic metre	37.2589
Btu per gallon	kilojoule per litre	0.232080
Btu per hour	watt	0.293071
Btu per pound	kilojoule per kilogram	2.326
Btu per square foot hour F	watt per square metre. kelvin	5.67826
bushel	litre	36.3687
bushel (US)	litre	35.2391
cubic foot	cubic metre	0.028317
cubic foot per second	cubic metre per second	0.028317
cubic inch	cubic centimetre	16.387064
cubic inch	cubic millimetre	16387.1
cubic yard	cubic metre	0.764555
fathom	metre	1.8288
fluid ounce	millilitre	28.4131
foot	metre	0.3048
foot per minute	metre per minute	0.3048
foot per minute	metre per second	0.00508
foot per second	metre per second	0.3048
foot pound force	joule	1.35582
foot pound force per second	watt	1.35582

To convert from	Convert to	Multiply by
furlong	metre	201.168
gallon	litre	4.54609
gallon (US)	litre	3.78541
gravity (standard)	metre per second per second	9.80665
horse-power	kilowatt	0.745700
hundredweight	kilogram	50.8023
inch	metre	0.025
inch	micrometre	25400.00
inch	millimetre	25.4
inch mercury	kilopascal	3.38638
inch water gauge	kilopascal	0.248642
kilowatt hour	megajoule	3.6
knot (international)	kilometre per hour	1.852
mile	kilometre	1.609344
mile per gallon	litre per 100 kilometre	divide 2.28481
mile per hour	kilometre per hour	1.609344
millimetre mercury	kilopascal	0.133322
ounce	gram	28.3495
ounce per square foot	gram per square metre	305.152
ounce per square yard	gram per square metre	33.9057
pint	litre	0.568261
pound	kilogram	0.45359237
pound force	newton	4.44822
pound force foot	newton.metre	1.355 82
pound force inch	newton.metre	0.112985
pound force per square inch	kilopascal	6.89476
pound force per square inch	megapascal	0.006895
pound force per square inch	pascal	6 894.76
pound per acre	kilogram per hectare	1.12085
pound per cubic foot	kilogram per cubic metre	16.0185
pound per foot	kilogram per metre	1.48816

<b>To convert from</b>	<b>Convert to</b>	<b>Multiply by</b>
pound per gallon	kilogram per litre	0.099776
pound per square foot	kilogram per square metre	4.88243
square foot	square metre	0.092903
square foot per gallon	square metre per litre	0.020436
square foot per ton	square metre per tonne	0.091436
square inch	square centimetre	645.16
square inch	square millimetre	645.16
square mile	square kilometre	2.589999
square yard	square metre	0.836127
superficial foot	cubic metre	0.002360
ton	tonne	1.0165
ton, freight (40 ft <sup>3</sup> )	cubic metre	1.13 67
ton, register (100 ft <sup>3</sup> )	cubic metre	2.83168
ton force foot	kilonewton metre	3.03703
ton force per square inch	megapascal	15.4443
ton per cubic yard	tonne per cubic metre	1.32894
yard	kilometre	0.000914

# AUSTRALIA

Australia comprises a land area of 7,682,300 square kilometres. The land lies between latitudes 10°41' north (Cape York) and 43°39' south (South East Cape, Tasmania) and between longitudes 113°09' west (Steep Point) and 153°39' east (Cape Byron).



The area of Australia is almost as great as that of the United States of America (excluding Alaska), about 50 per cent greater than Europe (excluding Russia and other Eastern European countries) and 32 times greater than the United Kingdom.

Australia is composed of six states - New South Wales, Victoria, Queensland, Western Australia, South Australia, Tasmania and two Territories: Northern Territory and Australian Capital Territory.

The longest river in Australia is the Murray River, 2,520 kilometres, which forms a natural border between the States of New South Wales and Victoria. The highest mountain in Australia is Mount Kosciusko, 2,230 metres, which is situated in New South Wales.

State/ Territory	Area (000km <sup>2</sup> )	Length of Coastline (km)	Estimated resident population Sept 17 ('000)	Capital city	Estimated resident population of city June '16 ('000)
<b>NSW</b>	801	2007	7896	Sydney	5030
<b>VIC</b>	227	1868	6359	Melbourne	4725
<b>QLD</b>	1724	6973	4949	Brisbane	2360
<b>SA</b>	979	3816	1727	Adelaide	1342
<b>WA</b>	2527	12889	2587	Perth	2020
<b>TAS</b>	65	2833	522	Hobart	224
<b>NT</b>	1336	5437	246	Darwin	145
<b>ACT</b>	2.4	54	412	Canberra	412
<b>AUST.</b>	7692	35877	(a) 24,702		

Note: (a) includes all other territories including Jervis Bay Territory, Christmas Island and the Cocos (Keeling) Islands.  
Source: Australian Bureau of Statistics.

## DISTANCES BETWEEN AIRPORTS (NEAREST 5 KILOMETRES)

Distances shown are those of the most probably selected direct or indirect commercial flights following the prescribed airline routes used by major and commuter airlines. Source: 'Great Circle Distances based on the International Reference Spheroid' as made available to the editor by former Australian company Ansett Airlines of Australia.

	PERTH	ADELAIDE	DARWIN	ALICE SPRINGS	MELBOURNE	LAUNCESTON	HOBART	CANBERRA	SYDNEY	TAMWORTH	COFFS HARBOUR	DUBBO	WAGGA WAGGA	BRISBANE	ROCKHAMPTON	COOLANGATTA	TOWNSVILLE	MACKAY	CAIRNS
PERTH	2120																		
ADELAIDE	2885	2610																	
DARWIN	3435	1315	1300																
ALICE SPRINGS	2705	645	3255	1955															
MELBOURNE	3175	1055	3665	2370	475														
LAUNCESTON	3320	1260	3870	2570	615	145													
HOBART	3090	970	3585	2285	470	945	1085												
CANBERRA	3285	1165	3220	2020	705	1180	1320	235											
SYDNEY	3600	1485	3540	2340	1025	1500	1640	555	320										
TAMWORTH	3725	1605	3660	2460	1145	1620	1765	675	440	185									
COFFS HARBOUR	3595	1475	3530	2330	1015	1490	1630	545	310	625	750								
DUBBO	3070	1005	3620	2320	365	840	980	160	365	685	805	675							
WAGGA WAGGA	4030	1910	2850	2245	1375	1850	1990	980	745	510	320	765	1110						
BRISBANE	4550	2430	3370	2335	1895	2370	2510	1500	1265	1025	840	1285	1630	520					
ROCKHAMPTON	3960	1845	2940	2700	1330	1805	1945	915	680	600	415	860	1045	90	610				
COOLANGATTA	4870	2850	2020	1450	2485	2960	3100	1920	1685	1620	1435	1880	2050	1110	600	1205			
TOWNSVILLE	4825	2710	2350	1780	2170	2650	2790	1780	1545	1305	1120	1565	1910	800	280	890	320		
MACKAY	5420	330	1680	1455	2765	3240	3380	2370	2135	1900	1715	2155	2500	1390	880	1480	285	615	

# GLOSSARY OF TERMS – PART 1

## METALLURGICAL TERMS

**AGEING** - Changes in the properties of steel occurring with the passage of time affecting the mechanical properties of a metal or alloy. Usually accelerated by an increase in temperature, and so may be natural or artificial.

**ABRASION RESISTANCE** - Resistance to frictional rubbing, as distinct from resistance to knocks and impacts.

**ACCELERATED WEATHERING** - Laboratory tests designed to simulate, but at the same time intensify and accelerate, the destructive action of natural weathering.

**ANNEALING** - A process involving heating and cooling, applied usually to induce softening. The term annealing is also used to cover treatments to:

- Remove stresses,
- Alter mechanical or physical properties,
- Produce a definite microstructure, and
- Remove dissolved gases.

**BACKING COAT** - See "wash coat".

**BEND TEST** - A test of ductility where (at ordinary temperature), a test piece must withstand, without fracture, bending through a specified angle around a specified diameter, e.g.:

- Ot - flat bend on itself
- It - bend around thickness of sheet.

**BRAZING** - Joining metals by fusion of a non-ferrous filler metal with a melting point above approximately 450 degrees Celsius, but lower than those of the metals being joined. The filler metal flows by capillary action between the surfaces to be joined.

**BRONZE WELDING** - Similar to brazing but the joint is characterised by a substantial external fillet of filler metal.

**CAMBER** - The deviation of a side edge of metal sheet or strip from a straight line. The measurement is taken on the concave side using a straight edge.

**CARBON STEEL** - A steel, free from intentionally added alloying elements, depending for its properties substantially upon its carbon content alone. Manganese up to 1% is not regarded as removing the steel from this designation.

**CENTRE BUCKLE** - (full centre) An out-of-flat condition caused by selective elongation of part of the strip width so that the centre of the sheet is longer than the edges.

**CHALKING** - A chalk-line formation on the surface of an organic coating caused by the breakdown of the surface layer of resin, releasing pigment particles and fillers normally bound by the resin. This normally occurs after long term exposure to sunlight.

**CHATTER** - A transverse series of marks or lines in either the metal surface of the paint film caused by vibration or eccentric rolls in processing equipment.

**COATING CLASS** - Coating Class is designated by the specified coating type and the minimum mass of coating on both sides of the sheet measured by the triple spot test as detailed in Australia Standard 1397, eg AZ150, aluminium/zinc coating with a minimum coating of 150 g/m<sup>2</sup>.

**COATING MASS** - The ability of a metallic-coated sheet and strip product to withstand corrosion in a particular environment is a function of the amount (and type) of coating on the surface of the steel base. This is quantified as the "coating mass" and is the mass of coating on both sides of the steel base expressed in grams per square metre (g/m<sup>2</sup>).

**COIL** - A rolled up length of strip. This word was previously used to describe strip itself.

**COIL SET** - A tendency of a length of strip to maintain the curved shape of the coil from which it was cut.

**COLD ROLLING** - Is the reduction of hot-rolled pickled steel strip to a specified thickness, using a series of stands of rolls reducing the thickness progressively. This distorts the grain structure of the steel significantly and therefore a loss of ductility results.

**CONVERSION COATING** - A chemical treatment which, by reaction with the surface of the strip, converts it to a non-metallic and non-conductive surface for improved paint adhesion and corrosion resistance. See also "chromating" and "phosphating".

**CORROSION** - Destruction of a metal by electro-chemical reaction with its environment.

**CUPPING TEST** - A test of the ductility of metal sheet or strip obtained by measuring the depth of bulge which can be formed before fracture.

**DECARBURISATION** - In steel, partial or complete loss of carbon by chemical reaction.

**DEEP DRAWING** - Forming cup-shaped articles, shells or deeply recessed parts by using a punch to force sheet metal into or through a die.

**DRY FILM THICKNESS** - The thickness of the dried paint film on the surface of primer under the top coat. It is measured in micrometers.

**DUCTILITY** - Relative ability of a metal to deform from a flat condition into a more complex shape without fracture, formability, workability.

**ELASTICITY** - That property of a material which causes it to resume its original form after removal of a load.

**ELASTIC LIMIT** - The maximum stress to which a material may be subjected without any permanent strain remaining upon complete release of stress.

**ELONGATION** - In tensile testing, the increase in the gauge length measured after fracture of the test specimen within the gauge length, usually expressed as a percentage of the original gauge length.

**FABRICATING PERFORMANCE** - Is the end-use performance of a BlueScope Steel product for application requiring bending, drawing, pressing, welding or painting. Note the numbering system is arbitrary and only compares BlueScope Steel products against each other.

**FATIGUE** - A condition in metals resulting from fluctuating stresses, leading to failure at a stress substantially below the normal tensile strength of the material. Fatigue failures invariably manifest themselves in the progressive development of a crack, generally undetected until after complete failure has taken place, since they occur without prior visible strain. Fatigue cracks commonly originate at some point of local and predominantly tensile stress concentration, either at the surface (sharp re-entrant corners, tool marks, scratches, etc) or in the interior (flakes, forging bursts, or inclusions) of the stressed component.

Where cracks develop under the combined effect of fluctuating stress and corrosive environment, the subsequent failure is termed corrosion fatigue.

**FINISH** - Finish refers to the degree of smoothness of lustre of the sheet.

**FLATNESS** - Flatness of sheet metal may be best defined as the absence of any waviness or buckles. The out-of-flatness of a sheet is the measured height of the buckles from a flat surface on which the sheet is lying.

**FLUTING** - The tendency to form a series of near parallel kinks or creases in sheet metal during curving or bending. The creases occur at right angles to the direction of curving and are associated with non-uniform yielding of metal causing localised deformation.

**FORMABILITY** - The relative ease with which a metal can be shaped through plastic deformation.

**FREQUENCY** - The number of complete cycles of current per second taken by alternating current.

**GALVANISING** - The process of applying a coating of zinc to a surface of iron or steel to provide a corrosion resistant surface.

Zinc may be applied by electroplating or more commonly by drawing the steel strip continuously through a molten zinc bath. A similar process is used for the manufacture of ZINCALUME®, the strip being drawn through a coating bath of zinc/aluminium alloy. Solid state diffusion (sherardising) or spraying are not usually termed galvanising.

**GLOSS** - The degree to which a painted surface possesses the property of reflecting light in a mirror-like (specular) manner. COLORBOND® steel surfaces are produced in 10%, 25% and 80% gloss. Building materials are all 25% gloss (semi-gloss).

**GRADE-OF:**

- Of BlueScope Steel from which steel products are produced.
- Of product within the BlueScope Steel product range to distinguish base types, eg. Hot-Rolled "Formable Grade".

**HARDNESS** - The resistance offered by a metallic material to plastic deformation by indentation or penetration. The above defines hardness as it is commonly measured in metals. Quantitatively it has no absolute significance, but serves for purposes of comparison between materials of similar type (in particular, of similar elastic properties). It is more specifically referred to as indentation hardness or penetration hardness.

**HEAT TREATMENT** - An operation or combination of operations involving the heating or cooling of a metal or alloy in the solid state for the purpose of obtaining certain desired conditions or properties.

Heating for the sole purpose of hot working is excluded from the meaning of this definition.

**HYDROGEN EMBRITTLEMENT** - Brittleness induced in steel due to absorption of hydrogen. This commonly occurs in pickling and electroplating operations. In the heat affected zones of welds, it can lead to cracking. Hydrogen embrittlement is particularly detrimental in steels of high hardness, and may be removed by annealing in the range 200 to 750 degrees Celsius.

**HUNTERLAB** - Is a colour difference meter which gives an accurate numerical measurement of colour differences between the painted steel sheet under test and an approved colour standard. The meter measures colour as seen in normal daylight similar to how the human eye responds to colour. The units are AE.

**INDUCED CURRENT** - The electric current produced by moving a conductor in a magnetic field.

**KILLED STEEL** - A steel with deoxidants such as aluminium or silicon added before casting molten steel to remove oxygen and so prevent evolution of carbon monoxide and chemical segregation during cooling.

**LOCK-FORMING** - The forming of two adjacent edges prior to interlocking.

**LOCK-SEAMING** - The closing of a tight seam of lock-formed edges of sheet metal, for example Pittsburg lock-seam, grooved single lock-seam, Snap Lockseam.

**LUSTRE** - Lustre finish is a smooth finish for electroplating achieved by using specially prepared rolls. Some surface preparation by the plater may be necessary.

**MATT** - Cold-rolled products are available with either matt or lustre finish. The matt finish is produced by rolling with mechanically roughened rolls. This finish is preferred for lacquer or paint finishes and is beneficial during drawing operations when used with a lubricant. This finish can be assumed when no surface is specified.

**MECHANICAL PROPERTIES** - Properties relating to the behaviour of materials under load in conventional mechanical tests, such as elastic moduli, tensile strength, elongation, hardness.

**MINIMISED SPANGLE** - The formation of normal zinc spangle is inhibited in cooling or by bath control. Skin-passing metallic-coated steel sheet and strip will smooth the surface, and is often done in conjunction with minimised spangle treatment.

**NORMALIZING** - Heating steel to, and if necessary holding at, a suitable temperature above the transformation range, followed by cooling in a still atmosphere to ambient temperature, in order to produce a medium-to-fine pearlite microstructure.

The effect of normalizing is generally to refine the grain size, render the structure more uniform, and improve the mechanical properties.

**PASSIVATION** - A surface treatment to give greater resistance to storage corrosion in which the protection is afforded by conversion coatings and films.

**PHOSPHATING** - Phosphating treatments produce adherent non-metallic conversion coatings which convert the galvanized surface to an insoluble complex, thick enough to provide good adhesion for subsequent paint films.

**PICKLING** - Removal of oxide films from metal by immersion in an acid. The process is applied particularly to scale removal from metal prior to operations such as cold rolling, wire drawing and electroplating, and in general is carried out in dilute solutions of the mineral acids, often with additions of organic material (inhibitors) to restrain the rate of attack on the metal. Absorption of hydrogen may occur in pickling of steel causing embrittlement of hard steels, and necessitating low temperature annealing for its removal.

**PRESSING** - Is a metal working process in which a flat blank, constrained between two surfaces, is forced by a punch to take a required shape.

**PRIMER** - The first coat of a painting system applied to an unpainted surface. It normally has very good adhesion and corrosion inhibitive properties.

**PROOF STRESS** - That stress at which a material exhibits a specific limiting permanent set. The proof stress of a material is found by observing, usually from a stress-strain diagram, the stress at which the predetermined permissible elongation (usually of the order of 0.1% or 0.2%) occurs.

**RECRYSTALLATION** - The reformation to "round" ferrite grains flattened during rolling. This occurs at temperatures above 725°C, either immediately after hot rolling or during annealing after cold reduction.

**RESQUARED** - This term describes a sheet which has been sheared to accurate dimensional limits as a last operation in its production. The name is derived from early guillotining operations necessary to achieve the required tolerance.

**ROLLING DIRECTION** - The main direction in which strip has been rolled. Associated terms used are:

- Longitudinal - in the rolling direction
- Transverse - right angles to the rolling direction

**ROLL-FORMING** - Process by which metal is unwound from coiled strip and passed through a number of pairs of metal profile rolls.

Each role pair is designed to progressively develop a profile by predetermined increments.

**SCALE** - Layers of iron oxide formed on the surface of hot steel when oxygen in the air combines with iron from the steel.

**SHEET** - A flat rolled steel product of any width and thickness cut into lengths and stored in a flat condition. Previously the official designation was "cut lengths". Note - this is not to be confused with plate.

**SKIN-PASSING** - A light cold rolling operation (about 1-2 per cent of cold work) which removes the yield point in steel which otherwise causes coil break, fluting or stretcher strain in subsequent operations. It can also be used to:

- Modify surface, for example, by reducing surface roughness for bright (lustre) qualities or by specially controlled roughening for matt finish for drawing qualities, and
- Flatten strip being rolled.

**SOLDERING** - Joining of metals by fusion with alloys that have relatively low melting points, most commonly lead and/or tin base alloys, which are known as soft solders. Joining with higher melting point alloys, sometimes termed hard solders at temperatures over 450 degrees Celsius, is generally termed brazing.

**SPANGLE** - Grain or crystal of zinc, or zinc/aluminium as appearing on hot-dip metallic coated steel.

**STRAIN AGEING** - Ageing which occurs subsequently to the cold working of an alloy. Strain ageing in steel is predominantly due to uncombined nitrogen, and results in a marked decrease in ductility.

**STRESS RELIEVING** - Heating a metal to, and if necessary holding at some temperature generally below the recrystallisation range, followed by uniform cooling, for the sole purpose of removing internal stresses.

**STRETCHER STRAIN MARKINGS** - Characteristic surface markings, usually of a parallel sided diagonal pattern, which appear during the early stages of the plastic deformation of mild steel and certain copper-base alloys. Their production is associated with sudden extension at the yield point. In steel, they are alternatively called Luders Lines.

**STRETCHER LEVELLED** - Stretcher levelled, as applied to sheets, indicates a standard of flatness. The term originated from an early method of obtaining flatness. This was by gripping the ends of the sheet and stretching it to remove surface waves and buckles.

**STRIP** - A continuously rolled flat product of any width and thickness, supplied rolled up into and stored in coil form. Previously, the official designation was "coil" used for both the strip and the rolled-up product.

**TEMPER** - To modify hardness of metals.

- Adjustment of hardness of heat treated articles by controlled heating after quenching.
- Increase of hardness by cold rolling. The degree of cold rolling is variable depending on the required hardness and is more than that of skin-passing.

**TEMPER ROLLING** - Is a cold-rolling operation which adjusts the metallurgical properties of cold rolled strip and at the same time enhances surface texture and flatness.

**TENSILE STRENGTH OR ULTIMATE TENSILE STRENGTH** - If a prepared sample of steel is strained in a tensile testing machine until it breaks, then the ultimate tensile strength of the material is obtained by dividing the maximum observed load by the original cross-sectional area of the sample.

**TENSILE TEST** - A standard sample of material is placed between two jaws and drawn apart in a tensile testing machine until fracture.

**TERNE** - Refer Metallic coated.

**VITREOUS ENAMELLING** - Refer Cold-Rolled General Information page.

**WASH COAT** - The coating applied to the back or unexposed side of the painted strip. There are standard wash coat colours for COLORBOND® steel products.

**YIELD POINT** - The stress at which a material permanently deforms.

**YIELD STRENGTH** - Strength at which steel first exhibits plastic strain.

# GLOSSARY OF TERMS – PART 2

## BUILDING & ENGINEERING TERMS

**ACCESSORIES** - Gutters, ridge capping, ventilators, flashings, downpipes, brackets and their fixings.

**ANGLE BRACE** - A brace that goes from corner to corner in framing. A tie to strengthen the angles of framing.

**APRON FLASHING** - Sheet used to prevent water from percolating through where a vertical surface pierces a roof.

**AS** - Australian Standard published by Standards Australia.

**ASTRAGAL** - A small moulding with a semi-circular section projecting above the surface, similar to a bead. A metal strap used to fasten downpipes to walls.

**BACKING** - The dihedral angle of a hip. Shaping the top of a hip to conform to the roof planes.

**BALUSTRADE** - A series of balusters in the one flight or along a landing.

**BARGE BOARD, VERGE OR GABLE BOARDS** - The inclined timbers on the gable ends which are fixed to the rafters and cover the ends of the roof timbers.

**BARGE CAPPING** - A protective timber or metal capping for a bargeboard.

**BARGE FLASHING** - A flashing used between a bargeboard or barge capping and the roofing material to prevent the ingress of moisture.

**BASE METAL THICKNESS** - (B.M.T.) The metal thickness before any subsequent coating.

**BT** - Boundary trap.

**BATTENS** - Narrow pieces fixed to walls to receive sheeting or on roofs to receive tiles, slates, etc.

**BEARERS** - Members supporting the joists in steel, timber framed or brick dwellings.

**BEARING** - That part of the beam resting on the supports.

- BEARING PLATE** - A stone or metal plate carrying the weight of a beam, etc.
- BELL ROOF** - A roof shaped like a bell by fixing false feet to the foot of the rafters.
- BOX GUTTER** - A gutter formed in the shape of a trough. It is formed between a roof surface and a parapet wall or between two roof surfaces.
- BRACKET** - The ornamental return piece fixed to the face of the string in a stair. A right angle support with angle brace; usually used to support a shelf, etc.
- BRIDGING** - The use of stiffening members between deep floor joists and purlins to limit lateral deflection.
- BRICK VENEER** - A brick facing applied to the outside of a timber structure.
- BUILDING PAPER** - A waterproof paper used in construction work for insulation or as an undercover for roofs as a protection against weather.
- BUILD-UP RIB** - A rib or member that is built up of several thicknesses, usually in brick bond.
- BULLNOSE** - The edge of a piece of timber, shaped to a quarter circle. A small metal plane with its cutter close to the fore end, used for cleaning up rebates.
- CAMBER** - To fix a horizontal structural member with a rise at its centre to counteract sagging.
- CANT** - To incline on an angle other than a right angle.
- CANTILEVER** - Beams that are supported at one end only as for a shop awning.
- CAPILLARY WATER** - Water drawn upwards into soil pores and held by surface tension.
- CAT LADDER** - A ladder fixed vertically to a wall.
- CEILING BATTEN** - A light timber or steel member fixed to ceiling joists to which the ceiling lining is then fixed.
- CEILING JOIST** - Light member across a room to carry the ceiling sheeting.

**CELLAR** - An underground room in a basement used for storage.

**CHALK LINE** - A long line or string used for setting out long straight lines. When coated with chalk, the ends are held taut, while the centre is lifted away from the surface and allowed to spring back, thus leaving a chalked line on the surface.

**CHAMFER** - A 45 degree bevel cut on the arris of timber, sometimes stopped before reaching the end of the timber. When the amount removed is unequal on each face it is called a splay or bevel.

**CHORD** - The horizontal member in a bowstring truss. A straight line drawn across a circle with each end touching the circumference.

**CLADDING** - The outer non-loadbearing covering of the external walls of a framed building or structure, applied for weatherproofing and sometimes decorative purposes. Also called 'External cladding' or 'wall cladding'.

**CLEAR SPAN** - The clear horizontal distance or space between faces of the supports of an arch, beam, truss or roof structure. It is always less than the effective span.

**COMPOSITE** - A type of construction made up of different materials or of different members in conjunction to improve strength or resistance to stresses.

**COMPUTER-AIDED DESIGN (CAD)** - The application of computer technology to the design of products, including buildings and structures, using interactive programs.

**CONCEALED GUTTER** - A gutter which is hidden from view except from above. Also called 'hidden gutter' or 'Secret gutter'.

**CONDENSATION GROOVE** - A groove formed for the purpose of collecting condensation on the inside of sashes to allow the moisture to escape to the outside, as in the bottom rail of a skylight.

**CORNICE** - The mould at the junction between the wall and the ceiling.

**CORRUGATED** - Sheet shaped into a sinusoidal, or circular curve.

**COVER** - The width of the profile less the lap.

**CRAMPING-UP** - The act of tightening up the joints in framing by means of cramps.

**CREEP** - Increasing deformation under constant load.

**CREST** - The top surface of a rib.

**DAR** - Dressed all round.

**DECK** - Predominantly flat profile roofing or cladding, also referred to as tray.

**DEFORMED SHANK NAIL** - Includes nails with annular, spiral or deformed shanks.

**DE-INDEXING** - The releasing of interlocking profiled sheets.

**DISTRIBUTED LOAD** - A design load, not necessarily uniform, which is spread over an area of surface, expressed in kilograms per square metre ( $\text{kg}/\text{m}^2$ ); or along a length of a structural member, expressed in kilograms per metre run ( $\text{kg}/\text{m}$ ). See also: Uniformly distributed load.

**DOME** - A curved roof, semi-circular in elevation over a square, hexagonal, octagonal, or other shaped plan.

**DORMER** - A window projecting from a roof surface.

**DOWNPIPE (DP)** - A metal or plastic pipe for conveying rainwater, either externally or internally, from a roof or gutter to a stormwater drain, sump, tank, ground level, or another part of a building. Downpipes are manufactured in 'rectangular' or 'round' cross-sections and are usually installed externally, but sometimes internally or in concealed positions. Also called 'Downspout' or 'Rainwater pipe'.

**DOWNTURN** - That part of the trough of a sheet turned down into a gutter.

**DUTCH GABLE** - A roof frame type that is partially hipped but which terminates as a gable.

**EAVES** - The lower edge of a roof slope.

**EAVES GUTTER** - An external gutter at the lower edge of a roof - also known as spouting.

**ELASTIC LIMIT** - The stage at which a noticeable permanent set occurs when the material is loaded.

**ELEVATION** - The part of a drawing which shows the front view giving length and height.

**END LAP** - In roofing, the distance by which the upper sheet, tile or other unit of roofing overlaps the top end of the one immediately below it to provide weatherproofing. See also: side lap.

**END SPAN** - A span which is part of a continuous roof, beam or slab only at its interior support. Therefore, an end span is often shorter and more heavily reinforced than interior spans.

**FACTOR OF SAFETY** - An arranged increase in size or strength of the member above that at which it is known to fail.

**FALL** - The slope (pitch) of a flat or low slope surface, such as a roof, gutter, or paving.

**FASCIA** - The upright board fixed to the feet of the rafters to carry the guttering. Any wide board fixed on edge. (Timber or steel)

**FASTENER** - A nail, screw or rivet used to fasten metal roofing or cladding to the structure.

**FIBRE CEMENT** - A building board composed of cellulose fibres and cement.

**FIXING** - The device used to fix or clip metal roof flashings.

**FLASHINGS** - Galvanized steel, lead, zinc sheet, etc. used to prevent water seeping through to an interior surface. Lead, however, should not be used with ZINCALUME steel sheet.

**FOOTING** - The lowest part of a building, an enlargement at the base of a wall to distribute the load over a greater area.

**FOUNDATION** - The soil or strata which supports the lowest part of a building – i.e. the footings.

**GABLE** - The triangular end of a building above the plate line with the rafters meeting the apex at the ridge.

**GABLE ROOF** - A roof having two slopes only with a gable at each end.

**GALVANISING** - The process in which steel is coated to prevent corrosion by dipping it into a molten zinc bath.

**GCI** - Galvanised corrugated iron, the old term for zinc-coated corrugated steel sheet and now usually but inaccurately used for corrugated ZINCALUME zinc/aluminium alloy-coated steel.

**GIRT** - Horizontal members in a wall used to support wall sheeting.

**GRADE** - The mechanical strength of a metal expressed in yield strength and measured in MPa.

**GUTTER** - The spouting, or valley gutter, a channel formed to collect and carry away rain water off a roof.

**GYPSUM BOARD** - A wallboard made from plaster of paris and covered with a stiff paper.

**HAMMER BEAM** - The lower cantilever member in the roof truss of the same name.

**HIP** - The external angle formed on a roof where two inclined surfaces meet.

**HIPPED ROOF** - A roof with its ends inclined as well as its sides.

**HIP RAFTER** - The inclined member at the intersection of two roof surfaces.

**JACK RAFTER** - The rafters running from a wall plate to the end of a ridge (sometimes called crown end rafters).

**JAMBS** - The vertical sides of openings or the vertical timbers fixed to the jambs of the opening.

**JOISTS** - A horizontal structural member of timber or steel, spanning a room either to carry the floor or the ceiling.

**KING POST** - The central vertical member of a roof truss, that from the centre of the tie beam to the apex of the roof.

**KNEE** - A curve in a handrail, convex on top and shaped in the form of a human knee.

**LAP (OVERLAP)** - The length by which one material overlaps another for structural or functional purposes. See also: End lap; Side lap.

**LEAN-TO OR SKILLION** - A roof with only one slope, formerly when used against another building, but now applied to any roof with a single slope.

**LEEWARD SIDE** - The side facing away from the prevailing wind.

**LINTEL** - A horizontal member, timber, steel or concrete, across an opening, usually to carry the wall above.

#### **LIMIT STATE:**

**SERVICEABILITY LIMIT STATE** - The condition when a building becomes unfit for its intended use due to deformation or deflection.

**ULTIMATE LIMIT STATE** - The condition when a building is permanently deformed or becomes unstable.

**LIVE LOAD** - A moving or variable load on a floor or beam.

**LONG-RUN** - Roofing and cladding in one length without transverse laps.

**MANSARD ROOF** - A form of roof having a break in the slope, the lower part being steeper than the upper.

**MONOSLOPE ROOF (MONOPITCH ROOF)** - A planar roof with a constant slope and without ridge. Also called 'Single pitch(ed) roof'. See also: Lean-to roof; Skillion roof.

**MULLION** - The vertical dividing member in a window or door frame.

**NOBLE METAL** - A metal that is less active or likely to corrode when compared to others.

**NOGGING** - Horizontal pieces fixed between studs for bracing and to which plaster sheeting, skirting, etc. can be fixed.

**OIL CANNING** - Distortion in the form of waviness of centre fullness in a profiled sheet.

**PAN** - The flat portion between the ribs in a profiled metal sheet.

**PARAPET GUTTER** - A gutter or water channel formed against a parapet wall at the bottom of a roof slope.

**PARTY WALL** - A wall between two adjoining properties, built half on one and half on the other; a wall separating one house from another.

**PENETRATION** - A projection through a roof or wall, e.g. vent pipe or air-conditioning unit.

**PERMEABLE MEMBRANE** - Sheet material that allows the passage of water vapour, also known as 'breather type'.

**PITCHED ROOF** - A common type of roof with two sloping surfaces of more than 10° of angle meeting at a central ridge.

**PLASTERBOARD** - A wall board made of plaster and covered on both sides with heavy paper.

**PLATE** - A horizontal member in structural framework, a level piece that carries the vertical pieces.

**PLUMB** - To make perpendicular; in a perpendicular position.

**PORTAL FRAME** - A structural frame of steel, reinforced concrete or timber constructed with rigid joints for stability without diagonal bracing. It has either two upright members rigidly connected at the top to a straight, sloping or curved third member, or a pair of rigidly jointed vertical columns and sloping roof members, jointed at the apex.

**PONDING** - Undrained water retained on a roof surface due to permanent deflection or deformation of a roof.

**PREPAINTED** - Base metal strip or sheet painted on, or laminated with a film, added to give protection or aesthetic appeal prior to subsequent forming or shaping.

**PROFILED SHEETING** - Metal sheeting produced with corrugations or ribs to increase its strength.

**PURLIN** - A horizontal member placed at right angles to and spanning across rafters or roof trusses to which the sheet roof covering or cladding is attached.

**RAFTERS** - The inclined members of a roof between the plate and the ridge which support the roof covering.

**RAINWATER HEAD** - An external box capable of collecting rainwater from a gutter. (Also called Rain Head)

**RAINWATER PIPE (RWP)** - See downpipe.

**RETURN PERIOD** - The average number of years within which a given wind gust or rainfall is expected to be equalled or exceeded.

**RIB** - A longitudinal upstand produced by roll-forming folding or crimping.

**RIDGE (ROOF RIDGE)** - The highest part (or apex) of a pitched roof, usually forming a horizontal line.

**RIDGE CAPPING** - A covering over the ridge to provide a continuous cover and effective weather seal between the two slopes. For sheet roofing shaped metal is used.

**RISE** - The vertical distance through which an element rises, such as the rise of a roof, arch, stair, or step.

**ROOF TRUSS** - A framed construction in a roof.

**SACRIFICIAL PROTECTION** - The coupling of two metals so that one is sacrificed by electrolytic corrosion in order to protect the other.

**SARKING** - A layer of timber boarding, covering the rafters underneath roofing tiles or slates of a pitched roof, to provide a moisture and thermal barrier.

**SARKING MEMBRANE** - A pliable, water-resistant membrane for use beneath the external roof or wall covering to collect and discharge any water that may penetrate, or water vapour that may form. Now often combined with reflective foil to provide thermal insulation benefits. Commonly abbreviated to 'Sarking'.

**SAW TOOTH ROOF** - A roof that in profile is the shape of the teeth of a saw. A trussed construction.

**SCISSORS TRUSS** - A roof truss so named because of its resemblance to a pair of scissors.

**SECRET FIXING** - The fixing of joinery in such a manner that on completion the method of fixing is not visible on the face.

**SIDE LAP** - In roofing, the distance by which the upper sheet, tile or other unit of roofing overlaps the side of the one immediately below it to provide weatherproofing.

**SKEW** - At an angle or out of square.

**SKEW NAILING** - Nails driven in at an angle to the surface to give greater holding power.

**SKILLION ROOF (SKILLION)** - A monoslope (single pitched) roof without a ridge or peak, providing the main roof or part of a roof.

**SKIRTING** - The moulded baseboard around a room.

**SPAN** - The horizontal distance between two supports as the springing points in an arch.

**SPIGOT** - The plain or specially formed end of a pipe for insertion into a socket or coupling to form a joint.

**SPOUTING** - See Guttering.

**SPREADER** - A piece of perforated horizontal piping connected to the foot of a downpipe from a higher roof to evenly spread rainwater over a lower roof.

**STANCHION** - A vertical steel or iron support for a beam

**TAPER(ED) FLANGE BEAM** - A rolled structural I-section with flanges that are tapered and rounded at the ends.

**TIE ROD** - A structural member in tension, such as a metal rod or bar serving as a tie, often threaded to enable on-site adjustment of tension.

**TILE BATTEN (TILING BATTEN)** - A light steel or timber member fixed to the tops of rafters or trusses to which the roofing materials may be fastened.

**TILTING BATTEN** - A batten cut diagonally from a 75mm x 38mm timber and used at the eaves to tilt the bottom course of tiles so that the ones immediately above will have a firm seating.

**TRANSOM** - The horizontal dividing member in a window or door frame.

**TRUSS** - A triangulated frame for carrying a roof over a large span.

**TRUSSED BEAM** - A beam formed of two timbers with triangulated strutting between, formed to distribute the load.

**TUDOR ROOF** - A steeply pitched roof with dormers on one or both sides.

**UB** - Universal beam.

**UC** - Universal column.

**UNIFORMLY DISTRIBUTED LOAD (UDL)** - A superimposed design load which is assumed to be distributed evenly over an area of surface or a length of structural member.

**VALLEY** - The angle formed by two internal slopes of a roof.

**VALLEY BOARDS** - Boards nailed to the surface of the roof at the internal intersection of two roof surfaces.

**VALLEY RAFTER** - The inclined member in a roof at the internal intersection of two roof surfaces.

**VERGE** - The overhanging edge of the roof covering at a gable.

**WEB** - The vertical portion of a rolled steel section, extruded section, girder or truss which connects the top and bottom flanges or the top and bottom chords. A web may be a solid plate, a perforated plate, or a lattice.

**WEB HOLE** - Joints in brickwork left free of mortar or a small hole bored through a trench in a window sill to allow the escape of water.

**WIND LOAD** - The forces on a building or structure due to wind pressure.

**ZED-PURLIN** - A pressed metal purlin with a cross-section in the shape of the letter Z. Also spelled 'Z-purlin'.

**SPECIAL NOTE:**

The "Terms" listed are an abridged version of those more commonly used within the steel, building and engineering industry as applied to this booklet. A complete "Glossary of Building Terms" published jointly by Standards Australia and Suppliers Index can be purchased from the Standards Association.

The Editor.

# USEFUL WEBSITES

## **Lysaght**

<http://www.lysaght.com>

## **BlueScope**

<http://www.bluescopesteel.com.au>

## **COLORBOND® steel**

<http://www.colorbond.com>

## **Australian Building Codes Board (ABCB)**

<http://www.abcb.gov.au>

Responsible for creating consistent building codes, standards, and regulations to meet community expectations for health, safety and amenity in the design, construction and use of buildings.

## **Australian Bureau of Agricultural and Resource Economics (ABARE)**

<http://www.agriculture.gov.au/abares>

An Australian government agency that conducts independent economic research and analysis.

## **Australian Bureau of Meteorology**

<http://www.bom.gov.au>

Responsible for understanding Australia's weather and climate, and providing meteorological, hydrological and oceanographic services including forecasts and weather warnings.

## **Australian Bureau of Statistics**

<http://www.abs.gov.au>

Conducts a national census every five years and provides statistics for use by governments, business and the media, including Household Expenditure and Economic Activity surveys.

### **Australian Certification Authority for Reinforcing Steels**

<http://www.acrs.net.au>

Administers an industry-based, third-party product certification scheme for steel reinforcement and prestressing strand.

### **Australian Commonwealth Government Entry Point**

<http://www.australia.gov.au>

Links to information and services on 700 Australian Government websites as well as selected state and territory resources.

### **Australian Heritage Directory**

<https://www.environment.gov.au/heritage>

A part of the Australian Government Department of the Environment and Energy responsible for national and local heritage matters.

### **Australian Steel Institute (ASI)**

<http://www.steel.org.au>

As the peak industry association representing the Australian steel industry, increases the awareness of the benefits of steel and promotes Australian made steel as the material of choice.

### **Australian Transport Safety Bureau (ATSB)**

<http://www.atsb.gov.au>

Australia's prime agency responsible for improving transport safety and public confidence and for transport safety investigations.

### **Australian Women in Agriculture**

<http://www.awia.org.au>

Promotes the advancement of women in agriculture.

**Building Products Innovation Council (BPIC)**

<http://www.bpic.asn.au>

Promotes the efficient and innovative use of building products within a nationally consistent regulatory environment.

**Building Sustainability Index (BASIX)**

<https://www.planningportal.nsw.gov.au/basix>

As a function of the NSW Government Department and Environment, establishes minimum energy requirements for new buildings and major refurbishments.

**Cement Concrete & Aggregates Australia (CCAA)**

<http://www.concrete.net.au>

Peak body representing the cement, pre-mixed concrete and extractive industries.

**Civil Aviation Safety Authority (CASA)**

<http://www.casa.gov.au>

Provides leadership in aviation safety.

**Cooperative Research Centre for Construction Innovation**

<http://www.construction-innovation.info>

A national research, development and implementation centre focused on the needs of the property, design, construction and facility management sectors.

## **Commonwealth Scientific & Industrial Research Organisation (CSIRO)**

<http://www.csiro.au>

Conducts industrial research and development programmes to improve the economic and social performance of Agribusiness, Energy and Transport, Environment and Natural Resources, Health, Information, Communication and Services, Manufacturing and Mineral Resources, and improve Australia's quality of life.

## **Department of Agriculture**

<http://www.agriculture.gov.au>

Useful information on a range of relevant topics for primary producers.

## **Department of the Environment, Water, Heritage and the Arts**

<http://www.environment.gov.au>

Develops and implements national policy, programs and legislation to protect and conserve Australia's environment and heritage and to promote Australian arts and culture.

## **Ecospecifier**

<http://www.ecospecifier.com.au>

An extensive database, decision making guide, project case-studies and training documents to assist eco-design.

## **Energy Smart**

<http://www.energysmart.com.au>

Provides NSW builders and homeowners with advice on cost reductions and energy savings in buildings.

**Green Building Council of Australia (GBCA)**

<https://new.gbca.org.au>

Committed to the creation of a green building rating tool, economic incentives, government initiatives and programmes, new technologies and industry knowledge to achieve greater sustainability in buildings.

**HIA GreenSmart**

<http://www.greensmart.com.au>

Educates builders, designers, product manufacturers and consumers about the benefits of environmentally responsible housing.

**Landcare Australia**

<http://www.landcareaustralia.com.au>

Supports Landcare and Coastcare movements across Australia by raising funds and awareness, and helps governments, companies and communities become partners in awareness campaigns and environmental repair projects.

**National Association of Steel Framed Housing (NASH)**

<http://www.nash.asn.au>

Promotes the use of steel framing in housing.

**National Association for Sustainable Agriculture Australia (NASAA)**

<http://www.nasaa.com.au>

Supports growers and retailers of organic crops to achieve certification and maintain standards.

**National Built Environment Rating System (Nabers)**

<https://www.nabers.gov.au>

A performance-based rating system that measures a building's overall environmental performance during operation.

**National Farmers' Federation**

<http://www.nff.org.au>

Provides information on national issues and links to State farming organisations.

**National House Rating Software (Nathers)**

<http://www.nathers.gov.au>

Enables the design of a home to be assessed by skilled professionals using sophisticated computer modelling programmes to improve the quality of design and as a means of achieving building approvals.

**National Trust Australia**

<http://www.nationaltrust.org.au>

The national secretariat representing the eight state and territory National Trusts. Links to state and territory sites.

**Safe Work Australia**

<https://www.safeworkaustralia.gov.au>

Leads and coordinates national efforts to prevent workplace death, injury and disease.

**Society for Responsible Design (SRD)**

<https://srd.org.au>

Combines society and industry efforts to improve products and services through environmentally and socially responsible design practices.

**Standards Australia**

<http://www.standards.org.au>

Facilitates standardisation solutions to meet community expectations for a safe and sustainable environment and enhance Australia's economic efficiency and international competitiveness.

**The Royal Australian Institute of Architects (RAIA)**

<http://www.architecture.com.au>

National body for Australia's architects.

**Welding Technology Institute of Australia**

<http://www.wtia.com.au>

Provides technical assistance, library and information services for the welding industry.

**Your Home: Design for Lifestyle and the Future**

<http://www.yourhome.gov.au>

A guide to environmentally sustainable house design and construction.

# INDEX

## A

ADHESIVES.....	320–324
ADHESIVES FOR JOINING STEEL SHEET PRODUCTS.....	320
AERIAL AGRICULTURE.....	371–374
ALSPAN®.....	137
ALSULATE®.....	138
AQUAPLATE® STEEL.....	48
AREA PER TONNE OF SHEET PRODUCT.....	57
ATMOSPHERIC CLASSIFICATION.....	258
ATMOSPHERIC EXPOSURE CONDITIONS – STEEL CLADDING.....	304
AUSTRALIAN STEEL INSTITUTE.....	23
AUSTRALIAN STEEL PRODUCTS.....	8

## B

BAROQUE®.....	59, 131
BASIC OXYGEN STEELMAKING.....	19
BISALLOY® STEEL.....	28
BLUESCOPE BUILDING PRODUCTS ASIA AND NORTH AMERICA.....	10
BLUESCOPE BUILDINGS NORTH AMERICA.....	10
BLUESCOPE HISTORY.....	13
BONDEK®.....	233
BONDEK® ACCESSORIES.....	239
BONDEK PLUS®.....	235
BONDEK PLUS® 2P.....	237
BONFILL®.....	239
BON-NUT.....	240
BONSTRIP®.....	239
BONWEDGE®.....	239
BRICKWORK DIMENSIONS.....	391

BUILDING & ENGINEERING TERMS.....	432-443
BUILDING SOLUTIONS.....	294-296

**C**

CASTING.....	19
CC BUILDER®.....	206
CEE SECTIONS.....	229
CHANNELS – DIMENSIONS & PROPERTIES.....	231
CIRCULAR HOLLOW SECTIONS.....	287-293
CLADDING PROFILES.....	59
CLADDING RANGE.....	121
COATING AND PAINTING.....	20
COLD FORM SECTIONS.....	231
COLD ROLLED STEEL PRODUCTS.....	36
COLONIAL® GUTTER.....	166
COLORBOND® PREPAINTED STEEL.....	46
COLORBOND® STEEL.....	46, 209
COMPOSITION/CARBON GRADES.....	39
CONCRETE.....	378
CONTACTS.....	
AIR SERVICES AUSTRALIA.....	374
AUSTRALIAN LIQUEFIED PETROLEUM GAS ASSOCIATION.....	401
AUSTRALIAN TUBE MILLS.....	275
BLUESCOPE DISTRIBUTION.....	243
BLUESCOPE RECYCLABILITY.....	341
CIVIL AVIATION SAFETY AUTHORITY AND AIR SERVICES AUSTRALIA.....	374
KITELEYS.....	296
INFRABUILD STEEL.....	243
INFRABUILD CONSTRUCTION SOLUTIONS.....	252
METALCORP STEEL.....	243

**C-E**

METALFORM.....	296
ORRCON.....	275
PERMALITE® ALUMINIUM BUILDING PRODUCTS.....	294
RANBUILD®.....	295
THE AUSTRALIAN HERITAGE DIRECTORY.....	350
THE CEMENT CONCRETE & AGGREGATES AUSTRALIA.....	378
THE ROOFING CENTRE TASMANIA.....	296
USEFUL WEBSITES.....	444-450
<b>CUSTOM BLUE ORB®.....</b>	<b>59, 77</b>
<b>CUSTOMER SUPPORT.....</b>	<b>22</b>
<b>CUSTOM ORB®.....</b>	<b>59, 74</b>
<b>CUSTOM ORB ACCENT® 21.....</b>	<b>59, 79</b>
<b>CUSTOM ORB ACCENT® 35.....</b>	<b>59, 81</b>
<b>CUSTOMSCREEN®.....</b>	<b>213</b>
<b>CYCLONIC FENCE RANGE.....</b>	<b>220-221</b>
<b>D</b>	
<b>DAMS AND RESERVOIRS.....</b>	<b>367-370</b>
<b>DAMS OR TANKS - MEASUREMENT.....</b>	<b>358</b>
<b>DECKFORM®.....</b>	<b>53</b>
<b>DIMENSIONS OF COLD ROLLED FLAT STEEL PRODUCTS.....</b>	<b>39</b>
<b>DIMENSIONS OF ZINC-COATED AND ZINC/ALUMINIUM ALLOY-COATED FLAT STEEL SHEET.....</b>	<b>56</b>
<b>DISTRICT RAINFALL.....</b>	<b>359-366</b>
<b>DOMINION®.....</b>	<b>59, 129</b>
<b>DOWNPIPES &amp; ACCESSORIES.....</b>	<b>171-172</b>
<b>E</b>	
<b>EASYCLAD®.....</b>	<b>59, 117</b>
<b>ECOLOGICAL FOOTPRINT.....</b>	<b>342-347</b>
<b>EDGEFORM.....</b>	<b>239</b>

ELECTRIC ARC FURNACE STEELMAKING.....	19
EMLINE® GUTTER.....	152
ENERGY CONSERVATION.....	347
ENSEAM®.....	59, 125
EQUAL ANGLES.....	247
EXTERNAL FASTENERS.....	316

**F**

FASTENERS.....	316–319
FENCING.....	209–221
FIRMLOK®.....	195
FITFAST® GUTTER.....	153
FLASHINGS.....	173
FLATBACK 190 GUTTER.....	160
FLATBACK GUTTER.....	157
FLATDEK®.....	59, 100, 199
FLATDEK® 310.....	59, 104, 203
FLATDEK® II.....	59, 102, 201
FOREWORD.....	7
FORMABLE (DUCTILE) GRADES.....	38
FORMABLE STEEL GRADES GALVABOND®.....	49

**G**

GALVALUME®.....	56
GALVSPAN®.....	53
GAS (LPG).....	401–405
GATE CONFIGURATION OPTIONS.....	217
GATES.....	216
GENERAL INFORMATION.....	375–421
GEOMETRY AND MENSURATION.....	406–419

**G-L**

GLOSSARY OF TERMS.....	422-443
GREEN STAR™ REQUIREMENTS.....	339
GUTTERS.....	140-182

**H**

HALF ROUND 190 GUTTER.....	159
HALF ROUND GUTTER.....	154
HANDLING AND SITE NOTES.....	311
HARDNESS GRADES.....	38
HAYSTACK IN STACKS.....	354
HERITAGE CONSERVATION.....	348
HOME IMPROVEMENTS.....	195-208
HOT ROLLED COIL.....	33-35
HOUSE FRAMING COMPONENTS.....	183-194

**I**

IMPERIAL™.....	59, 127
INTERLOK® II.....	241
INTRODUCTION.....	1-24
INTRODUCTION TO BLUESCOPE.....	8
IRONMAKING.....	19

**K**

KITELEYS.....	296
KLIP-LOK® 406.....	59, 92
KLIP-LOK 700 HI STRENGTH®.....	59, 94
KLIP-LOK CLASSIC® 700.....	59, 96

**L**

LAND MASS - AUSTRALIA.....	418-419
LEVELS OF EXPOSURE OF STRUCTURAL STEELWORK.....	260

LIFE CYCLE OF STEEL.....	333
LIQUEFIED PETROLEUM GAS (LPG).....	401
LOK-KLIP®.....	98
LONGLINE 305®.....	59, 122
LOUVRESCREEN®.....	214, 215
LT7®.....	136
LYSAGHT LIVING®.....	205

**M**

MAINTENANCE.....	331
MANUFACTURING STEEL.....	334
MASONRY.....	388
MERCHANT BAR PRODUCTS - ROUNDS.....	250
MERCHANT BAR PRODUCTS - SQUARES.....	251
METALFORM.....	296
METALLIC COATED STEEL PRODUCTS.....	40-45
METALLURGICAL TERMS.....	422-431
MINI ORB®.....	59, 106
MINISCREEN®.....	211
MULTICLAD®.....	59, 111

**N**

NEETASCREEN®.....	210
NEW ZEALAND STEEL AND PACIFIC ISLANDS.....	9
NORTH STAR BLUESCOPE STEEL.....	11
NOVALINE® FASCIA.....	168
NOVALINE® REBATE FASCIA.....	170

**O**

OGEE® GUTTER.....	161
ON-SITE SAFETY FOR EVERYONE.....	298-301

**P-Q****P**

PAINTING OF ZINC-COATED & ZINCALUME® STEEL.....	328
PAINTING OF ZINC-COATED & ZINCALUME® STEEL SHEET.....	328
PANELRIB®.....	59, 109
PARALLEL FLANGE CHANNELS.....	246
PERMALITE® ALUMINIUM BUILDING PRODUCTS.....	294
PERMALITE ALSPAN®.....	59, 137
PERMALITE ALSULATE®.....	59
PERMALITE ALUMINIUM CLADDING RANGE.....	133
PERMALITE LT7®.....	59, 136
PERMALITE V-RIB®.....	59, 135
PERMALITE WAVELINE®.....	59, 134
PLATE GRADES.....	25, 26
PLATE, SHEET & COIL.....	25-57
PLUS RANGE.....	219
POLYMER COATED STEEL WATER TANKS.....	222-224
PRACTICAL ADVICE ON USING STEEL.....	297-332
PT HOLD DOWN CLIP.....	240

**Q**

QUAD 115 HI-FRONT GUTTER.....	140
QUAD 115 LO-FRONT GUTTER.....	143
QUAD 150 HI- & LO-FRONT GUTTER.....	144
QUAD 175 GUTTER.....	145
QUAD (D) 125 GUTTER.....	146
QUAD SQUARE BEAD GUTTER UTTER.....	147
QUARTER ROUND GUTTER.....	167
QUIKA-FLOOR® SYSTEM.....	187

**R**

RAINFALL DISTRICT.....	359–366
RAINFALL INTENSITIES.....	175–178
RAINWATER GOODS.....	140–182
RAINWATER RUN-OFF.....	60, 178–182
RAINWATER TANKS.....	222–224
RANBUILD® SHEDS & GARAGES.....	295
RANCELINE® GUTTER.....	165
RAW MATERIALS IN STEEL.....	333
RECTANGULAR HOLLOW SECTIONS.....	279–282
RECYCLABILITY.....	341
REDUCING OUR ECOLOGICAL FOOTPRINT.....	342
REFEREE HISTORY.....	17
REINFORCING BARS.....	252
RIB END PLUG.....	240
ROLLING.....	20
ROOF DRAINAGE.....	60–71, 172
ROOF DRAINAGE SYSTEM DESIGN.....	172
ROOFING SOLAR ABSORPTANCE.....	336
ROOFING & WALLING PRODUCTS.....	58–137
ROOFING & WALLING SPECIFICATIONS.....	65–73
ROOF RUN FOR DRAINAGE.....	60–64
ROOFTRAK®.....	139

**S**

SEALANTS.....	326–327
SEALANTS FOR ZINCALUME® STEEL & COLORBOND® STEEL.....	326
SHEERLINE® GUTTER.....	148
SHORELINE® GUTTER.....	163

<b>S</b>	
SHORELINE® MINI GUTTER	164
SLATSCREEN®.....	214
SMARTASCREEN®.....	212
SMARTASCREEN® FENCING.....	212
SMARTPARTS™.....	205
SOLDERING ZINCALUME® STEEL.....	325
SPANDEK®.....	59, 90
SQUARE HOLLOW SECTIONS.....	283-286
STACK CIRCULAR.....	353
STACK RECTANGULAR.....	351
STEEL ADVANTAGES.....	336
STEEL AND TRANSPORT.....	334
STEEL BUILDING FRAME SYSTEM.....	186
STEEL COMPARATIVE FEATURES.....	39
STEEL DECKING.....	233
STEEL DESIGNATIONS.....	36
STEEL GRATING.....	241-242
STEEL PATHWAY.....	21
STEEL ROAD SAFETY BARRIERS.....	375
STEEL WATER TANKS.....	222-224
STOCK BREEDING TABLE.....	355
STRUCTURAL GRADES.....	38
STRUCTURAL & PIPELINE PRODUCTS.....	275-293
STRUCTURAL SOLUTIONS.....	225-242
STRUCTURAL STEEL.....	243-274
STRUCTURAL STEEL DECKING.....	233
STRUCTURAL STEEL IN HOUSING.....	262-274
SUPACEE® PURLINS DIMENSIONS.....	227
SUPAPURLIN®.....	225-230

SUPAZED® PURLINS DIMENSIONS.....	226
SUPRAFRAME®.....	183
SUPRATRUSS®.....	185
SURFACE PROTECTION GUIDE.....	258
SUSTAINABILITY.....	333–350

**T**

TANKS CAPACITY CALCULATIONS.....	357
TAPER FLANGE BEAMS.....	245
THE ROOFING CENTRE TASMANIA.....	296
TOPSAN® 96.....	192
TOPSPAN® 22.....	189
TOPSPAN® 40.....	189
TOPSPAN® 61.....	191
TOPSPAN® 120.....	193
TOPSPAN® SECTIONS.....	189
TRIMDEK®.....	59, 85
TRIM-KLIP®.....	88
TRIMLINE® GUTTER.....	150
TRIMWALL®.....	59, 115
TRUECORE®.....	55
TRU-SPEC®.....	26
TYPICAL COLD ROLLED STEEL QUALITIES.....	38

**U**

UNDERSTANDING STEEL.....	19
UNEQUAL ANGLES.....	249
UNI-PIER™.....	188
UNIVERSAL SECTIONS.....	244
USEFUL RURAL INFORMATION.....	351–374

**U-Z**

USEFUL WEBSITES..... 444–450

USE OF STEEL..... 335

**V**

V-RIB®..... 135

**W**

WALLCLAD®..... 59, 113

WASTE REDUCTION..... 345

WATER CONSERVATION..... 346

WATER USE..... 333

WAVELINE®..... 134

WEATHERLINE®..... 59, 119

WHAT IS STEEL?..... 19

**X**

XLERPLATE®..... 25, 27

**Z**

ZED SECTIONS..... 229

ZENITH™ ARCHITECTURAL CLADDING RANGE..... 1121

ZINCALUME®..... 54–55

ZINCANNEAL®..... 50

ZINCFORM®..... 51

ZINC HI-TEN®..... 52

ZINCSEAL®..... 50

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